

# Herding behaviour and investment choice: an experimental approach

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February 2007

## Abstract:

Herding takes place in financial markets when a subject chooses to put aside his private information, and follows the consensus of analysts. Several factors have been supposed to have an impact on this behaviour. Thanks to an experimental setting close to Cote and Sanders (1997), these hypotheses are empirically tested. Subjects are given some fundamental information in a firm and asked for a recommendation –buy or sell-. This personal judgement is then confronted to the consensus of analysts, which is opposed, in order to analyse if subjects are revising their recommendations. The main results show that herding takes place, and is inversely correlated to perceived individual ability. When reputation is at stake, conformist subjects are more prone to follow the consensus. On the other hand, subjects do not seem to be significantly influenced by perceived reliability of the information, *a priori* confidence in the consensus, nor the proportion of the majority in the consensus.

**J.E.L. classification:** D01, D8, G11

**Key Words:** Herding Behaviour, Decision Making, Investment Choice, Reputation, Informational Cascade, Experimentation

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## Introduction

*« It seems that designing tests that distinguish between the potential causes of herd behavior is a fertile area for future research »*

Graham (1999, p.262)

This research aims at clearly pinpointing herding behaviours in a financial decision, through an original experimental setting inspired from Cote and Sanders (1997). A better understanding of this behaviour and its motivations is actually crucial in the comprehension of the information used in an investment choice, and therefore in the way the price is set on the market. If people herd one another, the price might deviate from the fundamentals, since individuals focus on the behaviour of others, and not on the "true value" of assets, to take their decisions.

Herding behaviour is a frequently cited phenomenon by both money managers and academics to explain booms and crashes in financial markets (Denevow and Welch [1996]). Sometimes, agents on the market are presumed to act according others' behaviour. If this following behaviour is often analysed by the literature (e.g. Bikhchandani, Hirshleifer and Welch [1992], Scharfstein and Stein [1990], Orléan [1989] or Chamley [2004]), empiric evidence is, however, still really scarce (Welch [2000]).

Since Lakonishok, Shleifer, and Vishny (1992), many works (e.g. Wermers [1999], Wylie [2005]) try to show clusters among individuals, acting together on the market, compared to a « normal » behaviour. These studies come up against the detection of herding behaviour. The fact that individuals acted the same manner is not always the consequence of herding<sup>1</sup>. It can only be the same answer to a common constraint or information, just as people open their umbrella because of the rain, and not because other people opened it (Weber [1968, p.23]).

Then, genuine herding behaviour cannot be really isolated if the information set, of each actor, is unknown. Experimentation appears to be a convenient method to control this information set. Many works, stemming from Anderson and Holt (1997)<sup>2</sup>, reveal evidence on informational cascades in very simplified environments. The asset is presented as a state of nature, and information signals are designed by urns holding a proportion of indicators on this state<sup>3</sup>.

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<sup>1</sup> For a precise definition, see Hirschleifer and Teoh (2003): "Herding [...] is defined to include any behavior similarity [...] brought by the interaction of individuals".

<sup>2</sup> And other works of Cipriani and Guarino (2001) or Klüber and Weizsäcker (2005)

<sup>3</sup> For Anderson and Holt (1998), two states are possible: A or B. The state is chosen randomly and is unknown by the subjects. If state A is chosen the urn used contains p

This probabilistic environment appears, however, rather far from a real financial decision, which involves more complex information. In fact, a probabilistic environment is called into question since, for some authors, it confuses risk and uncertainty. Shiller (1984) or Orléan (2005) recall the distinction of Knight (1921): the future in financial markets is radically uncertain, whereas distribution laws are known in probability.

Cote and Sanders (1997) propose an original methodology to avoid this problem. They study the impact of the consensus on subjects' earnings' predictions. Individuals have access to an information set and make a prevision of earnings for the following year. After this prevision has been made, a consensus of analysts is submitted to them, and they can revise their prevision. The authors find that the consensus influences significantly the second estimation. This influence is more important when subjects find the consensus credible, and when they have a poor confidence in their own ability.

The contribution of this methodology is to test a choice close from an actual financial prevision, with a limited information set. This approach is appealing in a better understanding of herding behaviour in financial markets. The kind, as well as the quality of information given to subjects, can be controlled through this experiment. Moreover, genuine imitative behaviour can be observed, and distinguished from simple correlated behaviours, since information is under control. The previsions without and with the consensus clearly show the impact of others in subject's decisions.

If Cote et Sanders (1997) analyse herding behaviour in a continuous choice setting, however, the bulk of the academic works -including seminal models from Bikhchandani, Hirshleifer and Welch (1992) or Scharfstein and Stein (1990)- are based on a binary signal and binary choice setting. Herding behaviour is not defined as a choice closer to the consensus, but rather, in a more restrictive manner, when individuals give up their own signal to follow one or more agents, like the consensus of analysts. The goal of this experimentation is to empirically study herding on a simple binary choice: buying or selling.

We clearly find empiric evidence of herding behaviour. This behaviour is proved to be correlated with the implication of the reputation -especially for conformist subjects-, and inversely correlated to subjects' ability. The paper is organized as follows. First section (1) develops some of the major academic reasons explaining herding behaviour tested in this experimentation. Then the methodology is described in section (2), and the main results are presented in section (3).

## **1 Factors explaining herding behaviour**

Several factors have been analysed by the literature in order to explain herding behaviour. Orléan (1999) synthesises these factors through three main causes:

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balls  $a$  et  $(1-p)$  balls  $b$ . The signal given by the ball  $i$  is informative: the probability that a ball  $a$  corresponds to state  $A$  is  $p$ .

informational, normative and autoreferential<sup>4</sup> ones. However, these causes are still theoretical, and concrete, empirically testable hypotheses are needed<sup>5</sup>.

In their seminal model, Bikhchandani, Hirshleifer and Welch (1992) underline the role of information quest as a major factor of herding. In this framework, an agent imitates the previous ones when he believes that they are better informed than himself. Then, when every agent has the same signal reliability,  $p$ , if two previous agents acted the same way, the third rationally follows, disregarding his own information and a *cascade* occurs. If reliability is not the same for every agent, an actor having a low precision signal will logically be more inclined to herd.

*H1. The less the private signal is perceived as reliable by the agent, the more his tendency to herd is significant*

The precision of the private signal could be split into two components: the reliability of the signal itself, and the belief of the actor in his own ability to understand it. An agent could receive a very precise signal and feel *a priori* unable to interpret it properly. Therefore, the confidence of the agent in his own capacities could play an important role in his herding behaviour.

*H2. The less the agent has a priori confidence in his own capacities, the more his tendency to herd is significant*

Cote et Sanders (1997, p.24), note that the perception of other actors' ability is often invoked in social psychology studies. For instance, a major and famous analyst should have more impact on money managers than a younger one. In the same way, if the consensus of analysts is *a priori* perceived to be highly credible, he should have more impact on agent's decision.

*H3. The more the agent has a strong a priori confidence in the ability of analysts, the more his tendency to herd is significant*

The proportion of analysts making the same recommendation could also have an influence. Kübler and Weizsäcker (2005) show in a study on several experimentations based on Anderson and Holt's (1998) probabilistic environment, that a positive correlation can be proved between the length of the cascade and its strength. The more an important number of agents have made the same decision, the more the probability the next one makes the same choice is important.

*H4. The more the proportion of analysts agree on a recommendation, the more his tendency to herd is significant*

Since Scharfstein and Stein (1990), reputation is often cited to explain herding behaviours<sup>6</sup>. The money manager acts, not to optimise his decision in an informational manner, but in order to protect his reputation towards others, and

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<sup>4</sup> Since the price is viewed as a consensus between agents, following the herd can be interesting because the price is driven up by other's buying. This needs a feedback mechanism not used in this experiment.

<sup>5</sup> The hypotheses proposed rely primarily on the development of Scharfstein and Stein (1990) seminal model, including the informational constraints thanks to the comment of Ottaviani and Sorensen (2000). This was the aim of previous work.

<sup>6</sup> See for instance Graham (1999), Avery and Chevalier (1999), Dasgupta and Prat (2006), or Ottaviani and Sorensen (2006)

to avoid to be judged as incompetent. As a matter of facts, it is difficult to objectively judge the ability of managers on financial markets, insofar as their performance is highly affected by random components. The best way to evaluate their ability could be to compare their actions with the ones of their peers, postulating that the majority is correctly informed.

*H5. The more the agent tries to protect his reputation, the more his tendency to herd is significant*

Social psychology studies, (e.g. Asch [1951], Crutchfield, [1955]) show that some individuals are more prone to follow the majority than others. They exhibit a more conformist personality, and their behaviours are generally close to the group.

*H6. The more the agent is proved to be conformist, the more his tendency to herd is significant*

Briefly, an herding behaviour should be correlated with the perception of analysts' ability, the proportion of analysts who agree on a recommendation, the protection of reputation and individual conformism. On the other hand, a high reliability of the information signal and confidence in individual capacities should be negatively correlated with this behaviour. This paper is an exploration of an actual empirical testing of these factors. Next section describes the methodology used in the experimentation.

## 2 Methodology

### 2.1 Experimentation and finance

Experimentation was introduced in finance by Chamberlin (1948) and Smith (1962). This field is growing rapidly since the early 1990's<sup>7</sup>. Conversely, cognitive psychologists Tversky and Kahneman (1974) have studied the behaviour of subjects in risky environments. Daniel Kahneman and Vernon L. Smith, from both streams, have been awarded with the 2002 Nobel price in Economy.

The main contribution of this methodology is its power to isolate the variables and to enable a *ceteris paribus* study, as in physics or biology. The *in vitro* environment is then, by far, less influenced by multiple and uncontrollable factors. Eber and Willinger (2005, p.5), define an experiment as "creating a *controlled environment* in order to artificially reproduce a situation reflecting the conditions used by the economic theory".

The aim of experimentation is not to substitute the laboratory to field studies, but rather to propose a complementary methodology to better understand the role of some particular factors involved in a phenomenon. Concerning herding behaviour, experimentation seems to be a convenient manner to control the information set of each actor, and to discriminate herding from correlated behaviours. This constraint is not possible *in situ*, on financial markets.

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<sup>7</sup> See for instance Davis and Holt (1993 a and b), Kagel and Roth (1995) or more recently Plott and Smith (2006).

Naturally, the conditions including information set, decision rules, interactions and subjects -students- are highly simplified and do not correspond strictly to real ones. After all, this simplicity is just the transposition of the simplification required by theory which looses, if too complex, its explanatory power (Davis and Holt [1993a]). Then, experimentation is not a genuine replication of reality, but an environment creating a metaphor in order to better understand the base mechanisms who triggers financial behaviours (Poujet [2001, p.58]).

## 2.2 Experimental design

In order to isolate an actual herding behaviour, subject's choice has to be opposed to the one of the majority of the consensus. The pieces of information given to the subjects were selected with a screening using *JCF Quant - Factset* database, which is largely used by French portfolio managers. Two different firms were selected in order to satisfy three criteria:

1. to have ratios (including P/E and Price/book ratios) over or under-valuated compared to the market, as well as to their industry sector<sup>8</sup>
2. in order not to be recognized by subjects, these companies have been chosen in the mid and small caps. All companies recently breaking the news have been put aside.
3. the "new technology" companies, including information and communication have been isolated, since the recent internet bubble might have induced special behaviours.

The data submitted to subjects are real data from *JCF Quant - Factset* database, with complementary information from annual reports of the companies and an internet free financial data provider<sup>9</sup>. The two French firms chosen have been called X and Y. No subject recognized them.

## 2.3 Experimental decisions

The questionnaire was divided into three parts. The first and the third parts correspond to demographic questions as well as measures of indicators concerning the hypotheses. The experimentation, in the second part, was split into three stages.

### Stage 1

The first step submits an information set on the firm: a brief general presentation, industry statistics, evolution of sales, profits and EBIT, balance sheet, income statement as well as major ratios over the last four years. The comparison between firm's ratio and the industry pinpointed an over or under-valuated firm from a fundamental point of view. With this information set, subjects are asked to make a buying or selling recommendation and to disclose their confidence in this choice.

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<sup>8</sup> Between years 2000 to 2005, "over valuated" firms had a price/book ratio over 3 and a P/E ratio over 50. "under valuated" firms had a P/E ratio under 12 and a price/book ratio under 1.

<sup>9</sup> [www.boursorama.com](http://www.boursorama.com)

## Stage 2

At stage 2, new information is submitted to subjects:

1. a consensus of analysts, which was manipulated in order to be opposed to the over or undervaluation revealed at stage 1.
2. a five year financial summary, which *a priori* conveyed no more information than given at first stage<sup>10</sup>. As pinpointed by Cote and Sanders (1997, p.28), this summary is added because the only consensus may trigger demand effects and hypothesis guessing.

With data of the stage 1 and these new additional data, subjects have to make a second recommendation and indicate their confidence in their choice.

## Stage 3

At stage 3, no new information was submitted to subjects. The decision rule is however different, since a constraint of reputation is introduced, according to Scharftein and Stein (1990). If the personal recommendation diverges from the one of the analysts, the portfolio manager will be the only one to support a bad choice, and will be judged incapable by his clients and hierarchy. On the other hand, making a bad decision with the majority enables the manager to "share the blame" with others.

With this new constraint, subjects gave a third recommendation, and the confidence he places in this choice.

## 2.4 Measure of the hypotheses

Parts 1 and 3 of the questionnaire are designed to collect data in order to interpret the results of the experimentation, according to the hypotheses presented.

### ***A priori* confidence**

The *a priori* perception of the individual ability and the one of other agents should play an important role in the decision. To measure this confidence, diverse scales could have been used. Following Cote and Sanders (1997), the Lichtenstein and Bearden (1989) scale measuring source credibility has been chosen to gauge *a priori* the perception of the confidence of subjects in their own capacities, as well as the confidence they place in financial analysts.

Before any information on the firm, subjects are asked to estimate this confidence on a seven point Likert scale, rating the analysis as (1) dependable, (2) credible, (3) accurate and (4) trustworthy.

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<sup>10</sup> This financial summary reports some of the ratios already present at first stage, some are divided by share. The data about N-4 do not seem to give much more information. An *a posteriori* discussion with subjects showed that this summary was not really used in their second recommendation.

## **Perceived reliability of information**

All the subjects had access to the same information at stage 1: whether on firm X or on firm Y. However, all subjects may not have the same perception of this signal. Therefore, the reliability was assessed through a seven point Likert scale, in which subjects rated the information given as (1) precise, (2) easy to interpret, (3) reliable and (4) exhaustive.

## **Conformism**

Conformism is a difficult personality trait to assess *a priori*. The scale coined by Pettigrew<sup>11</sup> (1958) in psychology is widely used and seems the most reliable. On a seven point Likert scale, subjects had to assess their agreement (1: "not agree", 7: "totally agree") with affirmations trying to evaluate their personality when facing other's behaviour.

## **Proportion of the majority**

As opposed as the previous hypotheses which rely on individual characteristics, the proportion of the majority was a manipulated variable. Two modality of this factor were submitted to the subjects. Each firm was presented at stage 2 as being rated by seven analysts. In the *strong majority* case, six recommended the opposed choice compared to a fundamental point of view of stage 1, and one this fundamental choice. In the *weak majority* case, four analysts were opposed to a fundamental choice whereas three were coherent with it.

## **2.5 Experimental procedure**

The experimentation took place with students in finance in February 2006, with the agreement of each academic responsible. In order to avoid any bias, the students were not aware of this experimentation. All the procedure has been followed meticulously in order to preserve the reproduction of this research.

During the presentation of the instructions and the questionnaire, the goal presented was to better understand the information used in an investment decision. This was presented as an important research and had to be filled carefully.

After asking for questions, subjects were not allowed to communicate with each other during the time of the experimentation. Before the questionnaire was given, it was underlined that subjects had to respond to the questions sequentially, and that the data were different for two people sitting aside<sup>12</sup>. These instructions were reminded to subjects on the first page of the document. The average time of the experiment was 35 minutes.

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<sup>11</sup> Five representative items have been selected on this scale

<sup>12</sup> The questionnaires have been distributed in order to alternate X et Y firms as well as the proportion of the consensus (high/low): X1Y1X2Y2X1...



## 2.6 Subjects

Overall, 158 subjects from five different programs have filled this questionnaire. Four documents were not totally completed. The questionnaires in which the first recommendation fits the consensus of the analysts (49) were also set aside because they cannot clearly show a herding behaviour, since these subjects do not rely on fundamentals for their recommendation. On the remaining, 17 were excluded since they were aware of the goal of this experimentation and, knowing the hypotheses, could have therefore disguised their choice.

88 questionnaires have been statistically exploited. The subjects chosen for this experimentation were students in first and second year of Master, with a high level in their finance or accounting speciality. The repartition is detailed in table 1.

< INSERT TABLE 1 ABOUT HERE >

These subjects have from their formation a good knowledge of firm evaluation<sup>13</sup>. Beyond, some of them have an experience of the financial markets: 53 subjects declared having managed a virtual portfolio<sup>14</sup> and 23 had already personally bought real stocks.

There were four different questionnaires, with two firms (X and Y) and two proportion of the consensus (high and low, coded respectively 1 and 2). Overall, the number of each type of questionnaire is reported in the table 2 below.

< INSERT TABLE 2 ABOUT HERE >

## 2.7 Coding of the variables

Herding behaviour has been coded into two different manners. In order to measure herding, which can be either a buying or a selling recommendation – depending on X and Y-, a variable HERD2 was created, taking two values: 1 if the subject imitates the choice of the consensus at stage 2, and 0 otherwise. HERD3 is identical, concerning the choice with reputation, at stage 3.

To measure more precisely the inclination to herd, three variables called ICONF1, ICONF2 and ICONF3 have been created, corresponding to the confidence of the subject in his recommendation. When his recommendation is opposed to the consensus, ICONF has been coded between -1 to -7 according to the Likert scale of confidence in the decision. On the other hand, when the choice is to follow the consensus, the confidence has been symmetrically coded from 1 to 7. Hence, a subject who is very confident in a herding choice will be close from 7, whereas a subject very confidence in a fundamental decision will be close to -7. This coding enables us to consider both the choice made by the subject and the confidence attributed in this recommendation.

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<sup>13</sup> The acquisition of these techniques and the knowledge of the main ratios have been checked with the professor involved in this formation.

<sup>14</sup> The most cited simulations are *Boursorama* and *Stocktrak*

### **3 Results of the experimentation**

All the answers have been checked twice and exploited with SPSS 12.0. Descriptive results are developed first (3.1), before the analysis of explicative results (3.2).

#### **3.1 Descriptive results**

##### **Impact of the consensus on subjects' perception**

Before analysing the choice made by subjects, studying the impact of the consensus on their perception of the firm they had to evaluate is particularly interesting. They were asked to reveal, on a seven point Likert scale, if they thought that the performance of the stocks of the firm -for the next 12 month- would be below, above, or at the same level than the market. Before knowing the consensus, estimations of the firms rely on fundamentals and shows firm X over valued -performance is presumed to be worse than the market in the future- whereas firm Y is under valued (Figure 1).

< INSERT FIGURE 1 ABOUT HERE >

The consensus is manipulated in order to be opposed to this estimation: the majority of the analysts recommend buying stocks of X, and selling Y's stocks. This is not without consequences on the perception of subjects, as shows the figure 2.

< INSERT FIGURE 2 ABOUT HERE >

The performance estimated by subjects after the consensus are by far more close from the mean. The mean of the estimations for firm X rises from 2.86 to 3.60 whereas they fall from 4.61 to 4.46 for Y. The difference of perception is significant ( $F(1,86)=14.38$ ,  $p<0.000$ ). It is interesting to notice that perception for firm Y are less affected than for firm X. This could be explained by the industry, since Y belongs to the automotive industry whereas X leads research and development in the pharmaceutical industry, which can be considered as a more promising industry.

< INSERT FIGURE 3 ABOUT HERE >

##### **Evidence of herding behaviour**

There were diverse written reactions to justify the decision. One subject notes: "I'm rational, therefore I follow the analysts". Another one writes: "they are *only* analysts". The consensus had different impacts on the choices made.

On 88 subjects, whose personal analysis differs from the consensus in the first recommendation, 25 choose to put their own opinion aside, and followed the majority of analysts at stage 2. When the reputation is introduced at stage 3, most of the subjects who followed the analysts before did not change their

choice<sup>15</sup>. 21 subjects who did not herd for informal reasons, however, decided that it was a best choice to follow the consensus to preserve the reputation.

< INSERT FIGURE 4 ABOUT HERE >

Overall, 46 subjects, who initially had a different opinion from the consensus, have chosen to give up this opinion and to follow the analysts. On the other hand, 42 never followed the choice of the consensus and have maintained their own analysis on the two recommendations. In coherence with the perception of the performance, subjects analysing firm X are a little more prone to herd than the ones with firm Y, even if the difference is not significant<sup>16</sup>.

< INSERT FIGURE 5 ABOUT HERE >

Some of the subjects acknowledged the importance of the consensus in their decision: 18 mention it as one of the three most important information pieces, but only 4 times as the most important. Most of them do not mention the consensus, and invoke fundamental information to motivate their choice. Several explanations are possible. The consensus might have led them to search within fundamental data, some information confirming this point of view. Admitting following the analysts may also reveal their incompetence, and was possibly avoided by some of them.

In their study, Northcraft and Neale (1987) invited experts to visit a house during 20 minutes and gave them a 10 page document on the house, and the ones in the area. The experts are invited to make an estimation of the price. This estimation proves to be influenced by the prices of others houses mentioned in the document, but, during the experiment, only 8% of the experts acknowledged that this point was one of their three major criteria of evaluation. In the same way, an important part of the influence of the consensus is not spontaneously admitted by the subjects of this experiment<sup>17</sup>.

## **Evolution of the confidence in the decision**

The ICONF variables represent the confidence of the subject in his choice. When ICONF is negatively coded, the subject has confidence in a fundamental behaviour, opposed to herding. Every subject has been selected to adopt a fundamental behaviour at stage 1. The introduction of the consensus modifies the mean confidence in a fundamental choice, whose means is -4.15 before the consensus (ICONF1), and -1.93 (ICONF2) afterwards.

The median is almost stable between ICONF1 and ICONF2. Subjects who had a high confidence in their fundamental evaluation seem not to be influenced by the

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<sup>15</sup> One can notice two subjects who change their mind, and, after following the analysts, decide to come back to a fundamental choice. This might be interpreted as reaction of opposition to group pressure, but involves only two subjects.

<sup>16</sup> A chi-squared test gives for HERD2,  $\chi^2=0.256$  ;  $df=1$  ;  $p<0.613$  and for HERD3  $\chi^2=0.729$ ,  $df=1$  ;  $p<0.393$

<sup>17</sup> This could partially call into question some works only based on surveys, see e.g. Lütje (2005).

consensus. On the other hand, subjects who had doubts on their decision (ICONF between -3 and -1) have been largely more influenced by analysts.

< INSERT FIGURE 6 ABOUT HERE >

The introduction of reputation modifies the average confidence to -0.41, very close from the equilibrium between herding and fundamental behaviours. In this case, however, the median is significantly higher, and some subjects who placed high confidence in their own judgement have consciously decided to put it aside, in order to preserve the reputation of the portfolio manager. One can more closely observe the frequency of observations on confidence scales.

< INSERT FIGURE 7 ABOUT HERE >

The subjects who herd during stage 3 (ICONF3) have generally a low confidence in their third recommendation. Then, it seems that they do not believe that this decision is right, trustworthy, but understand the normative pressure the money manager has to support. Even if they are uncertain of making a "good" decision – i.e. optimal considering the information set-, subjects respond to an exogenous constraint, in order to preserve the reputation of the manager.

## **3.2 Explicative results**

### **Reliability of the scales**

In order to test the hypotheses, several questions in different parts of the document have tried to estimate the following parameters:

- confidence in the personal analysis (Lichtenstein and Bearden, 1989)
- confidence in the analysis of analysts (Lichtenstein and Bearden, 1989)
- perceived reliability of information
- conformism (Pettigrew, 1958)

The reliability of these scales is measured by Cronbach's alpha, who estimates the internal coherence of the elements of the scale<sup>18</sup>. This alpha has been calculated for each scale as written in the table 3.

< INSERT TABLE 3 ABOUT HERE >

The scale measuring the confidence, in personal analysis as in the one of analysts, appears rather reliable, with an alpha over 0.85. The two others scales seem to be a little less reliable, but the coefficient are still acceptable for values between 0.62 and 0.92 (Nunally, 1978).

### **Statistic exploitation and regression models**

In order to test the hypotheses, two distinct statistic treatments were used: simple linear regression and variance analysis. When variables were the results

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<sup>18</sup> This coefficient, widely used in marketing and psychology, is based on the mean correlation and the number of items of the scale

of scales, a simple regression model was used to link the confidence of the subject in their recommendation at stage 2 and 3, and the different scales:

$$ICONF2_i = \gamma_0 + \gamma_1 \cdot p_i + \gamma_2 \cdot \theta_{Bi} + \gamma_3 \cdot \theta_{Ai}^* + \gamma_4 \cdot c_i$$

$$ICONF3_i = \gamma'_0 + \gamma'_1 \cdot p_i + \gamma'_2 \cdot \theta_{Bi} + \gamma'_3 \cdot \theta_{Ai}^* + \gamma'_4 \cdot c_i$$

with

$ICONF2_i$  : confidence in the herding recommendation at stage 2 for subject  $i$

$ICONF3_i$  : confidence in the herding recommendation at stage 3 for subject  $i$

$p_i$  : perceived reliability of information for subject  $i$

$\theta_{Bi}$  : confidence of subject  $i$  in his own capacities

$\theta_{Ai}^*$  : confidence of subject  $i$  in the ability of financial analysts

$c_i$  : subject's  $i$  conformism

These variables are measured as the means of the values in the scales previously described.

Hypotheses H4 and H5, whose variables are dichotomous, have been tested through a variance analysis. The proportion of the consensus can be high or low and an ANOVA is able to detect if the differences in the means –for  $ICONF2$  and  $ICONF3$ – are significant. Besides, an intra subjects ANOVA, comparing the mean of the responses before ( $ICONF2$ ) and after ( $ICONF3$ ) the introduction of reputation, enables us to measure the influence of this constraint on the decision of subjects.

## Test of hypotheses

As mentions Trueman (1990), the revision of the recommendation is probably under estimated insofar as changing one's opinion could reveal the weakness of the initial recommendation. If the consensus of analysts had been given within the information set of stage 1, more herding might have been revealed<sup>19</sup>. The tests run and the results are in the table 4.

The regressions explain respectively 8.1% and 11.8% of the variance of  $ICONF2$  and  $ICONF3$ <sup>20</sup>. The coefficients obtained are:

$$ICONF2 = -0.18 - 0.16p - 0.99\theta_B + 0.32\theta_A^* + 0.44c$$

$$ICONF3 = 2.06 - 0.01p - 1.02\theta_B - 0.04\theta_A^* + 0.65c$$

The obtained signs are coherent with the hypotheses (excepted for the variable  $\theta_A^*$  in  $ICONF3$  regression). However, only three coefficients are statistically significant according to the t-test: those concerning the a priori confidence on the personal capacities in both regressions, and the conformism variable in the second one.

<sup>19</sup> But the interpretation would have been difficult, since one cannot know on which information the subjects used. In order to avoid this bias, two groups could be studied: one with and one without the consensus.

<sup>20</sup> As a comparison, Cote and Sanders (1997) explain 12% of the observed variance

< INSERT TABLE 4 ABOUT HERE >

### **Herding behaviour and *a priori* confidence**

The main statistically significant factor is the *a priori* confidence of the subjects in their own ability. The perception of their capacity to analyse a firm proves to have an influence coherent with H2: the more the individual has confidence in his ability, the less he has a tendency to herd. This relation is true for both informational imitation ( $t=-2.23$ ,  $p<0.03$  pour ICONF2) and reputational one ( $t=-2.37$ ,  $p<0.02$  pour ICONF3). A subject very confident in his capacities is less concerned by the consensus of analysts, whatever the nature of the group pressure.

This *a priori* confidence is very close from two other factors: interest for financial markets and having already bought stocks. An ANOVA pinpoints that herding behaviour is also negatively correlated with experience of the market<sup>21</sup>. The figure below shows that subjects who already bought stocks were less influenced by the informational dimension of analysts (stage 2). Reputation (stage 3) has more impact on their decision, even if most of them still prefer a fundamental choice.

< INSERT FIGURE 8 ABOUT HERE >

A study of the correlation between ICONF2 and the interest<sup>22</sup> shows that the more the subjects are interested in financial markets, the less they are inclined to herd at stage 2, for informational reasons. This correlation, however, is not significant for reputational reasons, at stage 3.

These results seem to support hypotheses linked with the ability of agents. Orléan (1992, p.696) thinks that the main factor is "the degree of confidence that operators place in their fundamental evaluation method". The more agents are uncertain with this method, the more they will be inclined to follow the consensus.

We must pinpoint that the confidence studied is an *a priori* confidence, which does not rely on the information set given to the subject. In fact, most of the models consider the confidence within the signal, exogenous to the agent, and not to individual intrinsic ability: the less informed actors herd the most. In the frame of this experimentation, there is no informational asymmetry and the confidence measured is the one they attribute to their own capacities, independently of the information received.

Informational as reputational herding behaviour is therefore not only the result of the environment on the individual, but also linked to the own characteristics of the actors. Crutchfield (1955) studies the link between conformism and personal criteria based on psychological tests. He concludes that conformist behaviours are principally and inversely correlated to individual competences. This is consistent with our findings in the field of investment choice.

<sup>21</sup>  $F(1,86)=7.887$ ,  $p<0.006$  for ICONF2,  $F(1,86)=5.386$ ,  $p<0.023$  for ICONF3

<sup>22</sup> The correlation is  $-0.299$  (resp.  $-0.081$ ) between interest for financial markets and ICONF2 (ICONF3), with a signification of 0.01 (n.s.) for  $n=88$  (id.).

The impact of a priori confidence seems to reinforce the approaches based on the experience of actors, such as Chevalier and Ellison (1999) who show that youngest money managers make generally less risky decisions and bear more conventional portfolios. The less experienced agents, who less believe in their own ability, avoid to make a decision revealing their incompetence, and to be the only one to afford it.

## **The role of reputation**

The introduction of a reputational constraint reinforces significantly the tendency to herd ( $F(1,87)=14.32$ ,  $p<0.01$ ). The decision is then not only based on the most profitable decision, but also on the pressure of clients and hierarchy on the manager. This changing of optimisation shows rather clearly that non financial constraints can also have an impact on investment decisions, and therefore on prices. Recently, Dasgupta and Prat (2005) or Ottaviani and Sorensen (2006) expose the theoretical arguments of this hypothesis which is supported by the results of this experimentation.

The reputation concerns subjects who are less confident in their capacities and conformist people according to Pettigrew's scale (1958). Reputation seems to have more influence on conformist subjects, more sensitive to normative pressure than others. H6 is validated by the data ( $t=1.66$ ) with a 10%<sup>23</sup> significance, but only for stage 3, concerning a reputational herding. When the consensus is only a source of information, conformist subjects are less sensitive to it. The figure 9 divides the subjects into two categories: those whose conformism measured were over the mean (« high conformism » group) and those whose conformism was below the mean. The median shows a notable difference concerning reputational herding.

< INSERT FIGURE 9 ABOUT HERE >

More generally, one can observe a positive correlation ( $r=0.269$  ;  $n=87$  ;  $p<0.012$ ) between the perceived importance of managers' competences assessment and ICONF3. Then, the more this estimation is viewed as crucial, the more the subject will have a tendency to herd. Reputation has to be understood as a continuous variable, according to the importance devoted to it by the subject. This experimental result is coherent with the study of Lütje (2005), who finds that German money managers who believe that herding can benefit to their career adopt more easily this behaviour, or at least assert more easily following the trend.

## **Other hypotheses**

Hypotheses H1 on the perceived reliability of the signal, H3 on the *a priori* confidence on the ability of analysts, and H4 on the proportion of analysts are not statistically significant. On information reliability, the coherence of the items of the scale may be too low. The internal coherence of the scale (Cronbach's

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<sup>23</sup> in reality, with more precision,  $p<0.10054310$

alpha) is however even poorer concerning conformism, who reveals a 10% significance in the regression.

(i) The confidence in the ability of analysts

The scale measuring the confidence of subjects in the ability of analysts (H3) proves to be poorly convincing. Several explanations can explain it. First of all, subjects, students, may have trouble to really assess the capacities of real analysts, because of their lack of knowledge on these last. Besides, the scale used is identical to the one used to estimate the confidence in their own ability – in order to ensure homogenous answers-. A blurring effect from the first scale is possible and may have fostered dependant answers. To avoid these problems, this questionnaire could be submitted to populations more close to analysts. Otherwise, finding another relevant scale might enable us in future works to measure more precisely this hypothesis.

(ii) The reliability of information

The reliability of the information signal (H1) is more or less comparable for all the subjects, for society X and Y, whenever subjects herd or not. This seems to be coherent with the identical information received by subjects and reinforces the idea that information by itself is not the only factor of herding, but also the confidence of the actor himself.

The influence of actual reliability of information is however not really tested by this experimentation which focuses on perceived reliability. Further work could focus on actual reliability of the signal, needing a clear and concrete definition of information signal, especially involving qualitative indicators. The number of convergent information could be used, with a weight for each of them. The research in this field seems to be promising, and more realistic than in probabilistic environments.

(iii) The proportion in the consensus

The results of this experimentation on the proportion in the consensus (H4) seems to support the conclusions of Klüber and Weizsäcker (2005) who find a positive relation between the preceding number of individuals who made a choice and the probability that a new actor adopts this choice. This study, in a probabilistic environment, relies on a great number of subjects and more data may enable us to validate this hypothesis.

< INSERT TABLE 5 ABOUT HERE >

If the difference found is not significant, the results are coherent with the hypothesis: when the proportion of analysts is 6 versus 1 (rather than 4 versus 3) to be opposed to subject's evaluation, he proves to be slightly more influenced. The percentage of herding behaviour rises to 34% for HERD2 and 56% for HERD3 versus respectively 23% and 45% with the lower proportion in the consensus.



#### (iv) Herding and autoreferentiality

Without a price mechanism, autoreferential herding (Orléan [1999]), stemming in the speculation of other's behaviours, was not tested in this experiment. A subject admits however being influenced:

"The propositions of analysts -rumours and information from acknowledged brokers- may greatly influence the decisions of investors"

Following analysts is then natural insofar as they have an impact on the market and will launch a trend. The belief in a price, result of the aggregation of individual behaviours, leads this subject to herd rationally. Further works, studying more precisely this feedback relationship between subjects and prices<sup>24</sup>, could enable us to better understand the speculative anticipations of actors.

## Conclusion

Herding behaviour, so often cited in theory, reveals to have only scarce concrete proofs of existence, in close to real investment decisions. Will it stay a chimera? The goal of this research was to bring some evidence on herding behaviour in a precise experimental framework, and to try to link it with measurable factors.

Yes, herding behaviour actually exists in this experimentation. Having to recommend to buy or sale a stock, subjects were largely influenced by the consensus of analysts opposed with their initial choice. In this experimental setting, half of them gave up their own analysis to follow the consensus. This result is particularly interesting and seems unprecedented in this field<sup>25</sup>.

Beyond the adaptation of the original methodology used by Cote and Sanders (1997), the main contribution of this research is to pinpoint the importance of the link between herding behaviour and individual capacities. The more a subject feels competent, the less he will be inclined to herd, even if the reputation of the portfolio manager is at stake. If this relation seems trivial, only poor concrete proofs enabled us to anchor this hypothesis in the empiric sphere. The reputation seems to influence more conformist subjects. On the other hand, the confidence of the subject in the ability of analysts, the proportion of analysts in the consensus and the perceived precision of information do not seem to have significant impacts on the decisions made.

Some non financial information, such as reputation, can influence the behaviour of individuals and, therefore, the price on the market. In this experience, subjects were highly influenced by the normative power of the group. They did not always herd because they considered the consensus as really true, but also because of the pressure on manager's reputation. The agency theory, supported for instance by Scharfstein and Stein's (1990) seminal model, seems consistent

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<sup>24</sup> The trend, which may reveal autoreferential dynamics, is the most cited missing information (10 over 88) by subjects.

<sup>25</sup> The feedback with students of this experimentation also revealed an interesting pedagogical dimension. Most of them appreciated to face an investment choice with real data on firms, and they have been incited to think about the importance of the consensus on their decision, and the factors influencing a choice on financial markets

with these results. The price, as the result of the operations of investors, may then involve factors not directly bound to the optimisation of the decision, from the classical financial theory point of view. Thus, studies in this field might consider a larger set of social interactions, including the constraints of portfolio managers, to better understand herding behaviour on financial markets.

## Appendix A: tables

| <b>Program<sup>26</sup></b> | <b>Nb</b> | <b>%</b> |
|-----------------------------|-----------|----------|
| Master 1- Finance           | 28        | 31.8%    |
| Master 1 - MSTCF 2          | 24        | 27.3%    |
| Master 2 - C.C.A.           | 13        | 14.8%    |
| Master 2 - M. F.            | 8         | 9.1%     |
| Master 2 - ESC 3 F.M.       | 15        | 17.0%    |
| <b>Gender</b>               | <b>Nb</b> | <b>%</b> |
| Male                        | 51        | 58.0%    |
| Female                      | 37        | 42.0%    |

**Table 1. Subject's characteristics**

| <b>Type of questionnaire</b> | <b>Nb</b> | <b>%</b> |
|------------------------------|-----------|----------|
| <b>X1</b>                    | 19        | 21.6%    |
| <b>X2</b>                    | 23        | 26.1%    |
| <b>Y1</b>                    | 22        | 25.0%    |
| <b>Y2</b>                    | 24        | 27.3%    |
| <b>Total</b>                 | 88        | 100.0%   |

**Table 2. Types of questionnaires**

|  | <b>Cronbach's alpha</b> | <b>Number of items</b> |
|--|-------------------------|------------------------|
| Confidence in personal analysis          | 0,906                   | 4                      |
| Confidence in the analysis of analysts   | 0,852                   | 4                      |
| Perceived reliability of the information | 0,701                   | 4                      |
| Conformism                               | 0,660                   | 5                      |

**Table 3. Cronbach's alpha for the measure of scales**

<sup>26</sup> MSTCF : Maitrise de Sciences et Techniques Comptables et Financières, C.C.A : Comptabilité Conseil Audit, M.F : Marchés Financier, F.M. : Finance de Marché

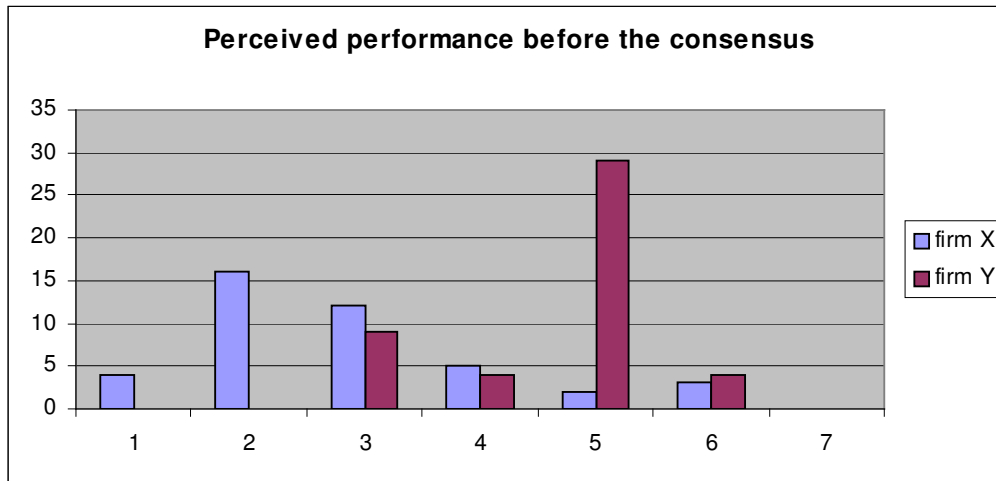
| Hypotheses   | Type of measure  | Test used            | Expected sign | ICONF2            |                     | ICONF3                  |                     |
|--|--|----------------------|---------------|-------------------|---------------------|-------------------------|---------------------|
|  |  |                      |               | Result            | Signification       | Result                  | Signification       |
| H1. The less the private signal is perceived as reliable by the agent, the more his tendency to herd is significant              | Likert Scale   | Linear Regression    | -             | t= -0,3235        | p< 0,7471           | t= -0,0279              | p< 0,9778           |
| H2. The less the agent has a <i>priori</i> confidence in his own capacities, the more his tendency to herd is significant        | Likert Scale   | Linear Regression    | -             | <b>t= -2,2279</b> | <b>p&lt; 0,0286</b> | <b>t= -2,3669</b>       | <b>p&lt; 0,0203</b> |
| H3. The more the agent has a strong a priori confidence in the ability of analysts, the more his tendency to herd is significant | Likert Scale   | Linear Regression    | +             | t= 0,7402         | p< 0,4613           | t= -0,0951              | p< 0,9244           |
| H4. The more the proportion of analysts agree on a recommendation, the more his tendency to herd is significant                  | Comparison between the two groups of consensus : high/low  | inter-subjects ANOVA |               | F(1,86)= 0,6840   | p< 0,4105           | F(1,86)= 1,3916         | p< 0,2414           |
| H5. The more the agent tries to protect his reputation, the more his tendency to herd is significant                             | Comparison between the second and the third recommendation | intra-subjects ANOVA |               |                   |                     | <b>F(1,87)= 14,3166</b> | <b>p&lt; 0,0003</b> |
| H6. The more the agent is proved to be conformist, the more his tendency to herd is significant                                  | Likert Scale   | Linear Regression    | +             | t= 1,0943         | p< 0,2770           | <b>t= 1,6609</b>        | <b>p&lt; 0,1005</b> |

**Table 4. Test of the hypotheses**

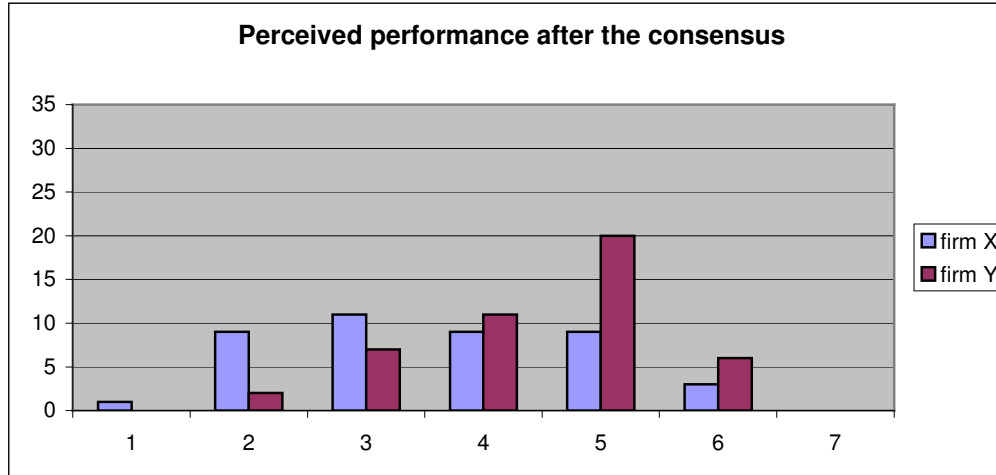
| Number and<br>percentage of<br>people who herd | Proportion of the<br>majority |     | Total |
|--|-------------------------------|-----|-------|
|  | high                          | low |       |
| HERD2  | 14                            | 11  | 25    |
| %  | 34%                           | 23% | 28%   |
| HERD3  | 23                            | 21  | 44    |
| %  | 56%                           | 45% | 50%   |
| Total of the subjects                          | 41                            | 47  | 88    |

**Table 5. Herding and proportion of the majority**

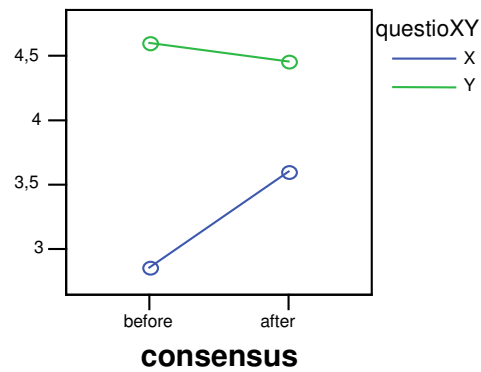
## Appendix B: figures



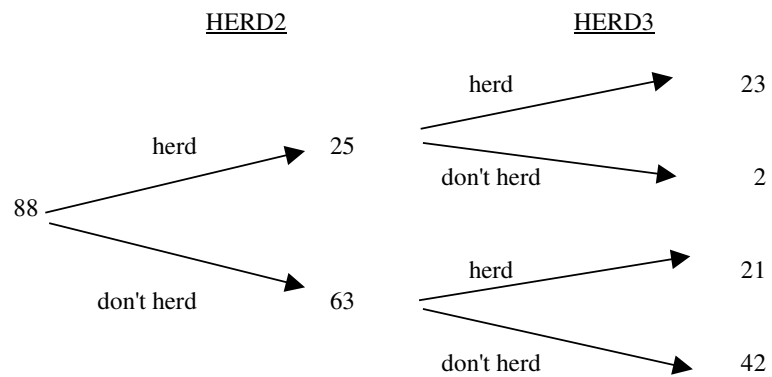
**Figure 1. Performance estimated of the firms before the consensus**  
(1: less than the market, 4: like the market, 7: higher than the market)



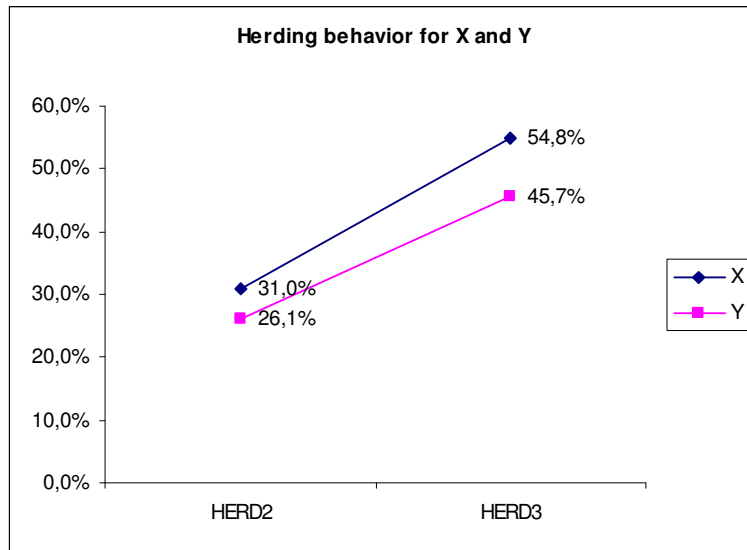
**Figure 2. Performance estimated of the firms after the consensus**  
(1: less than the market, 4: like the market, 7: higher than the market)



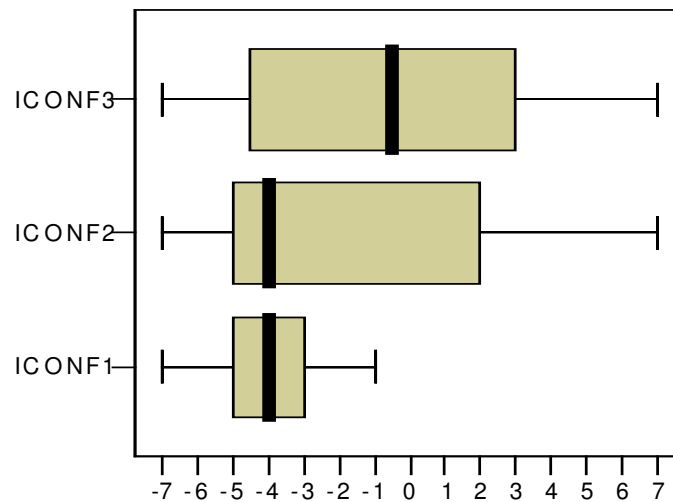
**Figure 3. Means of the estimations of the performance before and after the consensus**



**Figure 4. Observation of herding behaviour for recommendations at stage 2 and 3**

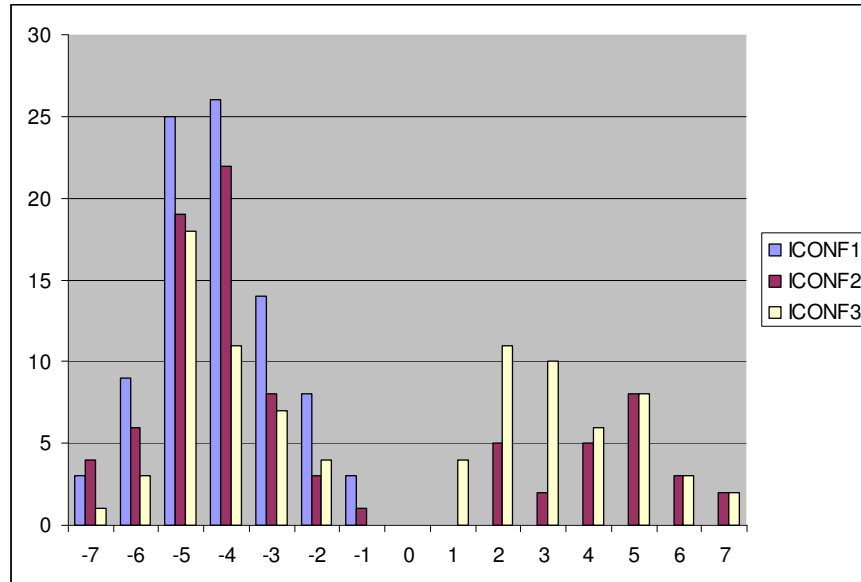


**Figure 5. Herding behaviour for each firm X and Y**

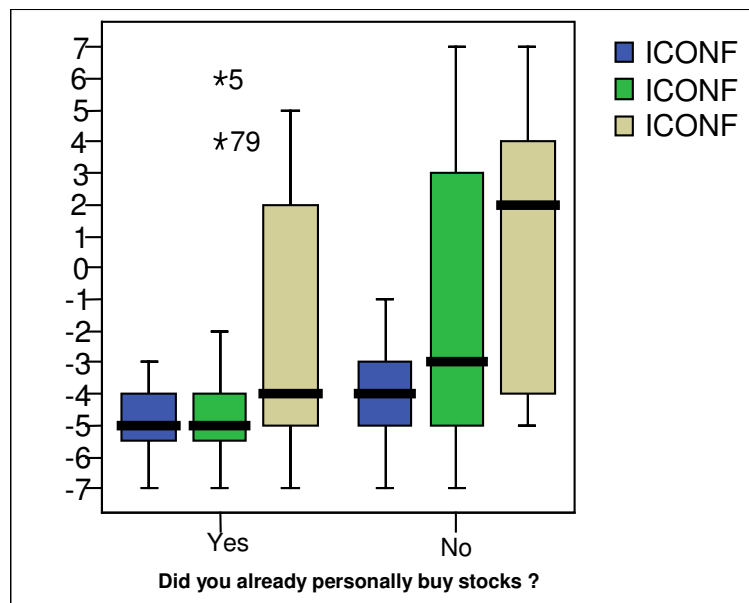


**Figure 6. ICONF variables description**

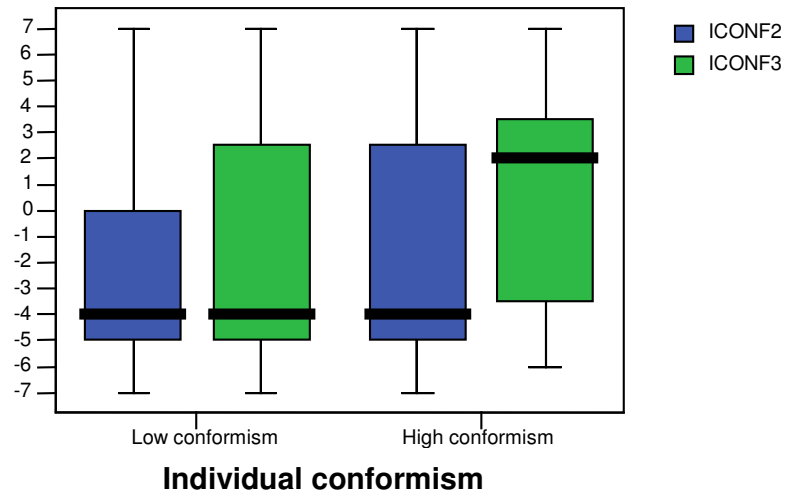




**Figure 7. Frequency of observations for variables ICONF**



**Figure 8. ICONF Variables and stock experience**



**Figure 9. ICONF2, ICONF3 and individual conformism**

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