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Do the most skillful managers herd?

MERCEDES ALDA
University of Zaragoza, C/Gran Vía, 2, Zaragoza, Spain
(*e-mail:* malda@unizar.es)

Abstract

This paper analyzes whether herding and skillful managers may coexist. When herding appears, managers tend to present poor timing abilities; however, a weak herding level (a result commonly found in pension funds) may evidence a mixed scenario, where some managers develop skills, and others follow the herd. Additionally, when informational cascades emerge, some managers may act as leaders, anticipating others' movements. Nonetheless, this anticipatory skill does not mean that leaders also anticipate market movements and present timing skills. Our results show herding and inter-temporal herding in a sample of Spanish pension funds, though the imitation behavior is not strong. We also find evidence of a mixed scenario, in which some non-herding managers present timing skills, while herding funds are not able to develop these abilities. Finally, we find successful timing for certain leaders, showing that the anticipation of others' movements does not show real timing abilities.

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Keywords: Abilities, herding, informational cascades, inter-temporal herding, timing

1 Introduction

In recent decades, the financial literature has documented the existence of convergence behavior among institutional investors. Although managers should make investments according to the fund investment objective, they are often influenced by other managers' words and actions. Whether managers react similarly and simultaneously to the same information, or even imitate each other, an informational externality problem arises: institutional herding.

This phenomenon can lead to a situation in which investor actions are uninformative to other individuals (Cao and Hirshleifer, 2001), and managers are unable to develop distinct strategies. Institutional investors have a large and growing influence on financial markets, so institutional herding can affect market prices and, therefore, market efficiency. Among institutional investors, pension funds deserve special study; they are long-term investments that comprise an important fraction of retirement savings (over €21 trillion invested globally in 2014 – INVERCO, 2015), so the pension fund industry has become a segment of first-order economic importance. The appearance of pension fund herding may affect the retirement assets of many savers;

nonetheless, the study of pension fund herding is scarce, which lends support to our analysis.

Lakonishok *et al.* (1992) indicate that institutions can herd more than individuals because institutions know more about others than do individuals, as well as, the reputational risks of acting differently from others (Scharfstein and Stein, 1990). Additionally, manager performance is usually evaluated by studying deviations from a benchmark, so managers try to stay close to their peers, inducing herding (Lakonishok *et al.*, 1992). Nevertheless, most institutional herding studies report low or moderate herding (Froot *et al.*, 1992; Lakonishok *et al.,* 1992; Hirshleifer *et al.*, 1994; Wermers, 1999; Hirshleifer and Teoh, 2003). This apparent contradiction may be due to the existence of a mixed scenario, in which only some managers herd. In a low-herding scenario, we would expect to find two kinds of managers. On the one hand, herding managers, who do not develop distinctive strategies and show little management ability (Grinblatt *et al.*, 1995; Wermers, 1999; Sias, 2004; Wei *et al.*, 2015), and on the other hand, non-herding managers who are able to develop managerial skills. To the best of our knowledge, this mixed scenario has not been explored previously in the literature.

When herding exists, the linked phenomenon of informational cascades may appear. While herding is a convergence of behavior, where managers simultaneously trade the same stock (Ortiz *et al.*, 2013), informational cascades emerge when investors consciously act together, following each other into (or out of) the same securities over certain periods, rather than relying on their own information. In informational cascades, certain individuals present leadership behavior (individuals who anticipate the movements of others), and others develop as followers (individuals following leaders). The capacity of leaders to anticipate others' movements can be understood as an anticipatory skill; however, it does not prove that these managers are able to anticipate market movements, exhibiting market timing ability. In this study, we examine whether leaders are able to develop real timing skills.

Accordingly, this paper first provides a comprehensive study of herding behavior, examining the possible existence of a mixed scenario with non-herding and herding funds. First, we study the herding phenomenon *per se* in several investment strategies, in a Spanish pension fund sample. Second, we look for the existence of inter-temporal herding and informational cascades, identifying leader and follower funds. To explore the mixed scenario, we analyze whether some managers develop timing skills, and what kind of managers (non-herding or herding funds) develop them; that is, whether skillful managers also herd, or only non-herding funds develop timing. Finally, we explore whether leader funds, with the capacity to anticipate others' movements, also present timing abilities. Our results show moderate herding and inter-temporal herding. Timing abilities are developed by some non-herding funds, and some leader funds are able to develop successful timing. These findings demonstrate the existence of a mixed scenario, where non-herding and herding managers coexist when the herding level is low.

The rest of the paper proceeds as follows. In Section 2, we undertake a literature review. In Section 3, we include a brief description of the Spanish pension fund

industry and the data used. Section 4 presents our methodology. Section 5 contains our empirical results, and Section 6 presents our main conclusions.

2 Literature review

Herding is a phenomenon extensively analyzed in the financial literature, and despite the uncertainties surrounding its appearance, rational, and irrational behaviors can justify it. Rational herding (the most frequently analyzed in the financial literature) appears when investors consciously act together, which is explained by several factors: imperfect information (Bikhchandani *et al.*, 1992), agency problems (Devenow and Welch, 1996), compensation incentives, and/or reputational issues (Scharfstein and Stein, 1990; Bikhchandani and Sharma, 2000; Hirshleifer and Teoh, 2003). On the other hand, irrational herding emerges from investor psychology, the consequence of social interactions between investors and their environment (Fenzl and Pelzmann, 2012). Irrational herding is tied to informational cascades, in which managers may ignore their private information and follow the herd.

Therefore, herding and informational cascades are related phenomena, but they differ significantly. Smith and Sørensen (2000) and Çelen and Kariv (2004) clarify that herding arises when certain individuals have carried out the same action based on their private information, but they may have acted differently from others when they possess different private signals. On the other hand, in informational cascades, individuals consider it optimal to follow their predecessors, without regard for their private signals, because their beliefs are so strong that no signal can outweigh them. Consequently, while decisions made on informational cascades ignore personal information (later individuals observe earlier individuals and make the same choice), herding implies that individuals make identical decisions, but not automatically ignoring private information. Thus, an informational cascade implies herding, but herding may not be the result of an informational cascade.

From a rational perspective, herding has been studied in diverse settings (capital markets, finance newsletters, foreign aid allocation, and institutional investing, especially mutual funds). Although pension fund studies are scarce, several works report their existence. Lakonishok *et al.* (1992) find weak herding in US equity pension funds. Jones *et al.* (1999) find feedback trading among US pension funds. Wermers (1999) finds that pension funds exhibit a slightly lower tendency to herd. Badrinath and Wahal (2002) report feedback trading among US pension managers, although to a lesser extent than other institutions. Blake *et al.* (2002) observe that UK pension fund managers are likely to herd around the funds with median outcomes. Voronkova and Bohl (2005) find that Polish pension funds herd, but their trading does not significantly affect Polish stock prices. Olivares (2005) observes that Chilean pension funds herd to be close to system returns. Andreu *et al.* (2009) find evidence of herding in Spanish pension funds. Raddatz and Schmukler (2013) detect herding in Chilean pension funds.

The prior evidence shows that, in general, pension fund herding is low or moderate, and seems not to affect the market. This result may be related to the long-term nature of pension funds; nonetheless, short-term pension herding is also plausible because

pension fund managers adjust their portfolio assets periodically, and react to analyst information about a particular security (Brown *et al.*, 2007). Additionally, pension fund managers are subject to periodiccontrol mechanisms to minimize poor results. As a consequence, whether short- and long-term herding are possible, the low level of pension fund herding may be related to our hypothesis of a mixed scenario, where some managers herd, and others are able to develop managerial skills. Indeed, this hypothesis could explain the minimal ability of managers to implement distinctive strategies when herding exists (Grinblatt *et al.*, 1995; Wermers, 1999; Sias, 2004), and the decreasing managerial skills with the growth of institutional investors (Barras *et al.*, 2010; Fama and French, 2010).

The majority of the above-mentioned studies use the common LSV (Lakonishok, Shleifer and Vishny) herding measure, introduced by Lakonishok *et al.* (1992); however, it presents some shortcomings. It does not identify inter-temporal imitation patterns (Bikhchandani and Sharma, 2000), and, as Wylie (2005) notes, makes certain restrictive assumptions (short-selling supposition, independent buying probabilities, and error omission for finite samples). In this work, we try to overcome this problem by analyzing inter-temporal herding with an alternative measure, and comparing these results with the LSV results.

3 Data

3.1 Brief description of the Spanish pension fund market

The Spanish pension fund industry presents certain characteristics that make its study important. First, despite the relatively late appearance of pension funds, in 1988, the industry has experienced considerable development in recent decades, being the eighth largest pension fund industry in the EU-25 (OECD, 2014), with more than €104 billion in assets under management.[1] Second, we focus on pension funds investing in European equities, because they are the main equity category (over 58% of the equity pension funds), and herding especially affects the equity markets. Furthermore, the industry is characterized by considerable concentration, as only four management groups control more than 50% of the market,[2] and a small number of large pension funds coexist with many small pension funds. In these circumstances, herding could likely appear when managers of major funds make the same investments (they possess similar information and resources, which encourages convergent behavior), and smaller funds, with fewer resources, tend to imitate the dominant funds.

The fund size may also determine the leader or follower behavior when informational cascades, as Ferruz *et al.* (2008) and Andreu *et al.* (2009) argue. Larger funds have more management resources to anticipate others, acting as leaders, while smaller funds tend to act as followers. In Spanish global mutual funds, Ortiz *et al.* (2013) find that this phenomenon is driven by fund families, rather than by individual funds.

[1] Data obtained from INVERCO, March 2015: http://www.inverco.es.
[2] The four management groups, from a total of 53 groups, are: BBVA, Vida Caixa Group, Santander, and Bankia, according to INVERCO (http://www.inverco.es).

3.2 Database used in the study

The database is obtained from Morningstar, and comprises all monthly returns and TNA (Total Net Assets) of the European equity pension funds in Spain, from January 1999 to April 2014. We focus on equity funds, since herding especially affects stock markets, and equity funds are primarily invested in stocks.

We require at least 24 months of data for each pension fund to ensure the consistency of the analysis, so the sample is restricted to 97 European equity pension funds. These data are free of survivorship bias, which eliminate the possible illusion of herding due to the consideration of only those funds that survive, as Wylie (2005) stresses.

Given the location of the pension funds studied, and following Ferson and Schadt (1996), we use the MSCI-Europe index as the market benchmark, and the risk-free asset is the 1-month Euribor rate. The size, book-to-market, and momentum factors are the European factors developed by Fama and French.[3]

The statistics of the pension funds (return and TNA) and the risk factors are displayed in Table 1. We observe that pension funds present lower returns (0.15%) than the market index (0.19%). The average total net assets (TNA) of the pension funds studied are €32.54 million, comprising 3.2% of Spanish pension funds, and more than 55% of the equity category of Spanish pension funds. With regard to risk factors, the market excess return is the smallest factor, but the momentum displays the highest return (0.9%).

4 Methodology

First, we analyze the characteristic investment styles of our pension fund sample, with the Carhart model (1997). Second, we evaluate the existence of herding in the four investment strategies studied, using the traditional herding measure of Lakonishok *et al.* (1992). Then, we introduce the models to examine the existence of intertemporal herding and informative cascades. Finally, style-timing models are presented.

4.1 Carhart model

Carhart (1997) develops a four-factor model to determine the investment styles followed by a fund manager, adding the momentum factor to the three-factor model of Fama and French (1993):

$$r_{i,t} = \alpha_{it} + \beta_{1,it} r_{mt} + \beta_{2,it} SMB_t + \beta_{3,it} HML_t + \beta_{4,it} PR1YR_t + e_{it}, \quad (1)$$

where: $r_{i,t}$ is the excess return of fund i at time t over the risk-free asset; $r_{m,t}$ is the excess return of a representative market index over the risk-free asset; SMB_t, HML_t, and $PR1YR_t$ are returns on value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market, and 1-year momentum in stock returns, respectively.

[3] Data available on the website of Fama and French: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Developed.

Table 1. *Summary statistics*

	Mean	Std. Dev.	Minimum	Maximum
Pension fund returns	0.002	0.047	−0.234	0.236
Pension fund TNA (in EUR million)	32.537	56.791	6.4×10^{-5}	381
MSCI-Europe index	0.002	0.046	−0.143	0.119
Risk-free asset	0.002	0.001	0.0001	0.004
Market excess return	10^{-5}	0.046	−0.146	0.119
SMB	0.002	0.023	−0.069	0.093
HML	0.005	0.028	−0.096	0.109
PR1YR	0.009	0.049	−0.259	0.138

Table 1 shows summary statistics (mean, standard deviation, minimum, and maximum) for the monthly returns and Total Net Assets (TNA) – in EUR million – of the 97 Spanish pension funds investing in European equities analyzed, the market index (MSCI-Europe), the risk-free asset, the market excess return, the size factor (SMB), the book-to-market factor (HML), and the momentum factor (PR1YR), from January 1999 to April 2014.

4.2 Herding detection

We examine the existence of herding in the four investment strategies of the Carhart model using the Lakonishok, Shleifer and Vishny (1992) measure (i.e., LSV), whereby herding is identified as the simultaneous trend of managers following the same investment style. Thus, there is herding when the proportion of managers who increase or reduce their investment in a specific style is above the expected proportion of managers taking independent decisions. The LSV measure is defined as follows:

$$H(j,t) = \left| p(j,t) - p(t) \right| - AF(j,t), \tag{2}$$

where $H(j,t)$ is the herding measure in style j in period t;

$$p(j,t) = \frac{B(j,t)}{B(j,t) + S(j,t)}, \tag{3}$$

$$p(t) = \frac{\sum_{j=1}^{k} B(j,t)}{\sum_{j=1}^{k} B(j,t) + \sum_{j=1}^{k} S(j,t)}, \tag{4}$$

$$AF(j,t) = E\left[\left| p(j,t) - p(t) \right| \right]. \tag{5}$$

$B(j,t)$ and $S(j,t)$ are the number of pension funds that increase and decrease their investment in style j in period t; $p(j,t)$ is the percentage of pension funds increasing their investment in style j in period t; $p(t)$ is the average of $p(j,t)$ over the k styles. $AF(j,t)$ is the adjustment factor, obtained under the null hypothesis of no herding ($H(j,t) = 0$).

When empirical evidence shows herding, $H(j,t)$ is positive and $|p(j,t) - p(t)|$ is higher than the AF, indicating that the proportion of managers who increase or reduce their investment in a style is above the expected proportion under the null hypothesis of no herding.

Following Ferruz *et al.* (2008) and Andreu *et al.* (2009), we determine whether a pension fund i increases or decreases its investment in style j, comparing the position in the style in two consecutive periods (I and II). The style position is determined by the style βs of the Carhart (1997) model. Specifically, when a fund presents a higher β in style j in the second period ($\beta_{i,j\mathrm{II}} > \beta_{i,j\mathrm{I}}$), the investment in this style has increased, showing greater exposure to this style. On the other hand, a β decrease between two periods ($\beta_{i,j\mathrm{II}} < \beta_{i,j\mathrm{I}}$) shows less style exposure; that is, lower investment in this style. The style β coefficients are estimated from the Carhart model using 36-month rolling windows for each pension fund, in order to avoid the problem of constant styles,[4] as in Ferruz *et al.* (2008) and Andreu *et al.* (2009). Accordingly, comparing the style of a pension fund in two consecutive rolling windows allows us to determine the monthly variation of each pension fund in the four styles analyzed. The rolling window involves overlapping data, which is an appropriate method to achieve greater efficiency in the estimation of multi-period changes, since all available information is used (Harri and Brorsen, 2009).

4.3 Inter-temporal herding

The traditional LSV herding measure evaluates herding in a given period (from a cross-sectional point of view); hence, it does not detect the existence of herding over time, as Bikhchandani and Sharma (2000) indicate. To overcome this limitation, Andreu *et al.* (2009) propose a time-series analysis, examining inter-temporal herding; that is to say, whether some pension funds present herding over time and their behaviors converge over time. Specifically, the analysis compares the variations of each pension fund investment to those carried out by other managers in an equally weighted portfolio, as follows:

$$\Delta\beta_{nj,t} = h_{ni}\Delta\beta_{ij,t} + e_{nj,t}, \tag{6}$$

where $\Delta\beta_{nj,t}$ is the monthly variation of the equally-weighted fund portfolio n in style j in period t, which includes all pension funds except pension fund i, $\Delta\beta_{ij,t}$ is the monthly variation of pension fund i in style j in period t, h_{ni} is the slope and shows the convergent behavior, and $e_{nj,t}$ is the residual term. A positive h_{ni} coefficient indicates inter-temporal herding in the style analyzed; that is, there is a positive relationship between the fund investment and the other funds' investments, displaying evidence of herding over time. Model (6) is estimated with a time-series regression for each pension fund i, so h_{ni} indicates whether the investment style changes of a fund and the investment style changes of the remaining funds converge.

4.4 Informational cascades

When there is herding, informational cascades may appear; that is, managers act consciously together and some of them may anticipate (follow) the investment strategies of other managers, behaving like leaders (followers).

[4] Thus, the coefficients are estimated over 3 years, and the window moves forward 1 month, deleting the first observation and adding the observation of the next period.

The study of informational cascades is interesting for the Spanish pension fund market, due to its concentration. Specifically, four management groups represent more than half of the market, and a few large pension funds coexist with many small pension funds. Given this scenario, in the analysis section, we study both pension funds and management groups. Specifically, we may expect larger pension funds to be leaders; however, small funds that belong to a large management group may also behave as leaders when they have access to the group resources (more information, analytical capacity, etc.).

Leader behavior is examined through equation (7), as in Andreu *et al.* (2009), which shows whether a fund changes its investment style (measured with the monthly β variation) one period before the other funds.

$$\Delta\beta_{nj,t} = b_{ni}\Delta\beta_{ij,t-1} + e_{nj,t}, \tag{7}$$

where $\Delta\beta_{nj,t}$ is the β monthly variation of the equally-weighted fund portfolio n (which includes all funds except fund i) in style j in period t; $\Delta\beta_{ij,t-1}$ is the β monthly variation of fund i in style j in period $t-1$; and b_{ni} is the slope of the regression. A significantly positive coefficient b_{ni} shows that fund i behaves as a leader. That is, the fund applies an investment strategy (increase or decrease the investment in the style) before the other funds do the same, one period later. A significantly negative coefficient shows that the leader fund applied, in the prior period, the opposite strategy than that undertaken by the others one period later. This is evidence of a negative result of the leader's strategy in the prior period. Finally, $e_{nj,t}$ is the residual term.

On the other hand, follower behavior is detected with equation (8), following Andreu *et al.* (2009). This model, opposite to equation (7), shows whether a fund changes its investment style after the other funds.

$$\Delta\beta_{ij,t} = k_{ni}\Delta\beta_{nj,t-1} + e_{nj,t}, \tag{8}$$

where $\Delta\beta_{ij,t}$ is the β monthly variation of fund i in style j in period t; $\Delta\beta_{nj,t-1}$is the β monthly variation of the equally-weighted fund portfolio n (which includes all funds except fund i) in style j in period $t-1$. The slope coefficient, k_{ni}, indicates the existence of follower behavior. A significantly positive k_{ni} shows that fund i applies the same strategy as the other funds one period later. A significantly negative coefficient shows that the follower fund applies the opposite strategy because the others' strategy provided bad results in the prior period. $e_{nj,t}$ is the residual term.

4.5 Market and style-timing abilities

Although managers will show little ability to implement distinct strategies in the presence of herding (Grinblatt *et al.*, 1995; Wermers, 1999; Sias, 2004; Wei *et al.*, 2015), a weak herding situation may produce the appearance of a mixed scenario. Additionally, the existence of leader managers shows anticipation of others' strategic allocations, which does not necessarily mean that these managers are able to develop market and style timing abilities. In consequence, we study whether pension funds develop timing abilities when herding exists, and the kind of fund that develops them. The most common model of market timing is that proposed by Treynor and

Mazuy (1966).

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \gamma_i r_{m,t}^2 + \varepsilon_{i,t}, \tag{9}$$

where $r_{i,t}$ and $r_{m,t}$ are the excess return of fund i and the excess market return over the risk-free asset during period t, respectively; β_i is the β of fund i; α_i is the fund alpha representing stock-picking ability. γ_i is the gamma coefficient of fund i, and determines the market timing skill, and $\varepsilon_{i,t}$ is the error term with an expected value of zero.

Managers may also obtain good results when they are able to predict the investment styles that are going to have better behavior; that is to say, developing style-timing abilities. Lu (2005) combines the TM and Carhart models to analyze style-timing with regard to Carhart styles, obtaining the multifactorial TM version:

$$\begin{aligned} r_{it} &= a_i + \beta_1 r_{mt} + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 PR1YR_t \\ &\quad + \gamma_1 r_{mt}^2 + \gamma_2 SMB_t^2 + \gamma_3 HML_t^2 + \gamma_4 PR1YR_t^2 + \varepsilon_{i,t}. \end{aligned} \tag{10}$$

This model assesses whether a fund manager increases (decreases) the fund risk exposure to a specific factor, prior to the factor index increase (decrease). If any one of the gamma coefficients (γ_1, γ_2, γ_3, γ_4) is positive, then it indicates timing ability with regard to that management style (market, size, book-to-market, or momentum).

5 Results

5.1 Investment style analysis.

Before studying the existence of herding in the styles of the Carhart model, we analyze whether our pension fund sample (97 pension funds) follows the different investment styles. Table 2 shows the Carhart model (1) results.

Table 2 shows the results of the Carhart model estimated on a pool basis (pool-regression), considering all pension funds, as well as the average results of the individual regressions for each pension fund. In the latter case, the number (percentage) of significantly positive and negative βs is also displayed. In the estimation process, standard errors are corrected with the Huber/White/Sandwich estimator to control for serial correlation and heteroskedasticity.

We observe that pension funds develop negative performance (significantly negative alphas), showing that these managers perform poorly. This result may be evidence of herding; that is, managers do not apply distinctive strategies when they herd, and the performance is affected. Additionally, it may show style drift herding. Style drift (Wermers, 2010) is a change of the portfolio style, so style drift herding is the imitation of previous style bets taken by competitors. Specifically, our negative performance result may indicate the existence of leaders and followers, and that followers drift to the same styles as leaders when positive outcomes were obtained in the prior period. Nonetheless, prior results do not guarantee positive future results, and the style drift herding affects performance negatively. In particular, we observe that managers follow the market (all funds present significantly positive β_1 coefficients) and invest in large-cap stocks (negative β_2 size factor coefficient), although, examining funds individually, 35% of the funds invest in large-cap stocks and 26% in small-cap

Table 2. *Carhart model results*

	α	β_1	β_2	β_3	β_4	$R^{2\ adj}$
Pooled-regression	−0.0005*** (0.004)	0.935*** (0.000)	−0.0002** (0.015)	0.0010*** (0.000)	5.70×10^{-6} (0.893)	0.830
Mean	−0.0003	0.910	−0.0002	0.0010	−0.0001	0.857
Significantly positive	3 (3%)	97 (100%)	25 (26%)	54 (56%)	14 (14%)	
Significantly negative	6 (6%)	0 (0%)	34 (35%)	7 (7%)	23 (24%)	

Table 2 shows the result of Carhart model (1), estimated on a pool-basis for all pension funds (pooled-regression), p-values are in parentheses, and the mean of the individual pension fund estimations (mean) from January 1999 to April 2014. In the latter case, the table shows the average exposure that each pension fund has allocated to each asset category, displaying the number, and percentage in parentheses, of pension funds with significantly positive and negative coefficients. Standard errors are corrected with the Huber/White/Sandwich estimator. $R^{2\ adj}$ is the adjusted *R*-squared coefficient. *,**,*** indicate significant at the 10%, 5%, and 1% levels, respectively.

stocks. Additionally, pension funds invest in value stocks (56% significantly positive β_3 vs. 7% significantly negative), and although the momentum factor is not significant in the pooled regression, 14% (24%) of the pension funds develop positive (negative) momentum strategies. We note that these percentages sum to more than 100%, because some funds follow more than one strategy. These results show that managers implement investment strategies in all styles, although some styles are preferred; as a consequence, we would expect to find herding in the different styles.

5.2 Herding results

The herding results obtained, applying the LSV herding measure (2), are collected in Table 3, which shows the average annual herding results (in percentage) of the 97 pension funds for the four styles analyzed (market, size, book-to-market, and momentum). The average herding of the period analyzed (2002–April 2014) is also displayed.

The results show some evidence of herding behavior, but not strongly, consistent with prior pension fund evidence (Lakonishok *et al.*, 1992; Wermers, 1999; Badrinath and Wahal, 2002; Voronkova and Bohl, 2005). Herding in the market is significant in 2007, 2012, and 2014. Herding in the size style is only significant in 2014. Herding in the book-to-market style is significant in 2006 and 2008. Herding in momentum strategies is significant in 2006, 2012, and 2014. Although herding in styles has not been analyzed previously for pension funds, our results are consistent with those mutual fund studies that show herding in those styles. Wermers (1999), Wylie (2005), Mohamed *et al.* (2009), and Frey *et al.* (2014) find size herding. Choi and Sias (2009) find institutional herding in the size and book-to-market styles. Fang *et al.* (2014) show momentum trading. Nevertheless, we find less herding than do other mutual fund studies. This scarce imitation behavior may support the hypothesis of a mixed scenario.

Our evidence also reveals certain herding patterns related to changes in economic cycles, increasing with the end of asset price bubbles (2006) and with financial crises (2007–2008). Accordingly, herding can be seen as the result of overreactions in short time periods, and the increase in imitation behavior in 2014 may indicate a forthcoming change of trend. Prior works also reveal some patterns between herding and market cycles. Seetharam and Britten (2013) detect herding before a contraction of the South African market. Ourarda *et al.* (2013) find herding in the European market in bullish and bearish periods, but they also find that herding contributes to bearish cycles. Raddatz and Schmukler (2013) find prevailing herding when risk increases in Chilean pension funds. On the other hand, Hammami and Boujelbene (2015) detect herding in booms and recessions of the Tunisian stock market, but herding contributes to an increase in the probability of stock market booms.

5.3 Inter-temporal herding

Table 4 shows the results of inter-temporal herding in the market, size, book-to-market, and momentum styles (equation 6), examining all pension funds (97 funds). The Table collects the number, percentage, and average inter-temporal

Table 3. *Herding in different styles*

	Market (%)	Size (%)	Book-to-market (%)	Momentum (%)
2002	4.41	6.78	5.17	5.65
2003	6.45	12.30	12.18	6.05
2004	7.07	5.09	12.22	5.51
2005	7.25	8.39	11.52	7.67
2006	13.27	5.93	16.47**	14.35*
2007	12.66*	6.71	10.68	7.03
2008	14.77	11.12	15.35**	14.56
2009	8.57	6.20	7.70	4.26
2010	11.55	4.97	9.44	2.86
2011	11.27	9.85	13.93	6.86
2012	19.27**	11.45	11.99	12.03*
2013	13.67	13.19	13.21	12.83
2014	14.97*	13.34	20.38	21.42**
2002–2014[1]	11.46	9.08	12.17	9.10

Table 3 displays the herding annual results for all pension funds studied, in the four investment strategies analyzed (market, size, book-to-market, and momentum) from 2002 to April 2014. The last row presents the average results from 2002 to April 2014.
[1] Indicates that in 2014 we only have data until April, according to the time period studied. *,**,*** indicate significance at the 10%, 5%, and 1% levels, respectively.

herding (h_{ni}) of the pension funds, with positive (non- and significant at 5%) and negative (non- and significant at 5%) herding (h_{ni}).

Table 4 shows evidence of inter-temporal herding (significantly positive and negative h_{ni}), confirming the herding existence found with the LSV measure (Table 3). Additionally, the inter-temporal herding measure (h_{ni}) overcomes the LSV limitation, and we find a convergent behavior through time. Inter-temporal herding is especially important in market strategies, where 86.6% (84 funds from a total of 97) of the pension funds herd market strategies over time. The inter-temporal market herding result (0.0078) is in line with Andreu *et al.* (2009) for Spanish mutual funds (0.0023). However, our result is far smaller than the evidence found by Sias (2004) in the US equity market (0.2048), and Cai *et al.* (2012) for US bond funds (0.3649).We also detect convergent patterns in size (significantly positive h_{ni} in one fund) and book-to-market (five funds present significantly positive h_{ni}); however, there is no inter-temporal herding in momentum strategies. Additionally, we detect that five funds present opposite convergence size behavior (significantly negative size h_{ni}). This is evidence of some degree of adverse herding, and may represent a reversion to the equilibrium, confirming the low level of herding found in the size style (Table 3).

5.4 Informational cascades: leader and follower behaviors

Table 5 displays the results of leader and follower behaviors (equations 7 and 8) in the market, size, book-to-market, and momentum investment strategies, for all pension

Table 4. *Inter-temporal herding*

		N° $h_{ni} > 0$	% $h_{ni} > 0$	Average $h_{ni} > 0$	N° $h_{ni} < 0$	% $h_{ni} < 0$	Average $h_{ni} < 0$
Market	Significant	84	86.60%	0.00781	0	0.00%	–
	Non-significant	13	13.40%	0.00223	0	0.00%	–
	Total pension funds	97			0		
Size	Significant	1	1.03%	0.00005	5	5.15%	−0.00004
	Non-significant	11	11.34%	0.000005	80	82.47%	−0.00002
	Total pension funds	12			85		
Book-to-market	Significant	5	5.15%	–	0	0.00%	–
	Non-significant	91	93.81%	0.00014	1	1.03%	−0.000003
	Total pension funds	96			1		
Momentum	Significant	0	0.00%	0.00022	0	0.00%	–
	Non-significant	63	64.95%	0.00001	34	35.05%	−0.000005
	Total pension funds	63			34		

Table 4 shows the inter-temporal herding found in market, size, book-to-market, and momentum investment strategies (equation 6), examining all pension funds (97 funds). Figures indicate the number (N°), percentage (%), and average herding of pension funds with positive and negative inter-temporal herding constant (significant and non-significant). Additionally, for each style analyzed, the total number of pension funds with positive (non- and significant at 5%) and negative (non- and significant at 5%) herding is shown.

funds. Panel A shows the number, percentage, and average leader measure (b_{ni}) of the pension funds with positive (significant and non-significant at 5%) and negative (significant and non-significant at 5%) leader measure. Panel B shows the same information for the follower measure (k_{ni}).

Panel A shows significant evidence of leaders in market strategies, as Andreu *et al.* (2009) find in Spanish mutual funds. Specifically, we observe that 81 of the 97 pension funds anticipate the market strategies of the remaining funds, acting as leaders. Four managers act as leaders in size strategies; nonetheless, among these, three funds develop a contrary strategy to that applied by the others in the next period. This shows that leaders' strategies provided poor results in the prior period, and the other funds follow the leader, but applying the opposite strategy in the next period. With regard to the book-to-market and momentum strategies, managers do not present anticipatory abilities. Panel B shows that five managers are followers of market strategies, but two of them follow market strategies inversely (k_{ni} significantly negative); that is to say, these managers apply the contrary market strategy of that applied by others one period before, because the prior strategy provided poor results. Fang *et al.* (2014) also find positive and negative cascades in the Taiwan stock market. Finally, two pension funds follow book-to-market decisions, and there is no follower behavior of size and momentum decisions. Comparing panels A and B, we find more

Table 5. *Informational cascades*

		Panel A: Leader managers					
		N° $b_{ni} > 0$	% $b_{ni} > 0$	Average $b_{ni} > 0$	N° $b_{ni} < 0$	% $b_{ni} < 0$	Average $b_{ni} < 0$
Market	Significant	81	83.51%	0.03688	0	0.00%	−0.00797
	Non-significant	16	16.49%	0.01062	0	0.00%	−0.00105
Size	Significant	1	1.03%	–	3	3.09%	–
	Non-significant	2	2.06%	0.00004	91	93.81%	−0.00004
Book-to-market	Significant	0	0.00%	0.00017	0	0.00%	–
	Non-significant	96	98.97%	0.00033	1	1.03%	−0.00008
Momentum	Significant	0	0.00%	–	0	0.00%	–
	Non-significant	70	72.16%	0.00001	27	27.84%	−0.00001
		Panel B: Follower managers					
		N° $k_{ni} > 0$	% $k_{ni} > 0$	Average $k_{ni} > 0$	N° $k_{ni} < 0$	% $k_{ni} < 0$	Average $k_{ni} < 0$
Market	Significant	3	3.09%	0.00830	2	2.06%	–
	Non-significant	90	92.78%	0.00220	2	2.06%	–
Size	Significant	0	0.00%	0.00005	0	0.00%	−0.00005
	Non-significant	31	31.96%	0.00001	66	68.04%	−0.00001
Book-to-market	Significant	2	2.06%	–	0	0.00%	–
	Non-significant	73	75.26%	0.00014	22	22.68%	0.00000
Momentum	Significant	0	0.00%	–	0	0.00%	–
	Non-significant	25	25.77%	0.00001	72	74.23%	−0.000004

Table 5 shows the results of informational cascades in the market, size, book-to-market, and momentum investment strategies for all pension funds (97 funds). Panels A and B show the results of the leader and follower analyses (equations 7 and 8), respectively. Figures indicate the number (N°), percentage (%), and average b_{ni} and k_{ni} of the pension funds with positive (non- and significant at 5%), and negative (non- and significant at 5%) leader and follower behaviors, respectively.

leaders in market and size strategies, more followers in book-to-market strategies, and an absence of informational cascades in the momentum style.

In order to carry out a further investigation and identify possible patterns at the management group level, we classify leader and follower pension funds by management groups.[5] The leader funds of market strategies belong to Vida Caixa (13 pension funds), Caser (11), Santander Bank (8), Mapfre (8), Sabadell Bank (5), Aviva (5), AXA (4), Insurances Generali (3), Renta 4 (3), Allianz -Popular Bank- (2), Bankia (2), BBVA (2), Deutsche Zurich (2), GVC Gaesco (2), Ibercaja savings bank (2), Kutxa Bank (2), Barclays (1), Bestinver (1), CAI Savings Bank (1), Caja Rural–Rural Credit Bank- (1), Cantabria Savings Bank (1), Catalana Occidente-insurance Company- (1), and Kutxabank Fineco (1). The leader in applying size strategies correctly is an Aviva fund, and those that do so incorrectly belong to Vida Caixa, Caser, and Mapfre.

The three followers that imitate market strategies belong to Vida Caixa, Caser, and Sabadell Bank; and those following inverse strategies belong to Santander and Caser. Finally, the two followers of book-to-market strategies are both in Caser.

In general, we observe that most of the leaders and followers are in two of the larger management groups (Santander and Vida Caixa), although other groups, such as Caser and Mapfre, also possess considerable numbers of leaders and followers. This is evidence that Spanish management groups have a great variety of funds, acting like leaders or followers, independently of the size management group.

5.5 Informational cascades and timing abilities

In the previous section, we find that certain funds act like leaders and present anticipatory abilities of others' investment movements; that is to say, they exhibit good timing of others' strategic allocations. Nonetheless, as we mentioned above, this timing does not necessarily mean that these funds develop true timing abilities with regard to the market or to certain styles. In this section, we study the timing abilities of all pension funds. Additionally, we examine whether timing abilities are developed by non-herding funds, leaders (who may develop these abilities taking advantage of their position), or followers (i.e. skillful managers who also herd).

Table 6 shows the timing results with regard to the market, size, book-to-market, and momentum styles, applying the multifactorial TM version (model 10). The model is regressed individually for each pension fund studied (97 funds). The Table displays the number, percentage and average timing coefficient of the pension funds with positive and negative (significant and non-significant at 5%) style timing. Additionally, the number of funds with positive and negative coefficients is included.

Table 6 shows that 92 pension funds present significant timing abilities (positive and negative). Specifically, 15 pension funds are able to time the market, and nine funds display perverse market timing, so more than 75% of the pension funds (73 of 97) do not present this ability. Nine funds present timing with regard to the size

[5] Since several names of the groups are Spanish trademarks, we clarify the legal form between dashes for those who may be unfamiliar.

Table 6. *Timing results*

		N° $\gamma_i > 0$	%	Average	N° $\gamma_i < 0$	%	Average
Market	Significant	15	15.46%	1.2594	9	9.28%	−1.3058
	Non-significant	33	34.02%	0.4905	40	41.24%	−0.4533
	Total funds	48			49		
Size	Significant	9	9.28%	4.7418	11	11.34%	−5.0665
	Non-significant	47	48.45%	1.6566	30	30.93%	−1.7420
	Total funds	56			41		
Book-to market	Significant	9	9.28%	2.6788	18	18.56%	−3.5520
	Non-significant	16	16.49%	0.8359	54	55.67%	−1.4824
	Total funds	25			72		
Momentum	Significant	10	10.31%	0.8846	11	11.34%	−0.7928
	Non-significant	34	35.05%	0.2274	42	43.30%	−0.3691
	Total funds	44			53		

Table 6 shows the results of timing model (10) for all pension funds, regressed individually for each pension fund, and reflects the timing abilities with regard to the market, size, book-to-market, and momentum styles. Figures indicate the number (N°), percentage (%) and average timing of the pension funds with positive and negative timing coefficients (significant and non-significant at 5%). Additionally, for each style analyzed, the total number of pension funds with positive and negative herding (significant and non-significant at 5%) is shown.

factor, eleven funds time this incorrectly, and more than 79% of the funds (77 of 97) do not possess this ability. Timing with regard to the book-to-market is developed correctly by nine funds, and incorrectly by 18 funds, while seventy funds (more than 72%) do not time the factor. Finally, ten funds present timing ability with regard to the momentum factor, 11 funds time it incorrectly, and 76 funds do not time the momentum style.

These results reveal that few managers are able to develop timing abilities, and many of those who do, do so perversely. This evidence is consistent with prior pension fund studies (Coggin *et al.*, 1993; Blake *et al.*, 1999; Thomas and Tonks, 2001; Koh *et al.*, 2010; Woodward and Brooks, 2010), and with the existence of herding. Wermers (1999), Sias (2004) and Wei *et al.* (2015) point out that managers show little ability to implement distinct investment strategies in the presence of herding.

Focusing on the pension funds that present significant timing abilities (92 pension funds, Table 6), we cross the timing results with their informational-cascades results (Table 5), and examine whether the skillful pension funds are leaders (significant b_{ni}), followers (significant k_{ni}), or non-herding funds (non-significant b_{ni} and k_{ni}). These results are collected in Table 7, which shows the number of leaders, followers, and non-herding funds with significantly positive and negative timing abilities with regard to the market, size, book-to-market, and momentum styles.

Table 7 shows support for the existence of a mixed scenario with herding and skillful managers. This situation is possible because the herding found is not strong, and both types of managers coexist; in particular, 72 of the 92 funds with timing abilities do not herd. Leaders display some market-timing abilities; specifically, 20 leaders display correct market timing and seven leaders do so incorrectly. If we compare the

Table 7. *Relationship between timing and anticipatory skills*

		No. of leaders	No. of followers	No. of non-herding funds	Total
Market	Sig $\gamma_i > 0$	13	0	2	15
	Sig $\gamma_i < 0$	7	0	2	9
Size	Sig $\gamma_i > 0$	0	0	9	9
	Sig $\gamma_i < 0$	0	0	11	11
Book-to-market	Sig $\gamma_i > 0$	0	0	9	9
	Sig $\gamma_i < 0$	0	0	18	18
Momentum	Sig $\gamma_i > 0$	0	0	10	10
	Sig $\gamma_i < 0$	0	0	11	11
Total		20	0	72	92

Table 7 shows the number of funds that present significantly positive (Sig $\gamma_i > 0$) and negative (Sig $\gamma_i < 0$) timing abilities at a significance level of 5% (92 funds, obtained from Table 6 results), with regard to market, size, book-to-market, and momentum strategies acting as leaders, followers, or not herding (non-herding funds) at a significance level of 5%.

market timing leaders (20) and the total number of market leaders (81) (Table 5, panel A), we observe that over 24% of the leaders develop timing skills, but only 16% of them time the market correctly. These figures constitute proof of our initial guess that leaders do not necessarily present true timing skills. Additionally, followers do not present timing skills; that is, herding funds are not able to develop timing abilities.

5.6 Herding of management groups

The low level of significant herding found when we analyze pension funds may also be due to the characteristics of the Spanish pension fund market (concentration in four management groups, few large funds, and many small funds). Thus, herding behavior may reside in management groups, rather than in funds.

In this section, we study the herding behavior of management groups. We merge our pension fund sample by management group, obtaining 24 groups.[6] The LSV measure shows little evidence of significant herding in the different styles (we do not report this analysis to save space).[7] The results are similar to herding at the pension fund level (Table 3). Specifically, herding with regard to market strategies is found in 2007 and 2012. In the book-to-market style, herding is observed in 2006, 2007, and 2008; and in 2012 for momentum strategies.

Table 8 shows the results of inter-temporal herding, informational cascades (leaders and followers), and timing abilities with regard to the market, size, book-to-market, and momentum investment styles, of the 24 management groups. Panel A shows the

[6] Following Phillips *et al.* (2013), the management group returns are calculated as the weighted average returns to all funds in the management group. The management group size is the TNA under management by all funds in the management group.

[7] These results are available upon request.

Table 8. *Inter-temporal herding, informational cascades, and timing abilities of management groups*

Panel A: Inter-temporal herding in groups						
	N° $h_{ni} > 0$	% $h_{ni} > 0$	Average	N° $h_{ni} < 0$	% $h_{ni} < 0$	Average
Market	7	29.17%	0.0025	0	0%	–
Size	0	0%	–	0	0%	–
Book-to-market	0	0%	–	0	0%	–
Momentum	0	0%	–	0	0%	–
Panel B: Group Leaders						
	N° $b_{ni} > 0$	% $h_{ni} > 0$	Average	N° $b_{ni} < 0$	% $h_{ni} < 0$	Average
Market	6	25.00%	0.0030	0	0%	–
Size	0	0%	–	0	0%	–
Book-to-market	0	0%	–	0	0%	–
Momentum	0	0%	–	0	0%	–
Panel C: Group Followers						
	N° $k_{ni} > 0$	% $h_{ni} > 0$	Average	N° $k_{ni} < 0$	% $h_{ni} < 0$	Average
Market	3	12.50%	0.0067	0	0%	–
Size	0	0%	–	4	16.67%	−0.0080
Book-to-market	0	0%	–	0	0%	–
Momentum	1	4.17%	0.0055	0	0%	–
Panel D: Timing abilities in groups						
	N° $\gamma_i > 0$	% $h_{ni} > 0$	Average	N° $\gamma_i < 0$	% $h_{ni} < 0$	Average
Market	3	12.50%	1.2354	2	8.33%	−0.9621

Table 8. (*cont.*)

Panel D: Timing abilities in groups						
	N° $\gamma_i > 0$	% $h_{ni} > 0$	Average	N° $\gamma_i < 0$	% $h_{ni} < 0$	Average
Size	4	16.67%	4.4417	1	4.17%	−2.8512
Book-to-market	2	8.33%	1.9554	4	16.67%	−4.2131
Momentum	3	12.50%	0.7688	5	20.83%	−0.6559

Table 8 shows the inter-temporal herding, leader and follower behaviors, and timing results of the 24 management groups that own the 97 pension funds analyzed. The table only shows the results of significant coefficients (positive and negative) at a significance level of 5%. Panel A shows the number, percentage, and average inter-temporal herding (equation 6) for the management groups with significantly positive and negative inter-temporal herding measure (h_{ni}). Panel B shows the number (N°), percentage (%), and average b_{ni} of the groups with significantly positive and negative leader measure (b_{ni}, equation 7). Panel C shows the number, percentage, and average k_{ni} of the groups with significantly positive and negative follower measure (k_{ni}, equation 8). Panel D shows the number, percentage, and average timing coefficients (model 10) of the management groups with significantly positive and negative timing skills. All panels show the results for the market, size, book-to-market, and momentum styles.

number, percentage, and average inter-temporal herding (h_{ni}) of management groups with significantly positive and negative measure (h_{ni}). Panel B shows the number, percentage, and average leader measure (b_{ni}) of the groups with significantly positive and negative measure (b_{ni}). Panel C shows the number, percentage, and average follower measure (k_{ni}) of the groups with significantly positive and negative measure (k_{ni}). Panel D shows the number, percentage, and average timing coefficients of the management groups with significantly positive and negative timing with regard to the market, size, book-to-market, and momentum styles.

Panel A only displays evidence of inter-temporal herding in market strategies. Seven management groups, representing 29.17% (7 of 24 funds), herd market strategies over time. These groups are Cantabria savings bank, Caser, Catalana Occidente, Ibercaja savings bank, Mapfre, Renta 4, and Vida Caixa. Panel B shows six groups acting as leaders of market strategies (AXA, Caser, Ibercaja, Insurances Generali, Mapfre, and Renta 4); however, these groups do not present anticipatory abilities in the other investment strategies. In panel C, three groups are followers of market strategies (Caja Rural, Kutxabank, and Insurances Generali), four groups follow size strategies inversely (BBVA, Catalana Occidente, Ibercaja, and Kutxabank), and one group follows momentum decisions (Insurances Generali). These results, contrary to our expectations, do not show more herding behavior in management groups, being similar to funds herding. A similar result is found by Ortiz *et al.* (2013), who report more herding among the funds of a family than among families in Spanish global funds.

Panel B shows fewer leader groups than leader funds (panel A, Table 5). Specifically, only six groups behave as leaders in market strategies. However, follower patterns are observed in market, size (inverse), and momentum styles (panel C). The unequal number of leaders and followers among groups and funds shows that funds act as leaders or followers independently of the group strategy.

Moreover, we find no clear evidence that followers are smaller groups and leaders are larger groups, contrary to prior mutual fund results. Ortiz *et al.* (2013) find that small (large) groups have more incentives to act as followers (leaders) because the group size may be a constraint with respect to the capacity to evaluate large amounts of data, produce economies of scale, or afford better financial analysis.

Panel D shows that three groups develop market timing (Sabadell Bank, Ibercaja, and Caja Rural), but two groups develop perverse timing (Insurance Generali and Deutsche Zurich). With regard to size timing, four groups time correctly (AXA, Sabadell bank, CAI, and Insurances Generali), but one group times incorrectly (Aviva). With regard to book-to-market, two groups time the factor correctly (Caser and Vida Caixa), but four groups time it incorrectly (AXA, BBVA, Caja Rural, and Kutxabank). Finally, three groups are able to time the momentum style (Bankia, Bestinver, and Deutsche Zurich), and five groups present negative momentum timing (Aviva, Sabadell bank, BBVA, Catalana Occidente, and Ibercaja).

Comparing panel D with Table 6, the timing abilities are similar; nevertheless, the percentages of groups that time correctly the size and momentum (market and book-to-market) are higher (lower) than in funds. This may be related to the assets of the management group, as Ortiz *et al.* (2013) find in Spanish global funds. In

Table 9. *Relationship between timing and anticipatory skills of management groups*

		No. of leaders	No. of followers	No. of non-herding groups	Total
Market	Sig $\gamma_i > 0$	1	1	1	3
	Sig $\gamma_i < 0$	0	0	2	2
Size	Sig $\gamma_i > 0$	0	0	4	4
	Sig $\gamma_i < 0$	0	0	1	1
Book-to-market	Sig $\gamma_i > 0$	0	0	2	2
	Sig $\gamma_i < 0$	0	0	4	4
Momentum	Sig $\gamma_i > 0$	0	0	3	3
	Sig $\gamma_i < 0$	0	0	5	5
Total		1	1	22	24

Table 9 shows the number of leader, follower, and non-herding management groups (from a total of 24 groups studied) that present timing abilities, significantly positive (Sig $\gamma_i > 0$) or significantly negative (Sig $\gamma_i < 0$) at 5% level, with regard to market, size, book-to-market, and momentum strategies.

our sample, Ibercaja, Caja Rural, and Sabadell Bank present market timing. AXA, Sabadell Bank, CAI savings bank, and Insurances Generali time the style factor. Caser and La Caixa savings bank time the book-to-market. Bankia, Bestinver, and Zurich time correctly the momentum factor.[8]

Finally, we examine what kind of groups present timing abilities (leaders, followers, or non-herding groups). We first identify the groups with significant timing abilities (panel D, Table 8), and we then look for the informational-cascade results (leader, follower, or non-herding) of these groups (panels B and C, Table 8). These results are collected in Table 9.

Table 9 shows the number of leader, follower, and non-herding management groups with significantly positive and negative timing skills with regard to market, size, book-to-market, and momentum styles.

The results are similar to the analysis of pension funds (Table 7), and confirm the existence of a mixed scenario with herding and skillful managers. We find again that skills reside in non-herding groups. One leader, among the six existing leader groups (panel B, Table 8), develops correct market timing ability, which corroborates that the anticipation of others' movements does not prove true timing abilities. One follower group also exhibits correct market timing. Although it is striking to find a follower group with market timing ability, we should take this result with caution, since we are analyzing groups, not funds. Consequently, even though the group displays follower behavior, we may find leader and follower funds in the same group. We examine this result in more depth, comparing the follower behavior and timing abilities of the group annually.[9] Results show an absence of market timing when the group presents follower behavior, and vice versa. Consequently, we find that herding groups do not develop timing abilities.

[8] These groups are among the 18th largest groups, from a total of 53 management groups in Spain.
[9] These results are not displayed for space issues.

6 Conclusions

Pension funds are important investment vehicles for retirement; therefore, whether managers develop convergence behavior, such as herding, they do not present managerial skills, and the retirement assets of many savers may be affected. Nevertheless, the financial literature finds low levels of pension fund herding. In this paper, we hypothesize that this result may be linked to the existence of a mixed scenario, where some managers herd and others are able to develop skills.

Additionally, we study the herding phenomenon for a fuller perspective in a sample of Spanish pension funds investing in European equities. First, we analyze herding with regard to several investment strategies (market, size, book-to-market, and momentum). We then study the existence of herding over time (inter-temporal herding), and whether certain funds act as leaders or followers, in a context of informational cascades. Finally, we explore the existence of a mixed scenario examining whether skillful managers also herd, or only non-herding funds develop timing.

Our results do not show significant degrees of herding, but there does appear to be a pattern related to economic cycles, with this being more evident at the ends of asset-price bubbles, and during financial crises. We also find inter-temporal herding, funds acting as leaders in market and size strategies, and as followers in market and book-to-market strategies. Furthermore, most of the leaders and followers belong to the Santander, Vida Caixa, and Caser management groups.

Our timing results demonstrate that a small number of managers develop timing abilities correctly, which is consistent with the existence of herding, since managers show little ability to implement distinct investment strategies in the presence of herding. Nonetheless, skillful managers do exist, as evidenced by the low level of herding. Specifically, we demonstrate that herding pension funds are not able to develop timing abilities, only some non-herding managers present timing skills, and even though leader funds anticipate others' movements, their true timing abilities are quite limited.

In the second part of our study, we analyze herding of management groups, given the low significance of herding found at the pension fund level. Herding and inter-temporal herding are also limited, and we only find leaders and followers of market strategies. Finally, the timing abilities of management groups are similar to those in pension funds.

The overall results indicate the existence of a mixed scenario in the Spanish pension fund market and, as a consequence of weak herding, herding and non-herding funds coexist. Although we do not find evidence that skillful managers herd, a further inquiry in this regard opens up a future research area, to examine whether any herding funds ignore the results of their private information and choose to join the herd, disregarding private information.

References

Andreu, L., Ortiz, C., and Sarto, J. L. (2009) Herding behavior in strategic asset allocations: new approaches on quantitative and intertemporal imitation. *Applied Financial Economics*, **19**: 1649–1659.

Badrinath, S. G. and Wahal, S. (2002) Momentum trading by institutions. *Journal of Finance*, **57**(6): 2449–2478.
Barras, L., Scaillet, O., and Wermers, R. (2010) False discoveries in mutual fund performance: measuring luck in estimated alphas. *Journal of Finance*, **65**(1): 179–216.
Bikhchandani, S., Hirshleifer, D., and Welch, I. (1992) A theory of fads, fashion, custom, and cultural change as informational. *Journal of Political Economy*, **100**(5): 992–1026.
Bikhchandani, S. and Sharma, S. (2000) Herd behavior in financial markets. *IMF Staff Papers*, **47**(3): 279–310.
Blake, D., Lehman, B., and Timmermann, A. (1999) Asset allocation dynamics and pension fund performance. *The Journal of Business*, **72**: 429–461.
Blake, D., Lehmann, B., and Timmermann, A. (2002) Performance clustering and incentives in the UK pension fund industry. *Journal of Asset Management*, **3**: 173–194.
Brown, N., Wei, K., and Wermers, R. (2007) Analyst recommendations, mutual fund herding and overreaction in stock prices. Working Paper, University of Maryland.
Cai, F., Song, H., and Li, D. (2012) Institutional herding in the corporate bond market. International Finance Discussion Papers, Number 1071.
Cao, H. H. and Hirshleifer, D. A. (2001) *Conversation, Observational Learning, and Informational Cascades*. Max M. Fisher College of Business, Ohio State University, Ohio, USA.
Carhart, M. M. (1997) On persistence in mutual fund performance. *Journal of Finance*, **52**: 57–82.
Çelen, B. and Kariv, S. (2004) Distinguishing informational cascades from herd behavior in the laboratory. *American Economic Review*, **94**(3): 484–497.
Choi, N. and Sias, R. (2009) Institutional industry herding. *Journal of Financial Economics*, **94**: 469–491.
Coggin, T. D., Fabozzi, F. J., and Rahman, S. (1993) The investment performance of U.S. equity pension fund managers: an empirical investigation. *Journal of Finance*, **48**(3): 1039–1055.
Devenow, A. and Welch, I. (1996) Rational herding in financial economics. *European Economics Review*, **40**: 603–615.
Fama, E. and French, K. (1993) Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, **33**: 3–56.
Fama, E. and French, K. (2010) Luck versus skill in the cross-section in the cross-section of mutual fund returns. *The Journal of Finance*, **LXV**(5): 1915–1947.
Fang, H., Lu, Y.-C., and Yau, H.-Y. (2014) The effects of stock characteristics on the direction and extent of herding by foreign institutional investors in the Taiwan stock exchange. *Emerging Markets Finance and Trade*, **50**(2): 60–74.
Fenzl, T. and Pelzmann, L. (2012) Psychological and social forces behind aggregate financial market behavior. *Journal of Behavioral Finance*, **13**(1): 56–65.
Ferruz, L., Sarto, J. L., and Vicente, L. (2008) Convergencia estratégica en la industria española de fondos de inversion. *El Trimestre Económico*, **75**(4): 1043–1060.
Ferson, W. E. and Schadt, R. W. (1996) Measuring fund strategy and performance in changing economic conditions. *The Journal of Finance*, **51**(2): 425–461.
Frey, S., Herbst, P., and Walter, A. (2014) Measuring mutual fund herding. A structural approach, *Journal of International Financial Markets, Institutions and Money*, **32**: 219–239.
Froot, K., David, A., Scharfstein, S., and Stein, J. C. (1992) Herd on the street: informational inefficiencies in a market with short-term speculation. *The Journal of Finance*, **47**(4): 1461–1484.
Grinblatt, M., Titman, S., and Wermers, R. (1995) Momentum investment strategies, portfolio performance, and herding: a study of mutual fund behavior. *American Economic Review*, **85**(5): 1088–1105.
Hammami, H. and Boujelbene, Y. (2015) Investor herding behavior and its effect on Stock Market Boom-Bust Cycles. *IUP Journal of Applied Finance*, **21**(1): 38–53.
Harri, A., and Brorsen, B. W. (2009) The overlapping data problem. *Quantitative and Qualitative Analysis in Social Sciences*, **3**(3), 78–115.

Hirshleifer, D., Subrahmanyam, A., and Titman, S. (1994) Security analysis and trading patterns when some investors receive information before others. *Journal of Finance*, **49**(5): 1665–1698.
Hirshleifer, D. and Teoh, S. (2003) Herd behavior and cascading in capital markets: a review and synthesis. *European Financial Management*, **9**(1): 25–66.
INVERCO (2015) *Las Instituciones de Inversión Colectiva y los Fondos de Pensiones. Informe 2014 y perspectivas 2015*. INVERCO. http://www.inverco.es.
Jones, S. L., Lee, D., and Weis, E. (1999) Herding and feedback trading by different type of institutions and the effects on stock prices. Working paper of the Kelley School of Business, Indiana University.
Koh, B. S., Mitchell, O. S., and Fong, J. (2010) Collective investments for pension saving: lessons from Singapore's Central Provident Fund Scheme. *Pensions: An International Journal*, **15**(2): 100–110.
Lakonishok, J., Shleifer, A., and Vishny, R. W. (1992) The impact of institutional trading on stock prices. *Journal of Financial Economics*, **32**(1): 23–43.
Lu, J. (2005) What is the Wind Behind this Sail? Can Fund Managers Successfully Time Their Investment Styles? PhD Thesis, Cranfield School of Management, The Centre for Financial Research, Cranfield, UK, August.
Mohamed, A., Bellando, R., Ringuedé, S., and Vaubourg, A.-G. (2009) Institutional herding in stock markets: empirical evidence from French mutual funds. SSRN Working Papers. Available at: http://ssrn.com
OECD (2014) *Pension markets in focus*. OECD. https://www.oecd.org/daf/fin/private-pensions/Pension-Markets-in-Focus-2014.pdf
Olivares, J. A. (2005) Investment Behavior of the Chilean Pension Funds. European Financial Management Association Conference (EFMA), Siena (Italy).
Ortiz, C., Sarto, J. L., and Vicente, L. (2013) Herding behavior in Spanish global funds country allocations. *Revista Española de Financiación y Contabilidad*, **XLII**(157): 63–81.
Ourarda, M., El Bouri, A., and Bernard, O. (2013) Herding behavior under markets condition: empirical evidence on the European financial markets. *International Journal of Economics and Financial Issues*, **3**(1): 214–228.
Phillips, B., Pukthuanthong, K., and Rau, P. R. (2013) Size doesn't matter: diseconomies of scale in the mutual fund industry revisited. SSRN Working paper.
Raddatz, C. and Schmukler, S. L. (2013) Deconstructing herding evidence from pension fund investment behavior. *Journal of Financial Services Research*, **43**(1): 99–126.
Scharfstein, D. S., and Stein, J. C. (1990) Herd behavior and investment. *The American Economic Review*, **80**(3): 465–479.
Seetharam, Y. and Britten, J. (2013) An analysis of herding behavior during market cycles in South Africa. *Journal of Economics and Behavioral Studies*, **5**(2): 89–98.
Sias, R. (2004) Institutional herding. *Review of Financial Studies*, **17**: 165–206.
Smith, L. and SØrensen, P. (2000) Pathological outcomes of observational learning. *Econometrica*, **68**(2): 371–398.
Thomas, A. and Tonks, I. (2001) Equity performance of segregated pension funds in the UK. *Journal of Asset Management*, **1**(4): 321–343.
Treynor, J. and Mazuy, K. (1966) Can mutual funds outguess the market? *Harvard Business Review*, **44**: 131–136.
Voronkova, S. and Bohl, M. T. (2005) Institutional traders' behavior in an emerging stock market: empirical evidence on polish pension fund investor. *Journal of Business Finance & Accounting*, **32**(7/8): 1537–1560.
Wei, K., Wermers, R., and Yao, T. (2015) Uncommon value: the characteristics and investment performance of contrarian funds. *Management Science*, **61**(10): 2394–2414.
Wermers, R. (1999) Mutual fund herding and the impact on stock prices. *Journal of Finance*, **54**(2): 581–622.
Wermers, R. (2010) A matter of style: the causes and consequences of style drift in institutional portfolios. Working paper. University of Maryland.

Woodward, G. and Brooks, R. (2010) The market timing ability of Australian superannuation funds: nonlinearities and smooth transition models. In Gregoriou, G., Hoppe, C., and Carsten, W. (eds), *The Risk Modeling Evaluation Handbook: Rethinking Financial Risk Management Methodologies in the Global Capital Markets*. USA: MacGraw-Hill, pp. 59–64.
Wylie, S. (2005) Fund manager herding: a test of the accuracy of empirical results using U.K. data. *Journal of Business*, **78**(1): 381–403.