Herding and Feedback Trading: Evidence on their Relationship at the Macro Level

Vasileios Kallinterakis⊠
University of Durham Business School
Department of Economics and Finance
23/26 Old Elvet
Durham DH1 3HY
Tel: +44 (0)191 334 6340
Fax: +44 (0)191 334 6341
Email: vasileios.kallinterakis@durham.ac.uk

Mario Pedro Leite Ferreira
Universidade Católica Portuguesa
Centro Regional do Porto
Rua Diogo Botelho, 1327
4169-005 Porto
Email: pferreira@porto.ucp.pt

⊠ *Corresponding author.*

Herding and Feedback Trading: Evidence on their Relationship at the Macro Level

Abstract

The behavioural expressions of herding and feedback trading maintain properties that render their coexistence a possibility. Although their joint presence has been largely confirmed by empirical work in the Finance literature at the micro level (i.e. using micro data), the pursuit of this issue at the macro level (i.e. the level of the aggregate market) has remained largely unexplored. To that end, we jointly test for herding and feedback trading at the market level using data from the Portuguese market for the 1993-2005 period. Our results indicate the combined significant presence of herding and positive feedback trading for that period, with this significance exhibiting signs of clustering during the second half of the 1990s, which accommodated a series of boom-bust episodes for that market.

1. Introduction

Herding and feedback trading have been at the forefront of extensive academic research, both analytical as well as empirical, following the advent of behavioural Finance in the 1980s. Conceptually, the term "herding" refers to the alignment of one's behaviour to the behaviour of others, while "feedback trading" relates to trading on the basis of historical prices.

A careful consideration of the theoretical content of these two behavioural patterns reveals potential for common ground in their manifestation. If investors *positive* feedback trade (i.e. trade to the direction implied by past prices), then this raises the possibility of the development of a market-trend which may be amplified if other investors choose to imitate their peers and herd on that trend. Conversely, if the market is characterized by a widespread herding mentality, it is reasonable to assume that the latter will translate itself into a trend imprinted onto the market's index. Thus, those wishing to join the herd will have to reinforce it by reinforcing the market's trend, i.e. positive feedback trade.

However, the relationship between the two patterns may appear to be less than perfectly straightforward. As Antoniou et al (2005b) argue, positive feedback trading can also be the outcome of rational speculative strategies (e.g. portfolio insurance; stop-loss orders) aiming at exploiting the market's trend. Therefore, the above indicate that positive feedback trading may well exist in the absence of herding tendencies.

In the empirical realm, herding and feedback trading have been jointly studied at the micro level across various investor-types (individual-institutional, indigenous-overseas). Evidence produced appears to be in most cases (Lakonishok et al, 1992; Grinblatt et al, 1996; Choe et al, 1999; Jones et al, 1999; Nofsinger and Sias, 1999;

Wermers, 1999, Iihara et al, 2001; Kim and Wei, 2002a; 2002b; Voronkova and Bohl, 2005) suggestive of jointly significant herding and positive feedback trading, while other findings (Bowe and Domuta, 2004; Sias, 2004; Do et al, 2006) seem to refute this. However, the above studies tend to restrict the joint examination of herding and feedback trading to separate investor groups without providing us with a picture of the issue at the macro level. In other words, although we have extensive knowledge about the joint presence of herding and feedback trading in the ranks of specific trader-groups internationally, the examination of this at the aggregate level of the market has been largely unexplored.

To that end, we aim at addressing this issue by testing for herding and feedback trading using a set of empirical, aggregate-data-based measures in the context of the Portuguese market during the 1993-2005 period. During the latter, Portugal underwent a multitude of abrupt market movements induced by a unique confluence of national and international events; consequently, we consider its choice to furnish us with interesting ground for the study of such behavioural phenomena. We believe our research to constitute a substantial contribution to the Finance literature, as it involves the joint examination of herding and feedback trading at a level never considered before.

The rest of the paper is structured as follows: Section 2 presents of the concepts of herding (2.1) and feedback trading (2.2), with section 2.3 exploring their theoretical association and discussing relevant empirical findings on the latter. Section 3 includes a brief overview of the Portuguese market's evolution during the period under investigation (1993-2005). Section 4 discusses the data (4.1) used in this research, delineates the methodology utilized (4.2) and provides some descriptive statistics (4.3). Section 5 presents and discusses the results and Section 6 concludes.

2 Theoretical Background

2.1 Herding

Herding, as Hirshleifer and Teoh (2003) have noted, involves a "similarity in behaviour" stemming from the interactive observations of *Actions* and *Payoffs* of individuals. Hence people observe/hear/read about the stock selection of other people or, what is more they may also get to find out about the outcome of such selections (whether somebody made a profit or a loss). Deciphering the causes of imitation is not always possible, as it can be ascribed to a variety of motivations of both psychological as well as rational background.

Regarding psychology-driven factors, *conformity*, namely the condition under which people feel more convenient when doing what others do, seems to be playing a major role. This tendency towards conformity (Hirshleifer, 2001) may well be related to the interaction of people, as they communicate with one another, be it explicitly (e.g. when people are conversing - see Shiller, 1995), or tacitly (when people observe others' choices, e.g. in fashion – see Bikhchandani et al, 1992).

Investors may find it "rational" to copy others (better informed, in their opinion) if this would allow them to benefit from the possible *informational payoffs* (Devenow and Welch, 1996) accruing from such an imitation. This is the case when one: a) possesses no private information, b) has private information yet is uncertain about it perhaps because it is of low quality, c) considers his information-processing abilities to be inadequate or d) perceives others as better-informed. With investors suppressing their private information in such a fashion, this is bound to bear an adverse impact over the public information pool by slowing/temporarily blocking the aggregation of information in it, thus fomenting the rise of *informational cascades* (Banerjee, 1992; Bikhchandani et al, 1992).

Professional considerations may also lead to herding. Investment professionals (be they fund managers or financial analysts) are subject to periodic evaluation (Scharfstein and Stein, 1990) which is normally of a relative nature, i.e. they are evaluated against one another. Under such circumstances, less able ("bad") investment professionals have an obvious incentive to copy the actions of their better able ("good") peers, if this will help them appear as "better" professionals. "Good" investment professionals, on the other hand, may choose to follow the investment-decisions of the majority of their peers, even if these are sub-optimal, if the risk from a potential failure is perceived as higher compared to the benefits accruing from a potential success by "going-it-alone".

Reputational considerations are relevant here, as they may also encourage investment professionals to herd. A professional who enjoys a strong reputation in his capacity has an incentive to imitate others in order to preserve his reputation (Graham, 1999), if the damage to his reputation by a potential failure outweighs the expected benefits from a potential success. Assuming that the well-reputed professionals are also the better-able ones (as it is hard to imagine how one's reputation would have grown in the absence of a distinctive ability), this may help explain the herding tendencies denoted previously with regards to "good" investment professionals. Ill-reputed professionals, however, may also resort to herding as a means of free-riding (Truman, 1994) on the reputation of better-reputed colleagues (*reputational externality*).

We conclude our discussion on the herding concept by drawing a line between the above cases of "*intentional*" herding and what Bikhchandani and Sharma (2001) termed "*spurious*" herding; the latter refers to the case where the observed convergence of people's actions is due to the similarity of responses to commonly

observed signals and not to imitative intent. An example here relates to changes in fundamentals becoming public knowledge, since they have the potential of inducing people to behave in a parallel fashion, without the latter necessarily originating in irrational traits. If, for instance, a drop in deposit rates materializes, then this may well have the potential of inducing investors to turn to the stock market in search for higher returns.

2.2 Feedback trading

Feedback trading constitutes an umbrella-term used in Finance to describe the conduct of a specific type of trader whose investment decisions are a function of historical prices. If he trades in the same direction with past prices he is called "*positive feedback trader*", while if he trades in the opposite direction, he is called "*negative feedback* (*contrarian*) trader". The very foundations of feedback trading lie in the perception that prices maintain some sort of inertia in the market (Farmer, 2002), in the sense that they tend to produce directional patterns (trends) for certain periods of time.

Although feedback trading is price-based, there is little agreement as to its practice as people are not expected to use past prices in the same way. To that end, the profitability of feedback trading strategies has been examined in studies related to either *momentum* or *contrarian* (e.g. De Bondt and Thaler, 1985; Bowman and Iverson, 1998; Mun et al, 1999; Jegadeesh and Titman, 2001; Kang et al, 2002; Antoniou et al 2005a) trading. *Technical analysis*, as a special type of feedback trading, has also received notable attention, with a number of researchers (e.g. Bessembinder and Chan, 1995; Ito, 1999; Ratner and Leal, 1999; Wong et al, 2003;

Ming et al, 2000; Strozzi and Zaldívar-Comenges, 2005) investigating the profitability of a variety of technical trading rules in several markets.

A number of psychological biases can be associated with feedback trading. Positive feedback trading can, for example, be reinforced through the *representativeness heuristic* (overweighting recent data as representative of a trend-at-works) and the *conservatism-bias* (underweighting recent data if the perception of an opposite trend-at-works prevails), (Barberis et al 1998). It can also be fuelled by the *overconfidence-bias* (aggressive trading following a "euphoric" period of recent gains (Odean, 1998; Glaeser and Weber, 2004a; Glaeser and Weber, 2004b). Negative feedback trading can also be addressed behaviourally through the *disposition effect* (Shefrin and Statman, 1985) according to which people are less reluctant to sell stocks that have recently performed well and prefer to hold onto those, whose performance has been poor.

Feedback trading is also motivated through *data-availability*, since historical data on prices are easier to find in the financial press (see Huddart et al, 2002), while more sophisticated data are harder to obtain. The simplified analysis of such data (as carried out mostly by technical analysts in the press) facilitates the communication of these "technical heuristics" to a wider audience, which is perhaps not typified by a sufficient educational background or investment experience.

Feedback trading, however, is not restricted to "noise" traders who may be susceptible to behavioural biases, maintain less abilities/resources or use technical analysis. A series of papers (Koutmos, 1997; Farmer, 2002; Farmer and Joshi, 2002; Antoniou et al, 2005b) have argued that rational traders may employ price-based trading rules if they feel they have to shield themselves against (or take advantage of) abrupt market movements; portfolio insurance (Luskin, 1988) and stop-loss orders

(Osler, 2002) are relevant here. Such strategic choices on behalf of rational traders are based upon the belief that noise traders might push prices away from their fundamental value, thus leading to a mispricing of indefinite duration and magnitude (Barberis and Thaler, 2002). Alternatively, rational traders may themselves launch a trend in order to attract noise traders with the intention of exploiting them at a later stage (Soros, 1987; De Long et al, 1990; Andergassen, 2003).

2.3 The relationship between herding and feedback trading

Having delineated the fundamental properties of herding and feedback trading, we shall now turn to the examination of the association between the two, as this constitutes the crux of our research here. We have shown previously that positive feedback trading is essentially trend-based, in other words it is founded upon the course of the market's trend; if the market rises, positive feedback traders buy and if it falls, they sell. As a result, there need not exist an imitative component here, since positive feedback traders are focusing upon the trend, not those trading on it. A positive feedback trader may resort to relevant trading patterns, such as momentum trading or technical analysis in order to formulate a strategy aiming at exploiting the trend. Rational speculators may employ portfolio insurance (Luskin, 1988) or stop-loss orders (Osler, 2002) in order to time their entry/exit from the market conditional upon the market's trend.

However, none of the above cases entails the notion of herding in its construction; although market-wide herding may be present in the considerations of those employing such tactics it is not herding itself that explicitly drives them towards those strategies. Having said that though, we cannot rule out the possibility that part of positive feedback trading may be due to herding as well if there are investors who

follow the trend due to intentional imitation of their peers. What we wish to make clear here is that the presence of positive feedback trading does not necessarily suggest the presence of herding.

We now turn to the inverse relationship between these two concepts. If there exists growing herding in the market for some time, then it is reasonable to assume that this will facilitate the launch of a price-trend, more so, if there exists a large number of investors whose trades are converging to the same direction simultaneously. If other investors decide to follow the herd, then they will have to follow its direction, which is the trend generated by that herd; in other words, they have to positive feedback trade. Since herding is capable of leading prices to exhibit trends, it follows that positive feedback trading constitutes the required trading expression of those who join the herd.

At the empirical dimension, there exists a rather impressive research output pertaining to the combined study of herding and feedback trading. Although the relationship between the two concepts appears not to have been the fundamental motivation underlying most of those studies, their results are, nevertheless, interesting as they involve the employment of data related to investors' accounts for specific investor-groups (individual-institutional, indigenous-overseas), thus allowing us unique insight into these two behavioural patterns at the micro level.

Evidence from the US (Lakonishok et al, 1992; Jones et al, 1999; Wermers, 1999) reveals a concentration of the statistical significance of both herding and positive feedback trading on behalf of institutional investors in small capitalization stocks, while Grinblatt et al (1996) and Nofsinger and Sias (1999) documented a positive correlation between funds' herding and positive feedback trading. A series of studies conducted on those premises in South Korea have also revealed the presence

of parallel lines between herding and positive feedback trading on behalf of various investor-types. Choe et al (1999) found that overseas investors engaged in significant herding and positive feedback trading shortly prior (2/12/1996 – 30/9/1997) to the transmission of the Asian crisis to the country; during the in-crisis period (1/10/1997 – 27/12/1997), however, both herding and positive feedback trading exhibited a sharp drop. Kim and Wei (2002a; 2002b) produced results indicative of widespread herding and positive feedback trading on behalf of all[1] investor-types (indigenous individual, indigenous institutional, overseas individual, overseas institutional) both prior to (January – October 1997) and during (November 1997 – June 1998) the crisis. Finally, evidence reflective of a similar coexistence between herding and positive feedback trading has been documented by Iihara et al (2001) and Voronkova and Bohl (2005) for Japan and Poland, respectively.

On the other hand, Bowe and Domuta (2004) report results indicative of the presence of significant herding yet insignificant positive feedback trading on behalf of indigenous[2] as well as overseas investors before (January – June 1997), during (July 1997 – September 1998) and after the Asian crisis (October 1998 – December 1999) for the Indonesian market. Sias (2004) reveals the absence of any association between herding and positive feedback trading of institutional investors in the US, while Do et al (2006) find that the level of herding in the Finnish market tends to somehow decrease with positive feedback trading.

Consequently, our discussion here has thus far illustrated the theoretical association between herding and feedback trading and has provided an overview of the empirical evidence relative to the joint examination of the two at the micro level. However, it is interesting to note that this association has not been examined at the

---

[1] *With the exception of indigenous institutional traders for the pre-crisis period, who, according to Kim and Wei (2002b) are found to be significant negative feedback trading.*
[2] *Indigenous investors' herding tends to drop in the post-crisis period.*

macro level, i.e. at the level of the market. To address the latter issue, we test for herding and feedback trading using a set of price-based measures for the Portuguese market during the 1993-2005 period. To that end, we believe our research to constitute an original contribution to the Finance literature, as it yields novel insight into the association of herding and feedback trading.

3. The Portuguese stock market (1993-2005)

We will now focus on the evolution of the Portuguese market during the period of our investigation, i.e. between 1993 and 2005. Our intention, in line with the motivation of our study, is to depict that this period accommodated a series of confluent events that resulted in the market exhibiting abrupt price movements capable of being associated with herding and positive feedback trading.

Following an initial period of boom (culminating during the latter half of the 1980s) and bust (early 1990s) after its official reopening in early 1977, the Portuguese Stock Exchange embarked onto a period of growth towards maturity during the mid-1990s. The ratification of the Maastricht Treaty in late 1993 led to the relaxation of restrictions on overseas capital flows and was accompanied by a sharp rise in foreign investment in Portuguese securities. The optimism of that time temporarily came to a halt in 1994 with the outbreak of the Mexican crisis and the poor performance of corporations (Balbina and Martins, 2002).

Following the sustained decrease witnessed in inflation and interest rates, the country entered into a booming cycle from 1996 onwards with foreign direct investment, exports and GDP documenting a sharp increase. This boom also bore an impact upon the stock exchange, which witnessed an unprecedented surge in the levels of market participation on behalf of investors, a fact that can be attributed to a

series of factors. Privatizations, namely of "blue-chip" state-owned firms[3] were very intense during this period with initial public offerings attracting large numbers of investors (Balbina and Martins, 2002)[4], thus benefiting the market in terms of both depth and liquidity[5] [6]. The latter was also boosted through the channeling of substantial domestic investors' savings towards mutual funds, which further fuelled market activity[7]. What is more, June 1996 saw the official launch of the Derivatives' Exchange in Porto, which provided the opportunity for increased market participation through derivative instruments. The accelerated growth of the market, especially during 1997, should also be viewed within the global context of the time, as the outbreak of the Asian Crisis in mid-1997 prompted a shift in international financial investments towards safer destinations, Europe being one of them. By December 1997 the Portuguese stock exchange was upgraded by Morgan Stanley to "mature" and 19 of its companies were listed in the Dow Jones indices. Finally, in early 1998, it was publicly announced that Portugal would be joining the third stage of the European Monetary Union. Overall, this sequence of favourable events led to a substantial increase in trading activity, reflected in the market index rising by approximately 270% (January 1996 – April 1998).

Year 1998 brought about the Russian Crisis, which, in the aftermath of the Asian Crisis, created a worldwide sense of financial instability. The impact of the latter upon Brazil affected Portugal as well, as Brazil constitutes a preferential destination for Portuguese foreign direct investment. The effect of that instability was

---

[3] *Examples include "Brisa", "Cimpor", "EDP" and "Portugal Telecom".*
[4] *According to Balbina and Martins (2002), the demand for the shares of the privatized companies' shares equaled about 42 times the number of shares offered (Balbina and Martins, 2002-p. 7)*
[5] *Source: CMVM Annual Report 1997, Section 2.2.*
[6] *On the positive effects of privatizations, see also Ferreira, J., 1999, "Cinco Anos de Capitalizaηγo Bolsista em Analise", Suplemento 1000 Maiores, Expresso.*
[7] *For more details on the evolution of the mutual fund industry in Portugal during that period, see the Annual Reports of the Portuguese Securities' Exchange Commission (CMVM) between 1996 and 2002 inclusive.*

particularly felt in the Portuguese stock exchange between the last quarter of 1998 and the last quarter of 1999, with the market index exhibiting multiple fluctuations without any definitive directional movement.

This uncertainty was followed by a surge in stock prices, around September 1999, when Portugal experienced the impact from the Dot Com bubble (Balbina and Martins, 2002). During the last quarter of 1999 and early 2000, there was a rise in the initial public offerings of IT-companies[8] accompanied by a rally in their prices (Sousa, 2002). This rally led the market index to a new peak, slightly higher than that of April 1998, and came to an abrupt halt in the beginning of March 2000, following the slump observed in the NASDAQ. The DotCom crash, coupled with the events in the US during September 2001 jointly contributed to the market's free-fall, which lasted for over two years. By October 2002, the market index effectively reached the levels of year-end 1996 (around 5150 units). The consolidating wave in the market after 2000 (Leite and Cortez, 2006) that threatened the viability of the stock exchange (as it led to a decrease in the number of listed companies) prompted the authorities to incorporate the Portuguese stock exchange into the Euronext-platform during 2002. Even so, however, the market managed to exhibit signs of only moderate recovery until 2005 (the end of our sample period).

4. Data and Methodology

4.1 Data

Before discussing the data employed in this research, we would like to emphasize that we are testing for herding and feedback trading in the Portuguese market on the premises of the PSI20 index. The latter is a value-weighted index

---

[8] *Examples include "PT Multimedia", "PT Multimedia.Com", "Novabase", "Impresa" and "Sonae.Com"*

including the twenty most liquid stocks and was officially launched on December 31st 1992. The choice of the PSI20 stems from the fact that there exist constituent lists that reflect its historical composition. This is important in methodological terms, since, as we shall see in the next section, the measure of herding we employ (Hwang and Salmon, 2004) requires the estimation of the cross-sectional standard deviation of the betas of the stocks of a given portfolio (in this case, an index). In the absence of exact knowledge as to which stocks are included in the portfolio of an index over time, the model may generate erroneous results. Our choice of the PSI20 is also motivated by the fact that Portugal does not maintain an all-shares' index (hence, we cannot simply include all stocks for which data is available) and also because historical constituent lists for other Portuguese market indices (such as the PSI Geral) were not available[9].

Our data includes daily prices both for the PSI20 as well as its constituent stocks and covers the period from its inception (1/1/1993) until 31/12/2005. The historical constituent lists for the PSI20 were obtained from the website of the Portuguese stock exchange (January 1993 - December 2001) as well as the Exchange itself (January 2002 – December 2005).

4.2 Methodology

4.2.1 Herding

To test for herding, we employ the model developed by Hwang and Salmon (2004) in their study of the US and South Korean markets. This model is price-based and measures herding on the basis of the cross-sectional dispersion of the factor-sensitivity of assets. More specifically, Hwang and Salmon (2004) argued that when

---

[9] *The PSI Geral is an index accommodating all stocks that meet the criteria of inclusion in the Main Market of the Portuguese stock exchange. As such, it is a selective index, not an all-shares' one. We did not manage to obtain historical constituent lists for that index, since, according to the Euronext Lisbon, such lists were not available.*

investors are behaviourally biased, their perceptions of the risk-return relationship of assets may be distorted. If they do indeed herd towards the market consensus, then it is possible that as individual asset returns follow the direction of the market, their CAPM-betas will deviate from their equilibrium values. Thus, the beta of a stock does not remain constant (as the conventional CAPM would posit), but changes with the fluctuations of investors' sentiment. As a result, the cross-sectional dispersion of the stocks' betas would be expected to be smaller, i.e. asset betas would tend towards the value of the market beta, namely unity. It is on these very premises that their herding measure is based.

More specifically, they assume the equilibrium beta (let β_{imt}) and its behaviourally biased equivalent (β_{imt}^{b}), whose relationship is assumed to be the following:

$$(E_t^b(r_{it}) \ / \ E_t(r_{mt})) = \beta_{imt}^b = \beta_{imt} - h_{mt} \ (\beta_{imt} - 1) \tag{1}$$

where $E_t^b(r_{it})$ is the behaviourally biased conditional expectation of excess returns of asset i at time t, $E_t(r_{mt})$ is the conditional expectation of excess returns of the market at time t and $h_{mt} \leq 1$ is a time-variant herding parameter. To measure h_{mt} (and for this reason, herding on a market-wide basis), the authors calculate the cross-sectional dispersion of β_{imt}^b, as:

$$Std_c(\beta_{imt}^b) = Std_c(\beta_{imt}) \ (1 - h_{mt}) \tag{2}$$

Equation (2) is rewritten as follows:

$$log[Std_c(\beta_{imt}^b)] = log \ [Std_c(\beta_{imt})] + log \ (1 - h_{mt}) \tag{3}$$

in order to extract h_{mt}.

Finally, (3) is written as follows:

$$log[\,Std_c(\beta_{imt}^b)\,] = \mu_m + H_{mt} + \upsilon_{mt} \qquad (4)$$

where

$$log[\,Std_c(\beta_{imt})\,] = \mu_m + \upsilon_{mt} \qquad (5)$$

with $\mu_m = E\,[log[\,Std_c(\beta_{imt})\,]]$ and $\upsilon_{mt} \sim iid\,(0,\ \sigma_{m,\upsilon}^2)$

and $H_{mt} = log\,(1\text{-}h_{mt})$ \hfill (6)

Hwang and Salmon (2004) assume that the herding parameter follows an AR(1) process and their model becomes:

$$log[\,Std_c(\beta_{imt}^b)\,] = \mu_m + H_{mt} + \upsilon_{mt} \qquad (7)$$

$$H_{mt} = \phi_m\,H_{m,t-1} + \eta_{mt} \qquad (8)$$

where $\eta_{mt} \sim iid\,(0,\ \sigma_{m,\eta}^2)$

The above system of equations (7) and (8) accommodates herding as an unobserved component. To extract the latter, Hwang and Salmon (2004) employ the Kalman filter.

Thus, in the above setting, the $log[\,Std_c(\beta_{imt}^b)\,]$ is expected to vary with herding levels, the change of which is reflected through H_{mt}, which bears the interesting property of being able to be depicted graphically, as Hwang and Salmon (2004) showed. Thus, the Hwang and Salmon (2004) measure allows us to obtain a picture of the herding-evolution over time, which we consider particularly helpful, especially in the context of our study, as we wish to study the association of herding with feedback trading over time. Special attention is drawn here to the pattern of H_{mt}. If $\sigma_{m,\eta}^2 = 0$, then $H_{mt} = 0$ and there is no herding. Conversely, a significant value of $\sigma_{m,\eta}^2$ would imply the existence of herding and (as the authors state) this would further

be reinforced by a significant ϕ_m. The absolute value of the latter is taken to be smaller than or equal to one, as herding is not expected to be an explosive process.

To estimate the above system of equations (7) and (8), we first estimate the OLS-estimates of the betas using daily excess return data within monthly windows in the standard market model:

$$r_{itd} = \alpha_{it}^b + \beta_{imt}^b \, r_{mtd} + \varepsilon_{itd} \tag{9}$$

where the subscript "td" indicates daily data for month t.

In line with Hwang and Salmon (2004), the r_{mtd} in (9) refer to excess returns. To calculate the latter, we first derive the percentage log-differenced returns from the closing prices of the index (PSI20) and its constituents and then adjust them by using the appropriate risk-free rate[10]. Having estimated these monthly betas for the stocks in month t, we then estimate their cross-sectional standard deviation for that month, thus constructing a monthly time-series. As Hwang and Salmon (2004) argue, the choice of monthly windows is driven by both estimation considerations (to reduce the estimation error of the betas) as well as practical ones (to maintain a number of observations sufficient enough to detect herding). The cross-sectional standard deviation derived is then used (in its logarithmic form-see equation (7)) as the input for the estimation of the herding measure.

4.2.2 Feedback Trading

To empirically test for feedback trading, we employ the model formally introduced by Sentana and Wadhwani (1992) that has literally dominated the literature related to feedback trading, since it has been applied for a variety of

---

[10] *We proxy for the risk-free rate here through the 3-month deposit-rate up to 31/12/1998 and the 3-month Euribor after 1/1/1999.*

markets, both developed (Koutmos, 1997; Watanabe, 2002; Bohl and Reitz, 2004; Bohl and Reitz, 2006; Antoniou et al, 2005b) as well as developing (Koutmos & Saidi, 2001; Nikulyak, 2002; Malyar, 2005). The model assumes two types of traders, namely "rational" ones, who maximize their expected utility and "feedback" ones who trade on the basis of lagged past returns (one period back). The demand function for the former is as follows:

$$Q_t = \frac{E_{t-1}(r_t) - \alpha}{\theta \sigma_t^2} \tag{10}$$

where Q_t represents the fraction of the shares outstanding of the single stock (or, alternatively, the fraction of the market portfolio) held by those traders, $E_{t-1}(r_t)$ is the expected return of period t given the information of period $t-1$, α is the risk-free rate (or else, the expected return such that $Q_t = 0$), θ is a coefficient measuring the degree of risk-aversion and σ_t^2 is the conditional variance (risk) at time t.

The demand function of their feedback peers can be portrayed as:

$$Y_t = \gamma \, r_{t-1} \tag{11}$$

where γ is the feedback coefficient and r_{t-1} is the return of the previous period ($t-1$) expressed as the difference of the natural logarithms of prices at periods $t-1$ and $t-2$ respectively. A positive value of γ ($\gamma > 0$) implies the presence of positive feedback trading, while a negative value ($\gamma < 0$) would imply the presence of negative feedback ("contrarian") trading.

In equilibrium all shares must be held; hence:

$$Q_t + Y_t = 1 \tag{12}$$

If so, then:

$$\frac{E_{t-1}(r_t)-\alpha}{\theta\sigma_t^2} + \gamma\, r_{t-1} = 1$$

Thus:

$$E_{t-1}(r_t) - \alpha + \gamma\, r_{t-1}\,\theta\,\sigma_t^2 = \theta\,\sigma_t^2$$

$$E_{t-1}(r_t) = \alpha - \gamma\, r_{t-1}\,\theta\,\sigma_t^2 + \theta\,\sigma_t^2 \tag{13}$$

which provides us with a modified version of the CAPM in the presence of feedback traders.

Assuming $r_t = E_{t-1}(r_t) + \varepsilon_t$, we have:

$$r_t = \alpha - \gamma\, r_{t-1}\,\theta\,\sigma_t^2 + \theta\,\sigma_t^2 + \varepsilon_t \tag{14}$$

where r_t represents the actual return at period t and ε_t is the error term. To allow for autocorrelation due to non-synchronous trading, Sentana and Wadhwani (1992) modify (14) as follows:

$$r_t = \alpha + \left(\gamma_0 + \gamma_1\sigma_t^2\right)r_{t-1} + \theta\sigma_t^2 + \varepsilon_t \tag{15}$$

where γ_0 is designed to capture possible non-synchronous trading effects and $\gamma_1 = -\theta\gamma$.

The addition of feedback traders in an otherwise CAPM-setting bears some interesting implications. As equation (14) shows, the inclusion of the term $\gamma\, r_{t-1}\,\theta\,\sigma_t^2$ leads to return-autocorrelation, the magnitude of which is a function of the risk in the market (as denoted by σ_t^2). Hence, the higher the volatility grows, the higher the autocorrelation. Also the sign of the autocorrelation will be determined by the sign of the feedback trading prevalent among feedback traders; if positive feedback traders

prevail, then the autocorrelation will be negative, whilst it will be positive in the presence of more negative feedback traders.

However, the feedback coefficient (γ_1) is not independent of volatility in this model. Positive feedback trading may well lead to the launch of a trend, thus forcing prices to fluctuate more wildly, hence becoming more volatile; the relationship can also assume a different form, as highly volatile markets may lead many investors to resort to strategies of positive feedback style, e.g. by employing portfolio insurance and stop-loss orders, which might cause a general price decline (in the event of a rising trend) or further exacerbate the price slump in case of a price fall.

The implications for rational traders from a rise in volatility are also obvious. As volatility rises, so does risk and, as a result, the risk-premium required on their behalf in order to hold more shares; assuming constant risk-aversion (the θ-coefficient), their ability to profit from a hypothetical trend may not be taken for granted, as the market will have grown riskier and they may well decide to liquidate their positions early on rather than follow the trend (see Kyle and Wang, 1997). Of course, they may well choose to stay on, in an attempt to profit from this trend, in the spirit of De Long et al (1990).

In order to test for feedback trading on these premises, we have to specify the measurement equation for the conditional variance, as indicated by equation (15). For robustness reasons, the conditional variance σ_t^2 is modeled here using three different specifications;

- a GARCH (1,1) process (Bollerslev et al, 1994):

$$\sigma_t^2 = \omega + \beta \ \varepsilon_{t-1}^2 + \gamma \sigma_{t-1}^2 \tag{16}$$

where, σ_t^2 is the conditional variance of the returns at time t, ε_t is the innovation at time t and ω, β and γ are nonnegative fixed parameters.

- an EGARCH process (Nelson, 1991, Brooks, 2002):

$$ln\,\sigma_t^2 = \omega + \xi\,ln\,\sigma_{t-1}^2 + \psi\,(u_{t-1}/\sqrt{\sigma_{t-1}^2}) + \kappa\,[(|u_{t-1}|/\sqrt{\sigma_{t-1}^2}) - \sqrt{2/\pi}\,] \tag{17}$$

EGARCH allows for asymmetric responses of volatility to positive and negative shocks, since if the volatility-returns relationship is negative, γ will be negative as well. As standardized residuals from GARCH models tend to exhibit signs of leptokurtosis, we estimate the EGARCH model by assuming a Generalized Error Distribution (GED).

- A conditional variance specification relevant to the EGARCH is the Asymmetric GARCH (1,1) developed by Glosten et al (1993):

$$\sigma_t^2 = \omega + \beta\,\varepsilon_{t-1}^2 + \gamma\sigma_{t-1}^2 + \delta S_{t-1}\varepsilon_{t-1}^2 \tag{18}$$

Here δ captures the asymmetric responses of volatility during positive versus negative innovations. S_t is a binary variable equalling one if the innovation at time t is negative and zero otherwise. If δ is positive and statistically significant then negative innovations increase volatility more that positive innovations.

4.3 Descriptive statistics

4.3.1 Herding

Table 1 presents some statistics related to the estimated cross-sectional standard deviation as well as the logarithmic cross-sectional standard deviation of the betas of the PSI-20 portfolio. As indicated by the table, the cross-sectional standard deviation of the betas is significantly different from zero and exhibits significant positive skewness and kurtosis, while the Jarque-Bera statistic indicates departures from normality (non-Gaussianity). When observing the statistics of the logarithmic cross-sectional standard deviation of the betas, the above phenomena disappear.

Therefore, the state-space model of Hwang and Salmon (2004) described previously can be legitimately estimated using the Kalman filter.

Table 1: Sample herding statistics (January 1993 – December 2005)

	Cross-Sectional standard deviation of OLS betas	Logarithmic cross-sectional standard deviation of OLS betas
Mean	*0.71873****	*-0.17004****
Standard Deviation	*0.26552*	*0.15166*
Skewness	*1.44690****	*0.05776*
Kurtosis	*3.79204****	*0.50618*
Jarque-Bera	*147.89895****	*1.75213*

(*=significance at the 1 % level; **=significance at the 5 % level; ***=significance at the 1 % level).

4.3.2 Feedback Trading

Descriptive statistics for the PSI20 daily returns are provided in Table 2. The statistics reported are the mean (μ), the standard deviation (σ), measures for skewness (S) and kurtosis (K) and the Ljung–Box (LB) test statistic for ten lags. The skewness and kurtosis measures indicate departures from normality (returns-series appear significantly negatively skewed and highly leptokurtic).

Rejection of normality can be partially attributed to temporal dependencies in the moments of the series. It is common to test for such dependencies using the Ljung–Box portmanteau test (LB) (Bollerslev et al., 1994). The LB-statistic is significant for the returns-series of the PSI20. This provides evidence of temporal dependencies in the first moment of the distribution of returns, due to, perhaps nonsynchronous trading or market inefficiencies. However, the LB-statistic is

incapable of detecting any sign reversals in the autocorrelations due to positive/negative feedback trading. It simply provides an indication that first-moment dependencies are present. Evidence on higher order temporal dependencies is provided by the LB-statistic when applied to squared returns. The latter is significant and higher than the LB-statistic calculated for the returns, suggesting that higher moment temporal dependencies are pronounced.

<div align="center">

Table 2: Sample statistics: PSI20 daily returns (1/1/1993-31/12/2005)

μ	*0.03252*
σ	*1.01773*
S	*-0.63459****
K	*7.68707****
LB(10)	*117.9430919****
LB²(10)	*766.0910101****

</div>

(* = 10% sign. Level, ** = 5% sign. Level, *** = 1% sign. Level).μ = mean, σ = standard deviation, S = skewness, K = excess kurtosis, LB (10) and LB² (10) are the Ljung-Box statistics for returns and squared returns respectively distributed as chi-square with 10 degrees of freedom.

5. Results-Discussion

5.1 Herding

Table 3 presents the results related to herding on the premises of the Hwang and Salmon (2004) measure. Our interest here is concentrated on the estimates for the parameters of the state-equation, namely ϕ_m and $\sigma_{m,\eta}$, since significant values for those two would indicate the presence of significant herding. As Table 3 illustrates, the persistence parameter (ϕ_m) is stastistically significant (1% level), while the standard deviation ($\sigma_{m,\eta}$) of the state-equation error (η_{mt}) is significant at the 5% level. These results thus indicate that there existed significant herding towards the

PSI20 index during the 1993-2005 period. The value of μ_m (reflective of the mean level of the logarithmic cross-sectional standard deviation of the index-portfolio betas as adjusted through herding-expressed here through H_{mt}) is found to be statistically significant at the 10% level, while a similar observation can be made for the logarithmic cross-sectional standard deviation of the index-portfolio betas, as the estimate of the $\sigma_{m,\upsilon}$ indicates. The bottom row of Table 3 provides us with the signal-proportion value, which according to Hwang and Salmon (2004) indicates what proportion of the variability of the logarithmic cross-sectional standard deviation of the betas is explained by herding[11]. As Hwang and Salmon (2004) showed empirically in their paper, the bigger the value of the signal-to-noise ratio, the less smoothly over time herding evolves. The signal-proportion assumes a value of approximately 17%, which is indicative of a smooth evolution of herding over our sample-period.

Table 3: Herding results

$$log \, [\, Std_c(\beta^b_{imt})] \, = \, \mu_m + \, H_{mt} + \, \upsilon_{mt}, \quad \upsilon_{mt} \sim iid \, (0, \, \sigma^2_{m,\upsilon})$$
$$H_{mt} = \phi_m \, H_{m,t-1} + \eta_{mt}, \quad \eta_{mt} \sim iid \, (0, \, \sigma^2_{m,\eta})$$

μ_m	-0.082584526 (0.049695057)*
ϕ_m	0.981432875 (0.015962296)***
$\sigma_{m,\upsilon}$	0.11566758 (0.001642507)***
$\sigma_{m,\eta}$	0.025511252 (0.000276008)**
$\sigma_{m,\eta}$ / S.D. (log-CXB)	0.168209125

(*=significance at the 1 % level; **=significance at the 5 % level; ***=significance at the 1 % level). Parentheses include the standard errors of the estimates; sample period: January 1993 – December 2005.

---

[11] *The signal-proportion is estimated by dividing the $\sigma_{m,\eta}$ by the time series standard deviation of the logarithmic cross-sectional standard deviation of the betas, in line with Hwang and Salmon (2004).*

The course of herding (represented by a thin line in Figure 1) compared to the PSI20 index (represented by a thick line in Figure 1) provides us with interesting insights. Herding exhibited a fall during 1993 (January-December), a year that coincided with the increase of foreign investment in Portuguese securities following the liberalization of overseas capital flows. During the first half of 1994 it entered an ascending course, reaching a peak during the summer 1994, a point corresponding to the outbreak of the Mexican crisis. The latter combined with the poor corporate performance witnessed during that period (Balbina and Martins, 2002), could well have convinced the Portuguese investors of the negative prospects for the market, thus prompting them to herd more. After June 1994, herding adhered to a descending course, which lasted well into 1995.

Enter 1996 herding begins to rally with the PSI20 and continues its rally throughout the market's boom until April 1998, when the PSI20 reached its peak. Although the PSI20 then exhibits descending tendencies due to the impact of the Asian/Russian crises that lead it to hit a bottom on September 1998, herding maintains its ascending course during that period and records its peak on November 1998. This implies that herding during this (roughly) three-year period kept growing as the market index skyrocketed and kept rising[12] roughly until it bottomed. This indicates that herding tended to increase during a period when the market produced "definitive" directional movements, a fact in line with the findings of Hwang and Salmon (2004). When the market was booming, investors were convinced of the rising trend and led herding levels to a unique (for the period under investigation) growth. In the advent of the global instability during 1998 (Asian/Russian crises), herding levels rose even more as investors may have been led to believe that a market-reversal was imminent,

---

[12] *November1998 was the month in which herding assumed its highest value of the entire sample period (0.26643)-see Figure 1.*

thus leading the PSI20 to its first bottom in September 1998. An alternative explanation for the slump after April 1998 may have been that the market reached levels that could not be sustained; a euphoric investors' sentiment following the market's upgrade in December 1997 could well be the reason underlying the price-overshooting during the first quarter of 1998.

Following year-end 1998, herding entered a descending course, which asserted itself more boldly after September 1999 and lasted until the beginning of year 2001. As mentioned previously, this period was characterized by a rather pronounced uncertainty (enhanced by the international knock-on effects of the Asian/Russian crises and imprinted into a multiplicity of swings of the PSI20) that was followed by the rise of the index after September 1999 (the DotCom bubble-effect) and its subsequent crash (following the Dotcom bubble crash in the US).

After a series of fluctuations during most of 2001, herding shows some signs of ascension which culminates in increasing herding levels, especially between November 2001 and September 2002, only to drop abruptly again afterwards. This short rise in herding is associated with the bottom hit by the index following the peak of March 2000 and is found to commence shortly after the terrorist attack in New York on September, 11th 2001. Interestingly enough, Hwang and Salmon (2004) reported an increase in herding levels in the US-market following this event, which they associated with the advent of a "bearish" sentiment among US-investors. According to the above authors, this event may have functioned as a confirmation of a "bearish" market that was already underway following the NASDAQ's slump in year 2000. The above may have impacted upon Portuguese investors as well, thus confirming the market drop that was underway in Portugal since March 2000.

Figure 1: Herding towards the PSI20 (January 1993 – December 2005)
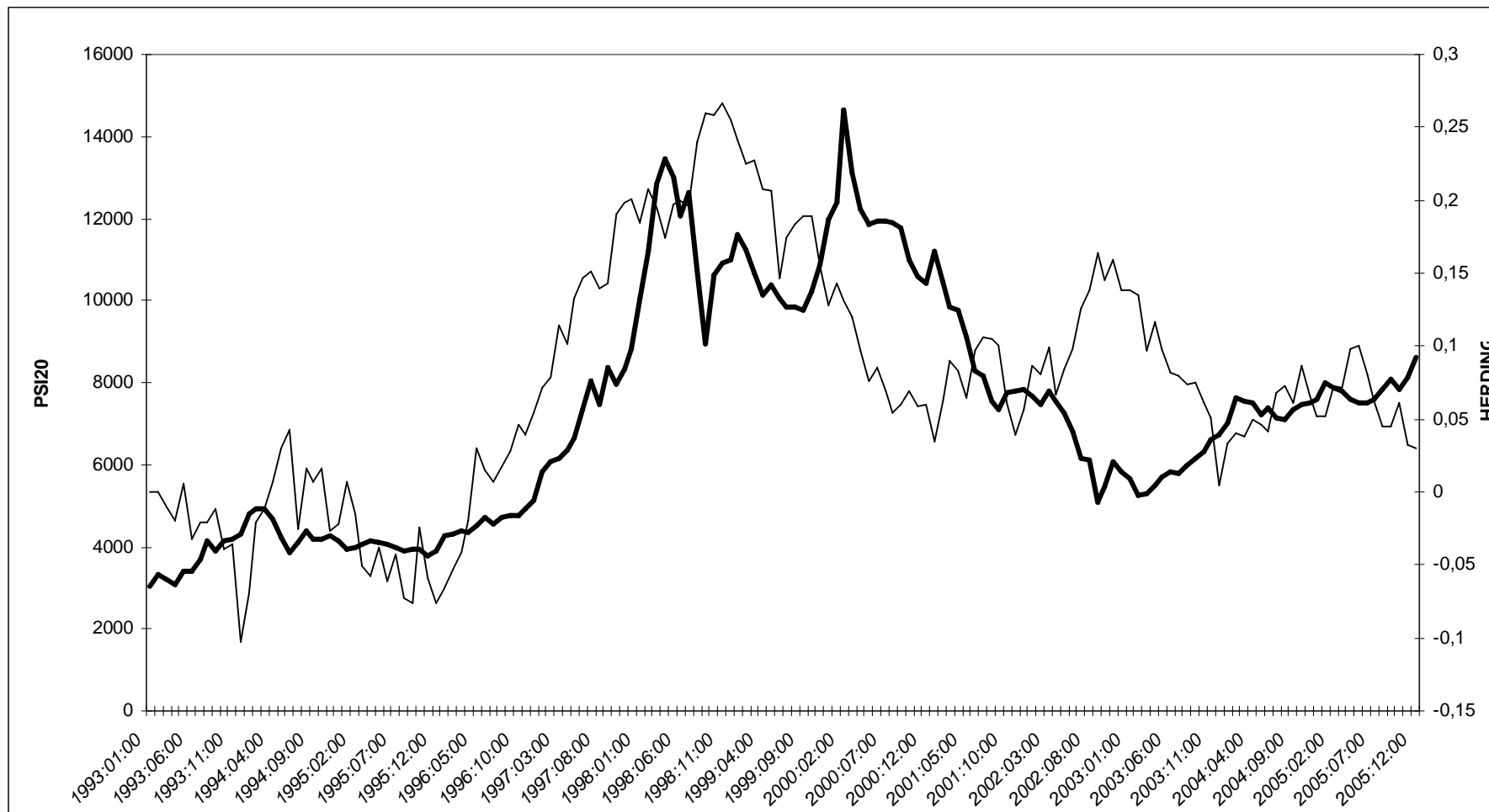
Herding = thin line
PSI20 = thick line

After the third quarter of 2002 herding started falling again reaching a bottom in December 2003. Following that point, it began to rise again during years 2004 and 2005 when the market was already reaffirming its ascending trend, although this rise was characterized by a multiplicity of swings of either direction.

5.2 Feedback Trading

Table 4 presents the results from the Sentana and Wadhwani (1992) model-tests using the three variance-specifications mentioned above. The coefficients describing the conditional variance process, ω, β, γ and δ, are all statistically significant (10% level) in all cases. Note also, that γ in the EGARCH-specification is negative and statistically significant (5%) implying that negative innovations tend to increase volatility more than positive ones. This is further confirmed by the δ-coefficient of the Asymmetric GARCH (1,1) which is positive (albeit insignificant). The feedback coefficient is indicative of statistically significant (5%) positive feedback trading for all three variance-specifications.

Table 4: Positive feedback trading tests (Sentana and Wadhwani, 1992)

Parameters	GARCH (1,1)	EGARCH (1,1)	GJR
α	0.024769364 (0.014053513)*	0.009563211 (0.017897544)	0.023874975 (0.014215710)*
ϑ	0.030028666 (0.015821378)*	0.030202721 (0.019298573)	0.016764791 (0.017217452)
ϕ_0	0.193831095 (0.020446627)***	0.207034743 (0.022513790)***	0.198475969 (0.022484012)***
ϕ_1	-0.015556872 (0.005861641)**	-0.024497583 (0.008969658)**	-0.015405740 (0.005702052)**
ω	0.013058591 (0.006530899)***	0.000596263 (0.006272384)*	0.014177318 (0.007342656)*
β	0.852927147 (0.039922082)***	0.967446179 (0.012112446)***	0.854552062 (0.038463671)***
γ	0.144475625 (0.040734626)***	-0.038718435 (0.016215273)**	0.115537084 (0.031122140)***
δ		0.279324016 (0.050434866)***	0.048052068 (0.031302742)

(* = 10% sign. Level, ** = 5% sign. Level, *** = 1% sign. Level). Parentheses include the standard errors of the estimates; sample period: 1/1/1993-31/12/2005.

To test for the robustness of our results over time, we run the Sentana and Wadhwani (1992) model using rolling windows of one, two and three years' length rolled every 30 days. For illustration purposes, we present the significance areas of positive feedback trading from the 2-year rolling windows' tests in Figures 2a, 2b and 2c, each of which corresponds to one of the three conditional variance processes (GARCH (1,1), Exponential GARCH, Asymmetric GARCH). Figures 2a-c indicate the clustering of the statistical significance[13] (5 percent level) of feedback trading between 1996 and 1999 inclusive; more specifically, the sign of the feedback coefficient for all tests corresponding to that window is negative, thus indicating that the 1996-1999 period was characterized by the presence of significant positive feedback trading. We also ran the Sentana and Wadhwani model using 1- and 3-year rolling windows and the estimates obtained were qualitatively similar to those generated by the 2-year windows.

5.3 Discussion

We mentioned in the beginning that the aim of our study related to the joint examination of herding and feedback trading at the market-level in order to see whether these two behavioural patterns exhibited any similarities in their evolution over time. To that end, we will now try to produce a synthesis of our results in the context of the Portuguese market in order to establish whether this is indeed the case.

When looking at the full-sample results, the estimates of our empirical tests for herding (Table 3) and feedback trading (Table 4) indicate that they were both found to

---

[13] *Indicated by the shaded area.*

Figures 2a-c: Areas of statistical significance of positive feedback trading towards the PSI20

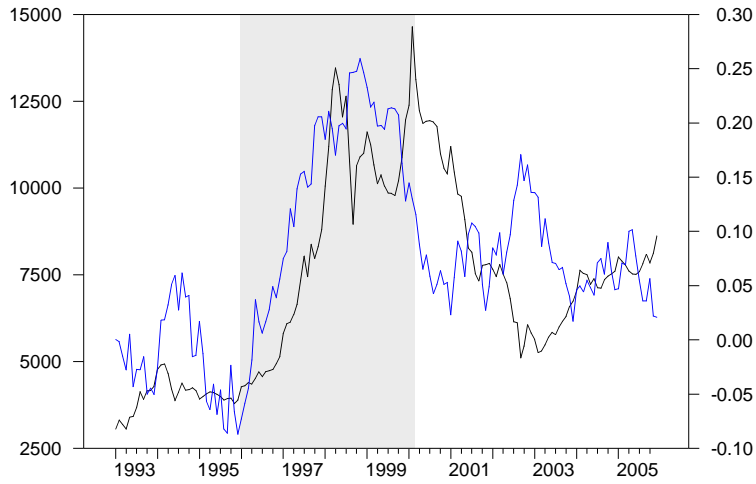**Figure 2a: GARCH (1,1) conditional variance process**

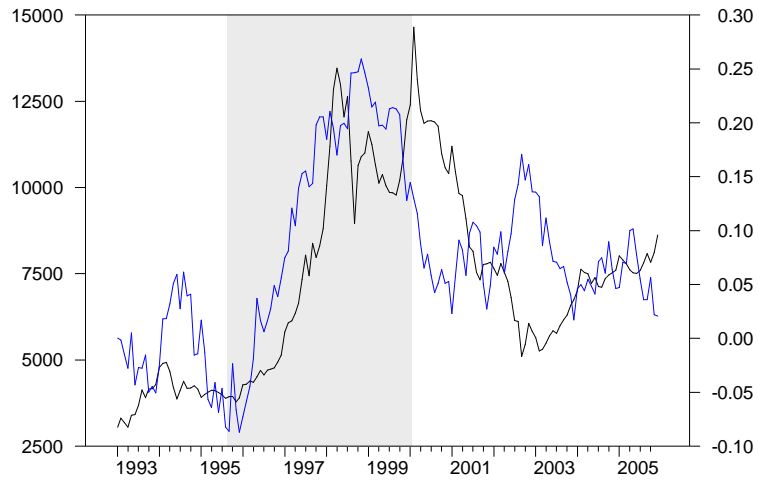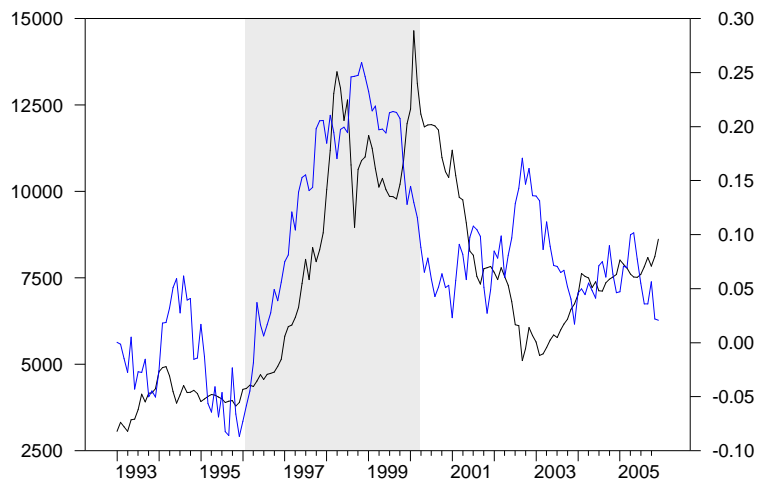**Figure 2b: EGARCH conditional variance process**

Figure 2c: AGARCH conditional variance process

PSI20 = black line
Herding = blue line

be statistically significant for the 1993-2005 period. More specifically, our findings denote the coexistence of directionally discernible herding and significant positive feedback trading at the level of the PSI20. These results are in line with our discussion in Section 2.3 referring to the conceptual association between herding and positive feedback trading as they illustrate the jointly significant presence of the two in Portugal during the period under investigation.

The intertemporal examination of herding and feedback trading provides us with an interesting visualization of their evolution. Herding experiences a unique surge between early 1996 and late 1998, while it begins to decline to lower levels afterwards (Figure 1). Feedback trading on the other hand appears to exhibit a clustering of its statistical significance between 1996 and 1999 inclusive (Figures 2a-c); the sign of the feedback direction here is always indicative of positive feedback trading. Consequently, our findings are reflective of the simultaneous presence of rising herding levels and significant positive feedback trading during the second half of the 1990s. As we discussed in Section 3, this period corresponds to a confluence of events of both local as well as global dimension that led the Portuguese stock exchange to undergo a series of successive booms and busts.

We consider these results to constitute interesting evidence, more so in view of the fact that herding and feedback trading have never been jointly investigated at the macro level before. More specifically, our findings demonstrate that herding and (positive) feedback trading both present themselves significantly, with their significance appearing to simultaneously exhibit a certain clustering during a distinctive time period. Interestingly enough, that period coincided with a sequence of events that led to a growth of investors' optimism and participation and culminated into a unique rise of the market (over 270% between January 1996 and April 1998).

Although it is not possible to claim that our results bear a universal applicability (given that we are only investigating the issue in a single market), we contend that the comparative study of the topic across a variety of markets would allow us greater insight into the relationship between herding and feedback trading at the macro level and whether the joint significance of these two behavioural patterns is prone to manifesting itself more boldly during such euphoric periods.

6. Conclusion

Herding and feedback trading constitute two patterns of behavioural trading whose study by researchers has increased notably following the advent of Behavioural Finance. Although much empirical work has been devoted to their combined study at the micro level, they have never been jointly examined at the macro level (i.e. the level of the market). Using data from the Portuguese market for the 1993-2005 period we tested for the first time for the relationship between herding and feedback trading in this context. Our results indicate the joint significance of these two patterns both globally (i.e. for our full-sample period) as well as intertemporally (their significance jointly exhibits an identifiable dramatic rise during the second half of the 1990s, a period of euphoric investor sentiment for Portugal).

We consider our work to constitute an original contribution to the Finance literature given that it produces evidence on the underlying relationship between herding and feedback trading at the macro level for the first time in the Finance research. Perhaps more importantly, our findings are in line with the discussion we conducted in the beginning regarding the conceptual association between herding and positive feedback trading, since the issue of this association has never been pursued

theoretically or empirically in the relevant Finance literature. As our present empirical design involved the Portuguese market only, we believe that our study provides the stimulus for further research in order to control for the robustness of our results by jointly testing for herding and feedback trading at the macro level across more markets internationally. Such a cross-market approach would also yield extra insight into whether the significant coexistence of herding and positive feedback trading we traced for the case of Portugal can be attributed to the unique elements of investors' psychology of the late 1990s in that market alone or constitutes a pattern that can be identified in other markets during periods with similar characteristics.

References

Andergassen, R., 2003, "Rational Destabilizing Speculation and the Riding of Bubbles", Working Paper, Department of Economics, University of Bologna.

Antoniou, A., Galariotis, E.C., and Spyrou, S.I., 2005a, "Contrarian Profits and the Overreaction Hypothesis: The Case of the Athens Stock Exchange", European Financial Management, 11, No. 1, 71-98

Antoniou, A., Koutmos, G. and Pericli, A., 2005b, "Index Futures and Positive Feedback Trading: Evidence from Major Stock Exchanges", Journal of Empirical Finance, Vol.12, Issue 2, 219-238.

Balbina and Martins, 2002, "The Analysis of Seasonal Anomalies in the Portuguese Stock Market", The Bank of Portugal.

Banerjee, A. V., 1992, "A Simple Model of Herd Behavior", The Quarterly Journal of Economics, Vol. CVII, Issue 3, 797-817.

Barberis, N., Shleifer, A. and Vishny, R., 1998, "A Model of Investor Sentiment", Journal of Financial Economics, 49, 307-343.

Barberis, N. and Thaler, R., 2002, "A Survey of Behavioural Finance", Working Paper 9222, National Bureau of Economic Research.

Bessembinder, H. and Chan, K., 1995, "The Profitability of Technical Trading Rules in the Asian Stock Markets", Pacific-Basin Finance Journal, 3, 257-284.

Bikhchandani, S., Hirshleifer, D. and Welch, I., 1992, "A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades", Journal of Political Economy, Vol. 100, No. 5, 992-1026.

Bikhchandani S. and Sharma S., 2001, "Herd Behaviour in Financial Markets", IMF Staff Papers, Vol. 47, No.3.

Bohl, M. T. & Reitz, S, 2004, "The Influence of Positive Feedback Trading on Return Autocorrelation: Evidence from the German Stock Market", in: Stephan Geberl, Hans-Rüdiger Kaufmann, Marco Menichetti und Daniel F. Wiesner (Hrsg.), Aktuelle Entwicklungen im Finanzdienstleistungsbereich, Physica-Verlag, Heidelberg, 221 - 233.

Bohl, M. T. & Reitz, S. ,2006, "Do Positive Feedback Traders Act in Germany's Neuer Markt?", Quarterly Journal of Business and Economics, Volume 45, Nos. 1 and 2.

Bollerslev, T., R.F Engle and D. Nelson, 1994, ARCH Models, in R.F. Engle and D.L.McFadden, eds, Handbook of Econometrics, Vol IV (Elsevier Science B.V.) Ch 49

Bowe, M. and Domuta, D., 2004, "Investor Herding During Financial Crisis: A Clinical Study of the Jakarta Stock Exchange", Pacific-Basin Finance Journal, Vol. 12, 387-418

Bowman, R., Iverson, D., 1998, "Short-Run Overreaction in the New Zealand Stock Market", Pacific-Basin Finance Journal, 6, 475-491.

Brooks, C., 2002, "Introductory Econometrics for Finance", Cambridge.

Choe, H., Kho, B.-C. and Stulz, R. M., 1999, "Do Foreign Investors Destabilize Stock Markets? The Korean Experience in 1997", Journal of Financial Economics, 54, 227-264.

CMVM (Portuguese Securities' Exchange Commission) Annual Reports: years 1996 – 2002.

De Bondt, W.F.M. and Thaler, R.H., 1985, "Does the Stock Market Overreact?", Journal of Finance, 40, 793-805.

De Long, J.B., Shleifer, A., Summers, L.H. and Waldmann, R.J., 1990, "Positive Feedback Investment Strategies and Destabilizing Rational Speculation", The Journal of Finance, Volume 45, Issue 2, 379-395.

Devenow, A. and Welch, I., 1996, "Rational Herding in Financial Economics" European Economic Review, 40, 603-615.

Do, V., Tan, M. G.-S. and Westerholm, P.J., 2006, "Herding Investors and Corporate Governance in a Concentrated Market", Working Paper, School of Business, University of Sydney.

Farmer, J.D., 2002, "Market Force, Ecology and Evolution", Industrial and Corporate Change, Vol. 11, No.5, 895-953 (59).

Farmer, J. D. and Joshi, S., 2002, "The Price Dynamics of Common Trading Strategies", Journal of Economic Behavior and Organization 49 (2) 149-171.

Ferreira, J., 1999, "Cinco Anos de Capitalizaηγo Bolsista em Anαlise", Suplemento 1000 Maiores, Expresso

Galbraith, J. K., 1994, "A Short History of Financial Euphoria", Livanis Publications (Greek Edition)

Glaeser, M. and Weber, M., 2004a, "Overconfidence and Trading Volume", Working Paper, Sonderforschungsbereich 504, University of Mannheim.

Glaeser, M. and Weber, M., 2004b, "Which Past Returns Affect Trading Volume?", Working Paper, Sonderforschungsbereich 504, University of Mannheim.

Glosten L, Jagannathan R, and Runkle D, 1993, "Relationship between the Expected Value and the Volatility of the Nominal Excess Return on Stocks", Journal of Finance, 48, 1779-1801.

Graham, J.R., 1999, "Herding Among Investment Newsletters: Theory and Evidence", The Journal of Finance, Vol. LIV, No. 1, 237-268.

Grinblatt, M., Titman, S. and Wermers, R., 1996, "Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behaviour", The American Economic Review, Vol. 85, No. 5, 1088-1105.

Hirshleifer, D., 2001, "Investor Psychology and Asset Pricing", Journal of Finance, Vol. LVI, No4, 1533-1598.

Hirshleifer, D. and Teoh, S.T., 2003, "Herd Behaviour and Cascading in Capital Markets: A Review and Synthesis", European Financial Management Journal, Vol. 9, No. 1, 25-66.

Huddart, S., Lang, M. and Yetman,M., 2002, "Psychological Factors, Stock Price Paths and Trading Volume", Working Paper, Pennsylvania State University.

Hwang, S. and Salmon, M., 2004, "Market Stress and Herding", Journal of Empirical Finance, 11, pp. 585-616.

Iihara, Y., Kato, H. K. and Tokunaga, T., 2001, "Investors' Herding on the Tokyo Stock Exchange", International Review of Finance, Vol. 2**,** No. 1, 71-98.

Ito, A., 1999, "Profits on Technical Trading Rules and Time-Varying Expected Returns: Evidence from Pacific-Basin Equity Markets", Pacific-Basin Finance Journal, 7, 283-330.

Jegadeesh, N. and Titman, S., 2001, "Profitability of Momentum Strategies: An Evaluation of Alternative Explanations", The Journal of Finance, Volume 56, Issue 2, 699-720.

Jones, S.L., Lee, D. and Weis, E., 1999, "Herding and Feedback Trading by Different Types of Institutions and the Effects on Stock Prices", Working Paper, Kelley School of Business, University of Indiana.

Kang, J., Liu, M-H and Ni, S.X., 2002, "Contrarian and Momentum Strategies in the China Stock Market: 1993-2000", Pacific-Basin Finance Journal, 10, 243-265.

Kim, W. and Wei, S-J, 2002a, "Offshore Investment Funds: Monsters in Emerging Markets?", Journal of Development Economics, Vol. 68, No. 1, 205-224

Kim, W. and Wei, S-J, 2002b, "Foreign Portfolio Investors Before and During a Crisis", Journal of International Economics, Vol. 56, No. 1, 77-96

Kindleberger, C.P., 1978, "Manias, Panics, and Crashes", New York Basic Books.

Koutmos, G., 1997, "Feedback Trading and the Autocorrelation Pattern of Stock Returns: Further Empirical Evidence", Journal of International Money and Finance, Vol. 16, No. 4, 625-636.

Koutmos, G. and Saidi, R., 2001, "Positive Feedback Trading in Emerging Capital Markets", Applied Financial Economics,11, 291-297.

Kyle, A.S. and Wang, F.A., 1997, "Speculation Duopoly with Agreement to Disagree: Can Overconfidence Survive the Market Test?", The Journal of Finance, Vol. LII, No. 5, 2073-2090.

Lakonishok, J., Shleifer, A. and Vishny, R., 1992, "The Impact of Institutional Trading on Stock Prices", Journal of Financial Economics, 32, 23-43.

Leite, P.A. and Cortez, M. C., 2006, "Conditional Performance Evaluation: Evidence from the Portuguese Mutual Fund Market", Working Paper, University of Minho.

Luskin, D.L., 1988, "Portfolio Insurance: A Guide to Dynamic Hedging", John Wiley and Sons.

Malyar, M., 2005, "Positive Feedback Trading and Return Autocorrelation in the Transition Markets: The Case of CEE Countries and Selected CIS Economies", MA Economics Thesis, National University "Kyiv-Mohyla Academy".

Mathiopoulos, H., 2000, "Ο Λίμιτ-Ντακ να δεις πώς φιλούσε" (="You Should See How Limit-Duck Was Kissing"), Metamesonykties Publications.

Ming, L.M., Nor, F.M. and Guru, B.K., 2000, "Technical Analysis in the Malaysian Stock Market: An Empirical Evidence", Paper presented at the 5th APFA Conference in Dundee.

Mun, J.C., Vasconcellos, G.M. and Kish, R., "Tests of the Contrarian Investment Strategy: Evidence from the French and German Stock Markets", International Review of Financial Analysis, 8:3, 215-234.

Nelson, D.B., 1991, "Conditional Heteroscedasticity in Asset Returns: A New Approach", Econometrica, 59(2), 347-370.

Nikulyak, M., 2002, "Return Behaviour in an Emerging Stock Market: The Case of Ukraine", MA Economics Thesis, National University "Kyiv-Mohyla Academy".

Nofsinger, J. and Sias, R., 1999, "Herding and Feedback Trading by Institutional and Individual Investors," Journal of Finance, Volume 45, number 6, 2263-2295.

Odean, T., 1998, "Volume, Volatility, Price and Profit when All Traders are Above Average", The Journal of Finance, Vol LIII, No. 6., 1887-1934.

Osler, C.L., 2002, "Stop-Loss Orders and Price Cascades in Currency Markets", The Federal Reserve Bank of New York, Staff Report No. 150.

Ratner, M. and Leal, R.P.C., 1999, "Tests of Technical Trading Strategies in the Emerging Equity Markets of Latin America and Asia", Journal of Banking and Finance, 23, 1887-1905.

Scharfstein, D.S. and Stein, J.C., 1990, "Herd Behaviour and Investment", The American Economic Review, Volume 80, Issue 3, 465-479.

Sentana, E. and Wadhwani, S., 1992, "Feedback Traders and Stock Return Autocorrelations: Evidence from a Century of Daily Data", The Economic Journal, Volume 102, Issue 411, 415-425.

Shefrin, H. and Statman, M., 1985, "The Disposition to Sell Winners too Early and Ride Losers too Long", Journal of Finance, 40, 777-790.

Shiller, R. J., 1995, "Conversation, Information and Herd Behavior" American Economic Review, 85(2), 181–185."

Sias, R., 2004, "Institutional Herding," Review of Financial Studies, Volume 17, Number 1, 165-206.

Soros, G., 1987, "The Alchemy of Finance", John Wiley and Sons, New York.

Sousa, A, 2002, "A Evolução do Mercado de Acções em Portugal", Mestrado em Economia, Faculdade de Economia, Universidade de Coimbra.

Strozzi, F. and Zaldívar -Comenges, J-M, 2005, "New Trading Methodology for Financial Time Series", LIUC papers, No. 162, Serie Metodi Quantitativi 15, Università Carlo Catanneo.

Trueman, B., 1994, "Analyst Forecasts and Herding Behaviour", The Review of Financial Studies, Vol.7, No.1, 97-124.

Voronkova, S. and Bohl, M.T., 2005, "Institutional Traders' Behaviour in an Emerging Stock Market: Empirical Evidence on Polish Pension Fund Investors", Journal of Business, Finance and Accounting, 32(7) and (8), 1537-1560.

Watanabe, T., 2002, "Margin Requirements, Positive Feedback Trading, and Stock Return Autocorrelations: The Case of Japan", Applied Financial Economics, 12, 395-403.

Wermers, R., 1999, "Mutual Fund Herding and the Impact on Stock Prices", The Journal of Finance, Vol. LIV, No.2, 581-622.

Wong, W-K, Manzur, M. and Chew, B-K., 2003, "How Rewarding is Technical Analysis? Evidence from Singapore Stock Market", Applied Financial Economics, Vol. 13, No. 7, 543-551.