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INFORMATIONAL CASCADES IN FINANCIAL ECONOMICS: A REVIEW[1]

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The paper surveys and appraises the recent research on informational cascades and herding behaviour in capital markets. Standard models of informational cascades hardly apply to capital markets where all publicly available information is reflected in the price and investment decisions are continuous. The paper briefly describes the situations in which an informational cascade may take place also in the context of financial markets and offers a critical review of both empirical evidence and experimental results.

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A central goal of financial markets is to aggregate information about fundamentals which is asymmetrically disseminated among market participants.

Standard market microstructure models predict that prices ultimately converge to fundamental values. However, the recent literature on herding suggests that the information aggregation may sometimes fail because agents optimally prefer to imitate other agents rather than act on the basis of their own information.

Imitative behaviour has been often connected with irrational agents who blindly adopt the same decision as their predecessors. In the last decades, the literature on social learning has reconciled herd behaviour with rationality.

Payoff externalities and informational externalities are the main sources of rational herding.[3] In most theoretical models both externalities are simultaneously present. An example is given by imitative behaviour due to reputational concerns in a principal-agent framework.

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[3] Brunnermeier (2001).

Herding due to payoffs externalities can arise when the payoffs depend directly on the behaviour of other market participants. Such externalities cause herding of analysts or fund managers in models of reputational herding[4] or herd behaviour of depositors in bank runs.[5]

Informational based herding arises when an agent gains information from observing the actions of previous agents and this externality is so strong that he acts as prior agents regardless of his own private information. Herding due to informational externalities involves a slower social learning, since a large amount of private information remains hidden. An informational cascade, is an extreme example of failure of social learning in which agents' decisions do not convey any information to other market participants. Hence, the occurrence of a cascade leads to a complete information blockage.

Informational cascades typically take place in economic settings where prices are taken to be exogenously given. So, standard cascading models cannot be easily applied to asset markets, where prices adjust continuously to reflect the changing information revealed by orders and trades effected by market participants. One may imagine that this informational role of prices would eliminate the tendency of agents to herd, that is, to trust the quantity signals issued by other agents. But some recent theoretical studies have analyzed mechanisms that may generate informational cascades also in the context of financial markets.

The main purpose of this paper is to provide a critical review of recent theoretical and empirical literature on herding and cascades by traders in financial markets and to suggest issues to be addressed in future research.

The survey is structured as follows. The first section presents a basic model of informational cascades similar to that proposed by Bikhchandani - Hirshleifer - Welch (1992). Moreover, it highlights the difference between the concepts of informational cascade and herd behaviour, and introduces the notion of partial informational cascade.

Section 2 reviews the main studies on cascades in asset markets with sequential trades and informational asymmetries. The most interesting results of this strand of literature are the following. In asset markets, where prices adjust continuously to reflect the information revealed by trades and traders are allowed for continuous investment decisions, an informational cascade rarely occurs. Nevertheless, multidimensional uncertainty and, more generally, non-monotonic signals open the possibility of herd behaviour that may lead to a significant, short-run mispricing of assets. Moreover, information-

[4] Among others, see Scharfstein - Stein (1990).

[5] For example, see Diamond - Dybving (1983).

al cascades may develop in the case of different risk aversion among traders and market makers, when traders care about their reputation for ability, or in the presence of transaction costs.

Sections 3 and 4 briefly describe empirical and experimental research on herding among traders in financial markets.

In particular, Section 3 points out some problems that empirical researchers face when testing informational cascades in capital markets. Overall, the absence of data on private beliefs of market participants, makes difficult to estimate theoretical models and to distinguish between different causes of herding.

In contrast, in a laboratory experiment, it is possible to control for all relevant variables, including traders' private beliefs. This allows to test theoretical predictions of cascading models. Section 4 illustrates the main findings of recent experiments. A key result is that, in tune with theoretical predictions, the flexible price mechanism seems to inhibit traders from herding.

Section 5 concludes.

1. THE BASIC MODEL FOR INFORMATIONAL CASCADES

In this section we describe the simplest model used by Bikhchandani – Hirshleifer - Welch (1992) to introduce the concept of informational cascades. In what follows, we will modify this model to show how the idea of herding due to informational cascades has been applied to capital markets.

Consider a market for an investment project whose liquidation value, V, is either 0 or 1, with ex ante equal probability.

A sequence of risk neutral agents face the choice of whether to invest or not in the project. Each agent privately receives a conditionally independent imperfect signal, $\theta \in \{\theta_l, \theta_h\}$, on the true value of the project. The probability of receiving signal θ_h is $p > 1/2$ if the project value is 1, and $(1-p)$ otherwise. Symmetrically, the signal θ_l is observed with probability p if the project value is 0 , and $(1-p)$ otherwise. We say that agents receiving θ_h are endowed with a good signal whereas agents receiving θ_l are endowed with a bad signal.

Decisions are taken in an exogenous order. Each agent observes his private signal and the past history of actions before making his choice.

The choice of each agent depends on whether his private belief - that is, the expected project value conditional on both public information and agent's private signal - is greater or lower than the investment cost, c.

To simplify the analysis, we assume $p = 2/3$ and $c = 1/2$.

The expected project value is equal to the probability attached to the high liquidation value. Since the initial prior probability of $V = 1$ is $1/2$, by the Bayes rule the private belief of an agent endowed with a good signal is $2/3$, and the private belief of an agent endowed with a bad signal is $1/3$.[6]

Since we assumed $c = 1/2$, the agent who arrives first in the market follows his private information: if he observes θ_h, then he invests; if he observes θ_l, then he rejects the project.

All market participants observe the decision of the first agent and correctly infer his signal. Suppose that they observe an investment decision and, then, infer θ_h. By the Bayes rule, the public belief about the project value - that is, the probability of $V = 1$ conditional on all publicly available information - becomes $\Pr(1|\theta_h) = 2/3$.

If the second agent observes q_h, he invests. Indeed, his private belief is:

$$\Pr(1|\theta_h, \theta_h) = (2/3 * 2/3)/(2/3 * 2/3 + 1/3 * 1/3) = 4/5,^{7}$$

which is greater than the investment cost. If, instead, his signal is q_l, his expected project value equals:

$$\Pr(1|\theta_h, \theta_l) = (2/3 * 1/3)/(2/3 * 1/3 + 1/3 * 2/3) = 1/2.$$

In this case, he is indifferent between the two alternatives. Assume, as a tie-breaking convention, that an agent indifferent between investing and rejecting invests and rejects with equal probability.[8]

If the second agent invests, the market infers that the first agent saw θ_h and the second one is more likely to have seen θ_h than θ_l. Applying the Bayes rule, the public belief after observing a buy in the second round is:

[6] The application of the Bayes rule implies that the probability of $V = 1$, conditional on signal θ, is:

$$\Pr(1|\theta) = \frac{\Pr(1)\Pr(\theta|1)}{\Pr(1)\Pr(\theta|1) + \Pr(0)\Pr(\theta|0)}.$$

where $\Pr(1)$ and $\Pr(0)$ are prior probabilities of $V = 1$ and $V = 0$, and $\Pr(\theta|1)$ and $\Pr(\theta|0)$ are conditional probabilities of θ.

[7] The repeated application of the Bayes rule implies that:

$$\Pr(1|\theta_h, \theta) = \frac{\Pr(1|\theta_h)\Pr(\theta|1)}{\Pr(1|\theta_h)\Pr(\theta|1) + \Pr(0|\theta_h)\Pr(\theta|0)}.$$

[8] This tie-breaking convention is the same as Bikhchandani – Hirshleifer - Welch (1992). Koessler - Ziegelmeyer (2000) show that, in the model of Bikhchandani – Hirshleifer - Welch, by relaxing their tie-breaking convention, there exist other equilibria in which informational cascades are not necessarily observed. More precisely, they consider the *non-confident* tie-breaking rule. Under this new rule, an indifferent agent simply imitates the action of his predecessor.

$$\Pr(1|\theta_h, a\ buy) =$$

$$\frac{\Pr(1|\theta_h)(\Pr(\theta_h|1)+\Pr(\theta_l|1)/2)}{\Pr(1|\theta_h)(\Pr(\theta_h|1)+\Pr(\theta_l|1)/2)+\Pr(0|\theta_h)(\Pr(\theta_h|0)+\Pr(\theta_l|0)/2)} =$$

$$\frac{2/3*(2/3+1/2*1/3)}{2/3*(2/3+1/2*1/3)+1/3*(1/3+1/2*2/3)} = 5/7.$$

If the third agent receives θ_h, another application of the Bayes rule entails that:

$$\Pr(1|\theta_h, a\ buy, \theta_h) = (5/7*2/3)/(5/7*2/3+2/7*1/3) = 5/6 > 1/2.$$

Hence, the third agent invests. But, he invests even if his signal is q_l, since the weight of the public information exceeds the private signal and his belief on the project value is above the cost. Indeed, by the Bayes rule:

$$\Pr(1|\theta_h, a\ buy, \theta_l) = (5/7*1/3)/(5/7*1/3+2/7*2/3) = 5/9 > 1/2.$$

Thus, the third agent always invests regardless of his private information. This implies that his decision is uninformative to others.

The fourth agent faces exactly the same situation as the previous one. Since all signals are drawn independently from the same distribution, he too invests independently of his own information. And so do all later agents arriving in the market.

This blockage of the information is called informational cascade. In the example, a cascade with investment starts in period 3. Similarly, if both first and second agents choose to reject the project, a cascade with no investment begins in period 3. This depends on both the magnitude of the investment cost and on the initial public belief. If, for example, the initial prior probability of the high liquidation value is greater than 1/2, and the first agent observes a good signal and, optimally, chooses to invest, a cascade with investment develops in period 2.

Thus, an informational cascade does not take place only if investing decisions alternate with rejecting ones. The probability that actions alternate consecutively for t periods, is decreasing in t, and converges to 0.

This simple example points out that, in a sequential decision framework with asymmetrically informed agents, when decision makers can observe only the actions of their predecessors (and not their signals), and when the action space is discrete, the choice of early agents may strongly affect the behaviour of all subsequent agents. Moreover, since a large amount of private information remains hidden, the probability that an informational cascade starts in the wrong direction is positive. It is useful to stress that if the signals received by predecessors are observable (instead of the actions taken), an informational cascade never develops. Moreover, later decision makers would have a very accurate information about the project value and would select the correct action.

An important feature of informational cascades is that they are fragile with respect to small shocks. The release of a small amount of new public information, where a small amount of public information refers to a publicly observable signal less informative than private signals, can break an enduring cascade. During a cascade, the information of a few agents influences the behaviour of all other agents. The change in the public belief, thus, needs only to offset the information conveyed by the last agent before the cascade.

Other general features of cascades are idiosyncrasy, in that the actions of the first few agents affect the behaviour of a large number of followers, and path dependence, in that outcomes depend on the order of information arrival. In the previous example, the investment decisions of the first two agents drastically affect the decisions of all subsequent agents, and the type of cascade depends on the order in which signals arrive.

1.1 Informational cascades and herd behaviour

In the literature, the notions of informational cascade and herd behaviour are often considered equivalent, but these two concepts are quite distinct.[9] An informational cascade is said to occur when all agents ignore their private information when choosing an action; whereas a herd takes place when all agents act alike after some period.

In a herd, all agents choose the same action, but some of them may have acted differently if the realization of their private signal had been different. During an informational cascade, agents rationally imitate their predecessors disregarding their private signal since the public belief is so strong that it outweighs any private signal. Thus, a cascade implies a herd but the converse is not always true.[10]

The distinction between cascades and herds is significant. During a cascade the learning process stops definitively, since the behaviour of all agents becomes purely imitative and, hence, uninformative. By contrasts, in a herd, the agents beliefs tend to converge. Thus, similar agents would take similar

[9] Smith - Sorensen (2000) first emphasized the difference between cascades and herd. Celen - Kariv (2004) test experimentally the difference among informational cascades and herding and find that not all observed herds are cascades.

[10] See Chamley (2004b) for a more formal explanation.

decisions and their actions would still provide some information. Clearly, in a long-lasting herd, the amount of social learning becomes extremely small because the probability that the herd is broken is vanishingly small.

Herd always occurs with probability *1*, while cascades develop only in very particular frameworks. In the model described to illustrate informational cascades, we assumed a binary signal space. Bikhchandani - Hirshleifer - Welch (1992) present a model for cascades with a finite set of conditionally independent and identically distributed private signals. Smith - Sorensen (2000) show that the hypothesis of bounded distribution of private signals is essential for the occurrence of informational cascades. The intuition is easy: in a model with identical preferences, binary actions space and two states, the learning process may stop only if the public belief from the history of actions dominates any private signal. This condition can be satisfied only if the distribution of private signals is bounded. In the case of unbounded signal distribution there exists always an agent, with a sufficiently strong signal, who prefers to act according to his private information, for any possible sequence of public signals. Thus, with unbounded distribution of private signals, the public belief eventually converges to the truth.

However, this result does not reduce the relevance of cascading models to explain many financial phenomena. Although cascades arise only under very specific assumptions, they are an useful stylized description of the process of social learning. Indeed, many settings where information arrives too slowly to be helpful, are equivalent, from the point of view of both welfare and predicting behaviour, to a framework where there is a complete information blockage.

Chamley (2003) demonstrates that, when the actions space of agents is discrete and the signals distribution is unbounded, the rate of convergence to the truth is exponentially slower than the rate when private signals are observable. He also illustrates, with a numerical example, how a model with unbounded private signals can generate long regimes where agents herd and sudden changes of the public belief occur.

Finally, Gale (1996) introduces the notion of partial informational cascade, which is a situation where only a subset of informed agents make an identical choice regardless of their private information. When many agents disregard their signal, this information is not revealed and the market accumulates a lot of hidden information. Partial informational cascades can be an useful tool to study financial settings where the learning process goes on, but very slowly.

2. INFORMATIONAL CASCADES IN FINANCIAL MARKETS: CRITICISMS AND APPLICATIONS

Cascades can help to explain many empirical phenomena in financial economics. Welch (1992) develops a cascading model to explain the decisions of IPO (initial public offering) investors.[11] He shows that, if sufficiently many investors underwrite early to receive shares, then all later investors rationally ignore their private information and imitate earlier investors. Corb (2003) models intra-bank panics using the concept of informational cascade and Chen (1999) explains inter-bank panics as the result of herding behaviour due to informational externalities. Finally, both practitioners and financial economists argue that herding may be the rationale for several asset price inefficiencies.[12] For example, the information aggregation failure due to imitative behaviour could be the source of the recurrent high volatility of financial market prices and the cause of many episodes of soaring prices and subsequent collapse.

While economists have made important progresses in developing rational models of herding and cascades, these models include two assumptions that make them difficult to apply to financial markets. Herding disappears from standard cascading models by assuming endogenous pricing or continuous action space. Following Chari - Kehoe (2004) we label these critiques the price critique and the continuous investment critique, respectively. The price critique seems to be especially strong because it suggests that herding should never occur in capital markets where prices are flexible. The investment critique is also relevant because the scale of investments can often be changed easily. Section 2.1 illustrates the relationship between herd behaviour and competitive asset prices. The possibility of herding under continuous investment decisions is the focus of Section 2.2. Finally, last sections discuss extant applications of cascading models to financial markets, emphasizing the different mechanisms through which herd behaviour can arise.

Before proceeding, it is worth mentioning that there exists a relatively large body of literature on herding and cascades that investigates the behaviour of financial analysts and other providers of financial information.[13] An informational cascade among analysts seems to be quite probable, especially because of reputational motives. Moreover, herding in the forecast of analysts may trigger large movements in prices. Therefore, this is a relevant phenomenon that deserves further investigation. However, due to space con-

[11] Offering prices are fixed by regulation in the U.S..

[12] Devenow - Welch (1996).

[13] See, among others, Welch (1992), Lamont (2002), Ottaviani - Sorensen (2006).

straints, we exclude this part of the literature and we concentrate on herding and cascades among traders.

2.1 The price critique

The most relevant critique to the standard herding models is that cascades apply in settings where prices are exogenously fixed. But in asset markets, prices are not fixed; they move every time to reflect all new publicly available information. The instantaneous prices adjustment should prevent informational cascades. As Brunnermeier (2001) remarks, in these frameworks, the decisions of predecessors produce both an *informational externality* as in Bikhchandani – Hirshleifer - Welch (1992), and a *payoff externality*. The informational externality has a positive impact on the expected utility of successors, because it improves their information set. On the contrary, the payoff externality has an opposite sign effect, because changes in prices alter expected profits. In fact, trades also affect the information set of price-makers who adjust prices accordingly. In many situations the latter effect offsets the former, eliminating any incentive to herd.

To show this result, we modify the simple framework formerly considered and present a special case of a simplified version of the Glosten - Milgrom (1985) model.[14]

We assume that the investment opportunity is represented by a financial asset whose value can be low or high. A sequence of imperfectly informed traders exchange the asset with competitive market makers responsible for setting prices.[15] In each period, the asset price is equal to the expected asset value, conditional to the history of orders placed in the previous periods.[16] Hence, the initial asset price is *1/2*. Finally, as in Section 1, we suppose that private signals have a two-thirds chance of indicating the true asset value.

[14] Glosten - Milgrom's sequential trading model offers an excellent microstructure of actions, which is similar to that developed by Bikhchandani - Hirshleifer - Welch (1992).

[15] Glosten - Milgrom (1985) assume two types of investors: profit maximizing informed traders and noise traders who transact for exogenous reasons. The presence of noise traders is needed to guarantee that trading occurs. Indeed, without the presence of traders who trade for reasons other than speculation, the no-trade theorem of Milgrom – Stokey (1982) applies and the market breaks down. For simplicity, in this example we ignore noise traders.

[16] Perfect competition among market makers implies that the equilibrium price reflects all publicly available information. In the Glosten - Milgrom (1985) model, the ask price is the market maker's expected asset value conditional on an arriving buy order and the bid price is his expected asset value conditional on an arriving sell order. To simplify the exposition, we do not take into account here the information contents of incoming orders and, then, ignore the bid-ask spread.

As in the previous example, the trader who arrives first in the market follows his private information. Suppose he receives a good signal and buys. All market participants infer θ_h and update their beliefs. Thus, the asset price in the second period is equal to *2/3*, as can be verified by the Bayes rule.

If the second trader also receives a good signal, then he follows his private information and buys the asset, since his expected asset value is 4/5 and exceeds the asset price. If he receives a bad signal, then he follows his private information and sells the asset, since his expected asset value is 1/2 and is below the asset price. Therefore, the second action also reveals that trader's private signal. The market maker updates the price to incorporate the new public information.

As in past periods, the beliefs of traders observing the bad and the good signals straddle the quoted price. Then, the third trader in the sequence follows his private information. All subsequent traders face a similar situations and act according to their private signals. Thus, an informational cascade never arises.

In this simple example we considered the case of binary signals. Avery - Zemsky (1998) show that an informational cascade never takes place when prices adjust to reflect available information.

Moreover, Avery - Zemsky (1998) differentiate between an informational cascade and herding. As usual, an informational cascade is defined as a situation where all traders act ignoring their private information. Instead, the definition of herding that they use differs from the standard definition used in the literature. An informed trader is said to herd if, as a result of observing the actions of others, he makes a different choice from the one that he would make initially. More precisely, a trader engages in herd buying (selling) if, before the start of trade, he is inclined to sell (buy) the asset and, after observing a sequence of buying (selling), he prefers to buy (sell). Thus, herding in their framework is any history-induced change of actions in the direction of the crowd.[17] Notice that, during an informational cascade, all informed traders act alike.

Avery - Zemsky (1998) argue that if private signals are monotonic, herd behaviour never arises in an asset market *á la* Glosten - Milgrom (1985). However, this last result strongly depends on the non-standard definition of monotonic signals the authors adopt.[18]

[17] The standard definition of herding does not make any hypothesis about the history of actions.

[18] Avery - Zemsky (1998) define a signal q monotonic if there exists a function $v(q\ )$ such that the expected asset value for a trader observing q is always (weakly) between $v(q\ )$ and the common knowledge expected asset value, for all histories. This notion entails that, for all trading histories, monotonic signals always shift the conditional expectation of informed traders towards some fixed valuation, $v(q\ )$.

Park - Sabourian (2006) consider a more standard signal monotonicity requirement in the Glosten - Milgrom (1985) setting. They prove that signals satisfying the monotone likelihood ratio property[19] may generate herd behaviour if i) the proportion of informed traders is not too large, ii) there are more than two possible asset liquidation values, and iii) private signals can be either strong or weak.[20]

To illustrate the intuition behind this result we modify the example formerly described by assuming i) three possible asset values: low, intermediate and high, and ii) three types of signals: strong bad, weak and strong good.[21] We also assume that the conditional distribution of the weak signal is U-shaped in asset values.[22]

Traders observing a U-shaped weak signal could prefer to sell when prices are low and to buy as prices increase sufficiently.[23] Indeed, they believe more in extreme than in moderate asset values. When revising their belief, traders with the weak signal discount the possibility of the intermediate asset value and update the probabilities of either extreme asset values faster than uninformed market participants. So, even if their prior is quite pessimistic, after a large number of buys, they update their belief and put more weight on the highest asset value with respect to the market maker. Thus, these traders are quite volatile in their actions, switching from selling to buying and back.

Monotone likelihood ratio property implies that both the strong bad and good signals have a monotone conditional distribution in values. As a consequence, traders observing the most accurate signals always act according to their private information. Then, the learning process does not stop during a herding and an informational cascade never occurs.

Interestingly, during a herd the price volatility is substantially high. The impact of orders on prices is larger when herding occurs relative to a situation in which traders disregard public information and herding does not occur. This result is somewhat surprising because it contrasts with the wide-

[19] Let V be the set of all potential liquidation values of the asset. The monotone likelihood ratio property states that, for any signals q_1 and q_2, such that $q_1 < q_2$, and any value V in V, $Pr(q_2|V)/Pr(q_1|V)$ is increasing in V.

[20] The attributes strong and weak refer to the precision of private signals.

[21] The expected asset value of traders who receive the weak signal is always between the expectation of traders receiving the strong bad signal and that of traders receiving the strong good signal.

[22] A signal has a U-shaped conditional distribution in values if both extreme asset values generate this signal with larger probability.

[23] Traders could optimally choose to buy when prices are low and to sell when prices are high if their signal distribution is hill-shaped.

spread belief that modest information is revealed during a herd. In the asset market described by Park - Sabourian (2006) herding is informationally significant because of the U-shape of the herders' signal distributions. Therefore, this simple setting may be useful to explain large mispricing and financial crashes.

2.2 The continuous investment critique

In the model illustrated in Section 1, informational cascades arise because of the discrete actions space.[24]

Lee (1993) shows that the hypothesis of discrete actions space is fundamental for the occurrence of cascades in Bikhchandani – Hirshleifer - Welch (1992) setting. A discrete actions space negatively affects the social communication for two reasons. First, a finite set of actions strongly reduces the capability of decision makers to reveal their private information, especially when public information is very strong with respect to private signals. Second, the discreteness hinders decision makers from fully using their private information. As a consequence, the likelihood of a wrong cascade increases as the action space shrink.

In Banerjee (1992), informational cascades - termed herd in the paper - develop despite the continuum action space.[25] More precisely, an informational cascade takes place because the actions of agents are not a sufficient statistic for private information. Indeed the actions space, even if continuous, is one-dimensional, while the uncertainty, in the paper, is two-dimensional.

However, the assumptions on the distribution of wrong signals[26] and on the tie-breaking rule[27] are essential for the occurrence of informational cascades. Therefore, it is difficult to study the robustness of cascades and their general properties in the setting developed by Banerjee.

[24] To simplify, we assumed two actions, but all the results could be generalized to any finite set of actions.

[25] Another interesting example where cascades occur although a continuous action space is illustrated by Chari - Kehoe (2004). In their model, a cascade takes place because the action space has a lower bound of zero, given by the (discrete) option to reject a new project.

[26] A fraction of investors privately receive a signal about the asset with positive return. With positive probability the signal is false. In this case, it is uniformly distributed on the continuum. This implies that the probability that two agents receive the same wrong signal is equal to zero.

[27] When agents are indifferent between two or more actions, they follow their private signal, if informed; they refrain from investing, otherwise.

2.3 Herd behaviour with multidimensional uncertainty

In the previous section we argued that in a sequential trading model *á la* Glosten - Milgrom (1985), a cascade never occurs because prices move in the same direction as private beliefs. Furthermore, in a two-states world, the competitive price mechanism also prevents traders from imitating their predecessors.

However, the price is a single-dimensional instrument and it only allows to learn about one dimension of uncertainty at time. Therefore, if there are multiple sources of uncertainty, herd could arise even in the Glosten - Milgrom framework.

Avery - Zemsky (1998) find that multidimensional uncertainty can lead traders and the market maker to a different interpretation of the history and it may produce herd behaviour in the short-run. In any case, multidimensional uncertainty does not prevent beliefs to converge to the true asset value in the long-run.[28]

To obtain herding behaviour, Avery - Zemsky (1998) add to the uncertainty about the liquidation asset value, the *event uncertainty*. In the framework described by Glosten - Milgrom (1985), an information event is assumed to have occurred. Avery - Zemsky (1998), following Easley - O'Hara (1987), consider a market in which an information event may occur with positive probability $a < 1$.

More precisely, they assume that, if no information arrives, the liquidation asset value is $1/2$. Otherwise, some traders privately receive an imperfect signal on the liquidation asset value, which can be either 0 or 1. Besides, all traders know whether an information event has occurred, while the market maker does not. This is the second dimension of uncertainty.[29]

As the market maker does not know whether an information event has occurred, he learns less than informed traders from the sequence of orders and adjusts prices slowly.[30] If the price movement is sufficiently slow, the payoff externality induced by past trades is negligible, and informed traders may optimally choose to imitate their predecessors, regardless of their own

[28] The impact of multidimensional uncertainty on social learning in asset markets has been also analyzed by Gervais (1996). In contrast to Avery - Zemsky (1998), Gervais (1996) finds that the learning process about the signals precision can definitively stop with positive probability. However, even though interesting, this result is not robust. Indeed, the occurrence of a cascade strongly depends on the atypical assumptions of the model.

[29] The information structure that Avery - Zemsky (1998) consider makes signals nonmonotonic.

[30] The model of Bikhchandan – Hirshleifer - Welch (1992) can be considered as the limit case in which prices are constant.

private information. During the herding, the market maker collects new information about the occurrence of an information event. As a consequence, with such an information structure a cascade never starts.

It is useful to underline that, since herding takes place when prices adjust slowly, event uncertainty cannot lead to a price bubble or to a market crash.

In order to reproduce bubbles and crashes, Avery - Zemsky (1998) add to their framework another source of uncertainty: the *composition uncertainty*, which is related to the accuracy of the information dispersed among market participants.

In the new framework, some traders observe an imperfect signal, whereas other traders know for certain the true asset value. The fraction of traders observing an imperfect signal can be either low or high. In the first case the market is said to be well-informed, in the second case it is said to be poorly-informed. No market participant knows the fraction of perfectly informed traders for sure.

The authors investigate the combination of event uncertainty and composition uncertainty, by means of a simulation, and show that traders may herd for an extended length of time and a sudden price change may occur.

To obtain this result, they consider a market with an extreme information event (low a) and high probability of well-informed market.

In the simulation, Avery - Zemsky (1998) consider the case where a sequence of buy orders takes place. Since the market maker does not know whether an information event has occurred and a is low, the asset price does not move significantly.

After a few periods, traders observing a low precision signal choose to buy regardless of their private information, since their expectation exceeds the ask price. After a while, the market maker understands that all these buys are more likely after an information event. The price suddenly jumps to near *1* since a well-informed market with high asset value is more likely. At this point, all imperfectly informed traders stop buying because the asset price is too high. If the market is poorly informed, the trading volume reduces significantly.

At some point, the market maker understands that the market cannot be well-informed since the trading volume is too low. Consequently, the asset price suddenly collapses to near 1/2. Avery - Zemsky (1998) define this sequence of events a bubble.

The price path described by Avery - Zemsky (1998) is very impressive. Nevertheless, as stressed by Chamley (2004b), the empirical relevance of their results is not completely convincing. Indeed, a price bubble develops only if an unlikely state of nature occurs and a specific sequence of traders arrive in the market.

2.4 Risk aversion and informational efficiency

In the standard Glosten - Milgrom (1985) setting, both informed traders and market makers are assumed to be risk neutral. Decamps - Lovo (2006a) relax this hypothesis, by assuming risk averse informed traders. They find that differences in the risk aversion between market makers and traders can induce history dependent behaviour and long run mispricing, in asset markets where the regulation prescribes a minimum size of trade per period.

More precisely, Decamps - Lovo (2006a) analyze a sequential trading model similar to Glosten - Milgron (1985). The peculiarity of their framework is that informed traders are risk averse[31] and, before transacting, receive an initial endowment of risky asset and money. Moreover, traders can transact any discrete quantity of the asset.

When market makers and traders differ in their risk aversion, the same information affects market makers' prices and traders' valuations differently. Indeed, the risk aversion hypothesis has a significant effect on the trading motivations of traders. In the Glosten - Milgrom (1985) framework, risk neutral informed traders only transact exploiting their informational advantage. By assuming risk aversion, Decamps - Lovo (2006a) add to the trading motivations of traders the inventory component, which reflects the traders preference for low-risk-portfolio.

As the public belief gets concentrated in the extreme tails of the asset value distribution, the information component of traders decisions reduces. Thus, if the initial portfolio exposure to risk of traders is significant, because of the discreet action space, transactions only reflect their inventory unbalance. At this point, trades stop providing information on the asset value and a cascade develops.[32]

The analysis developed by Decamps - Lovo (2006a) yields intriguing theoretical results, in that it shows that herding can occur even in the absence of multidimensional uncertainty. However, the empirical predictions about informational cascades in asset markets seem to be quite weak. The occurrence of an informational cascade strongly depends on the exogenous distribution of the traders portfolio composition and on the discreetness of the investment decisions. Moreover, in the presence of informed traders with zero initial endowment of the risky asset, the learning process should never stop and the market should be strong-form efficient in the long run.

[31] Whereas the market maker is risk neutral.

[32] Decamps - Lovo (2006b) show that informational cascades and long term mispricing can also occur when traders are risk neutral and market makers are risk averse. Moreover, analogous results have been founded by Cipriani - Guarino (2001).

2.5 Informational cascades and transaction costs

Market microstructure is mainly about the effect of trading frictions on price formation, so it is natural to ask whether such frictions are more conducive to informational cascades.

Lee (1998) shows that trading frictions in price formation may induce informational cascades as they deter informed traders from trading.

The setting analyzed by Lee (1998) differs from the previous ones in many aspects. A sequence of risk averse informed traders exchange a risky asset with a risk neutral market maker, who is responsible for quoting the price, over T trading rounds. In each trading round a new trader enters the market. In contrast to the previous models, traders can decide when to trade, and can transact several times. The first time a trader transacts he bears a fixed cost.

Traders have zero initial risky asset holding. Then, when entering the market, they only transact to exploit their private information. Since the action space is continuous, the first transaction fully discloses traders' private signals. Hence, after the first trading order, the informational advantage disappears and traders, who are risk averse, prefer to get perfect insurance at a price who reflects their private information.

Each trader places his first order when the expected profit from trading exceeds the fixed transaction cost. A trader's expected profit depends on the precision of his private information and decreases as the public information grows more precise. Therefore, since the transaction cost is fixed, an informational cascade develops as the public belief becomes sufficiently accurate, despite of the continuous action space. Moreover, traders with middle informational advantage refrain from trading in advance with respect to traders with strong signals.

During a partial informational cascade, the trading volume is low and the market accumulates a lot of hidden information. The author argues that this failure of information aggregation can help to explain the empirical evidence that prices raise before a market crash and stay low for a significant time after the crash.[33] Indeed, if a partial cascade starts in a bullish market,

[33] Recently, two interesting theoretical papers, in order to explain high asset prices volatility, have proposed models where market imperfections lead to an incomplete information aggregation. Romer (1993) shows that informed investors delay their transactions when immediacy in trading is costly. So, prices can adjust long after an information event. Cao – Coval - Hirshleifer (2002) shows how transaction costs may induce some investors with superior information to be sidelined. This leads to path dependent skewness of price changes.

low-precision signals are indistinguishable and the price remains high for a substantial length of time.

A trader with a strong signal may shatter the partial cascade, by placing an order which disagree with the asset value supporting the cascade. If such an order is observed, all the traders entered the market without trading, simultaneously choose to trade and all the hidden information accumulated during the partial cascade is revealed.[34] In the hypothesis that the true asset value is low, traders with weak bad signals, who are more numerous, sell the asset and the price collapses dramatically.

Even though Lee's model aims to explain financial crises, it does not present a specific bias for a crash: the same mechanism can generate both a crash and a boom.

The main criticisms are related to the price mechanism. The market maker, by setting the asset price, ignores the implication of current trades for the information and cannot adjust the price within the trading round even when his belief changes because of trading orders. Those assumptions, implausible in asset markets, are crucial for the occurrence of informational avalanches. The large trading volume characterizing avalanches would probably not occur with a fully rational market maker.

Romano (2007) introduces, in the standard Glosten - Milgrom (1985) setting, the assumption that the competitive market makers have to pay an exogenous cost to execute each trading order. The analysis shows that fixed transaction costs lead to an informational cascade, despite the competitive price mechanism.

Romano (2007) also shows that, in the case of proportional - rather than fixed - transaction costs, if the liquidation asset value in the bad state of nature is sufficiently low, an informational cascade may develop only when prices are particularly high. The reason is that when the asset price is low, the cost of trading is arbitrarily close to zero. Therefore, the potential gain from buying the asset for a trader observing a good signal, albeit small, is always greater than the negligible trading cost. This implies that cascades tend to be asymmetric: they are likely in bull markets and rare in depressed ones. By the same token, informational cascades are more prone to result in crashes than in frenzies.

2.6 Informational cascades due to reputational concerns

Scharfstein - Stein (1990) present a principal-agent model where reputational concerns of fund managers can generate herd behaviour. In the pres-

[34] Lee (1998) defines this situation *informational avalanche*.

ence of uncertainty about the ability of fund managers to anticipate the investment liquidation value, their reputation plays a crucial role. In particular, if the managers remuneration depends only on the confidence of the principal about their ability, managers may optimally choose to ignore their private information and imitate decisions of previous managers.

As in the model of Bikhchandani - Hirshleifer - Welch (1992), Scharfstein - Stein (1990) assume that the cost of the investment is fixed. Dasgupta - Prat (2008) introduce reputational concerns of informed traders in a sequential trading model *á la* Glosten - Milgrom (1985) where prices are endogenously determined.

In their paper informed traders are fund managers who trade on behalf of other agents. They can be of two types: smart or dumb. The precision of their signal depends on their unknown type. The fund managers remuneration depends not only on the trading profits, but also on their reputation.

Dasgupta - Prat (2008) show that, in the equilibrium, the expected reputational component of the remuneration reduces when the manager chooses the opposite option with respect to his predecessor.

As the uncertainty about the true asset value decreases and the price becomes sufficiently precise, trading profits shrink and fund managers ignore their private information, acting in a conformist way, because of reputational concerns. Thus, financial markets may be informationally inefficient even in the long run, because of herd behaviour of market professionals.[35]

Dasgupta - Prat - Verardo (2008) extend the analysis by Dasgupta - Prat (2008) to a setting where a monopolistic dealer trades with career-concerned fund managers and profit-motivated proprietary traders. Both fund managers and proprietary traders are, on average, better informed about the asset liquidation value than the dealer.

Dasgupta - Prat - Verardo (2008) show that fund managers behave in a conformist way, while proprietary traders behave as contrarian. Moreover, assets persistently bought (sold) by fund managers trade at too high (low) prices, producing return-reversals in the long-term, when the uncertainty vanishes.

To give an intuition for these results, suppose that most traders have bought the asset in the recent past, indicating the high liquidation value.

[35] Alevy – Haigh - List (2007) analyze the behaviour of market professionals in a controlled experimental context. They report that professionals' behaviour is consistent with herding, although professionals are more able than students to infer public information and to use their private signal. As a consequence, professionals are involved less frequently in cascades. Welch (2000) analyzes 302 thousand recommendations issued by 226 security analysts in the period 1989 - 1994. He finds that the recommendation of each analyst is affected by the recommendations of the previous two analysts.

A manager with a bad signal would prefer to refrain from trading due to the tension between his private information - which suggests him to sell the asset - and his reputational concerns - which induces him to follow other traders. Thus, only a proprietary trader with a bad signal would choose to sell the asset at the fair price.

On the other hand, a fund manager with a good signal would buy the asset at a price above the fair price because of the reputational reward. The monopolistic dealer takes advantage of this manager's reputational motivation and quotes an ask price larger than the expected liquidation value. As a consequence, a proprietary trader with a good signal would choose not to buy the asset at the equilibrium price.

Hence, in equilibrium, proprietary traders are contrarian while fund managers are conformist, and such conformism has a first-order impact on the prices of assets that fund managers trade.

Thus, Dasgupta - Prat - Verardo (2008) provide a theoretical framework able to explain empirical literature on the price impact of institutional herding. It would be interesting to verify whether their results are robust to the more realistic assumption of imperfectly competitive dealers.

2.7 Endogenous timing of decisions

A typical assumption of cascading models is that agents choose sequentially, with subsequent agents observing actions, and not information, of their predecessors. The basic informational cascades setting focuses on the assumption of exogenous sequencing of decisions. Yet, cascades are robust to the relaxation of this assumption.

In a dynamic game with asymmetric information, waiting allows agents to take advantage of the information revealed by others. Hence, in a setting where delay is costless and agents can choose the timing of their decision, everybody would prefer to decide last. Since someone has to decide first, individuals compete for the best place in the decision-making queue.

Strategic delay due to informational externalities has been analyzed by Chamley - Gale (1994).[36] They study a strategic model of investment in which some agents privately receive a real option with fixed exercise price and risky payoff. The value of the underlying asset is increasing in the number of real options. Agents who exercise the option make known that they received an investment opportunity. This positive externality allows successors to gain information about the true asset value. Delay in the investment decision is costly.

[36] Chamley (2004a) extends the analysis to any distribution of private signals.

Chamley - Gale (1994) show that, if beliefs about the expected value of the underlying asset are sufficiently pessimistic, the investment cost exceeds the expected payoff and, then, no agent exercises the option in the first period. Since no information is revealed in the absence of investment, the situation does not change in the second period, and so on in all following periods. Therefore, if no one invests in a period, the investment stops forever. On the other hand, if beliefs are sufficiently optimistic, all agents exercise the option in the first period. Finally, for intermediate beliefs, agents randomize between investing in first period and delaying the investment. Then, no investment in first period is a possible outcome.

The delay in the investment produces inefficient aggregation of information which may result either in a collapse of investment or in an investment surge.

An investment surge can occur, in equilibrium, only if it is socially optimal. This is not true in the case of a collapse of investment.

Interestingly, the probability of a collapse depends on the speed at which agents can react to the information inferred from past actions: it increases as the period length reduces.

3. Empirical evidence of herding in financial markets

Although recent theoretical literature has emphasized many different mechanisms ensuring the potential occurrence of herding in financial markets, most of empirical research does not test extant models of herd behaviour directly. Rather, the approaches generally adopted to detect the occurrence of herding in financial markets are based on statistical measures of clustering.[37]

Lakonishok - Shleifer - Vishny (1992) define a statistical measure of herding evaluating the propensity of a specific group of traders to buy or sell the same stocks. This measure, adopted by several works, has been criticized in the literature especially because, while herding implies correlation in trading patters, the reverse need not be true.

Lakonishok - Shleifer - Vishny (1992) analyze the portfolios of pension funds between 1985 and 1989 and find little evidence of herding in their sample. Moreover, they document a larger tendency to herd in smaller stocks. Similarly, Grinblatt – Titman - Wermers (1995), using the Lakonishok - Shleifer - Vishny (1992) measure, study the portfolios of mutual funds from 1974 to 1984 and report only weak evidence of herding.

[37]Bikhchandani - Sharma (2001) provide a critical review of statistical measures of herding.

The occurrence of herding may be understated in both works because they consider groups of traders too large and heterogeneous. Indeed, by market clearing, it is unfeasible that all traders are buyers or sellers at the same time. Grinblatt – Titman - Wermers (1995) attempt to alleviate this problem by separating fund managers according to their investment strategies. By considering smaller and more homogeneous groups of traders, they find strongest evidence of herding, mainly among aggressive growth, growth, and income funds.

Wermers (1999) investigates the tendency to herd for all mutual funds between 1975 and 1995. By using the approach proposed by Lakonishok - Shleifer - Vishny (1992), he reports weak propensity to herd in the average stock, even if he finds significant herding in sale of small stocks.

A further problem associated to the Lakonishok - Shleifer - Vishny (1992) approach is that it only considers the number of traders on the two sides of the market, without taking into account the amount of stock traded. As a consequence, it does not allow to evaluate the intensity of herding in a specific stock.

Wermers (1999) suggests a new measure of herding, the portfolio-change measure, which allows to evaluate the intensity of herding. This statistic relies on changes in weights of stocks in managers' portfolios. Wermers (1999), using the portfolio-change measure, finds a significant evidence of herding from 1975 to 1995.

In the last years, numerous other approaches based on statistical measures have been proposed in the empirical literature. However, all these measures cannot distinguish spurious herding, due to external factors which independently influence the behaviour of a group of traders, from herding due to the decision of traders to ignore their private information and to imitate their predecessors. A compelling challenge to future empirical research is to evaluate the importance of herding in asset markets on the basis of microeconomic theories of herd behaviour.[38]

4. EXPERIMENTAL ANALYSIS OF HERDING IN FINANCIAL MARKETS

As we briefly mentioned in the previous section, a serious limit of the empirical analysis is the absence of data on the information that traders privately observe. This problem yields two relevant consequences. First, it

[38]Cipriani - Gale - Guarino (2006) propose a new interesting methodology to investigate herd behaviour in asset markets. However, to our knowledge, their project is at a preliminary stage.

makes difficult to assess whether observed herding is driven by an informational externality. Second, it does not allow to examine or test directly a theoretical model of herd behaviour. Experimental analysis overcomes these problems since, in a laboratory market, we observe all relevant variables not available for actual markets. In particular, by knowing the information set of each subject, we are able to analyze the influence of private signals on trades.

Anderson - Holt (1997) conducted a seminal experimental analysis of cascades development.

The theoretical setup they implement is similar to the example described in Section 1. They consider a model characterized by two states of nature, A and B, with ex ante equal probability. Each of a set of agents privately receives an independent signal, *a* or *b*, which indicates the true state of nature with probability *2/3*. After observing the signal, each agent is asked to predict the true state of nature. If the prediction is correct he receives a monetary reward. Predictions are made in an exogenously determined order. Agents observe predictions - but not private signals - of their predecessors. As illustrated in Section 1, agents decisions become uninformative whenever the number of public predictions of one type exceeds the other by two or more.

To implement this setup, Anderson - Holt (1997) utilized two urn types, A and B. Urn A contained two balls labelled *a* and one ball labelled *b*; Urn B contained two balls labelled *b* and one ball labelled *a*. The urns had equal probability to be used for the draws. Each type of ball had ex ante equal probability to be drawn. The probability of drawing a ball labelled *a* from urn A was 2/3. Symmetrically, the probability of drawing a ball labelled *b* from urn B was 2/3. In sequence, subjects announced their prediction about the urn used for the draws. Any subject observed decisions of prior participants before he decided. Everyone who predicted the right urn received a monetary payment; others received nothing.

The authors report that cascades were possible in the experiment in roughly sixty percent of the rounds, and actually developed in about seventy percent of the rounds in which they were possible.

Following Anderson - Holt (1997), there is by now a large experimental literature on herding and informational cascades.[39] In particular, Allsopp - Hey (2000) ran a laboratory experiment to test the occurrence of informational cascades in a theoretical setting *á la* Banerjee (1992), where only one

[39] See, for example, Noth - Weber (2003), Kubler - Weizsacker (2004), Kramer - Noth - Weber (2006), Hung - Plott (2001), Huck - Oechssler (2000).

of a set of assets has positive return. They find significant herding, even if the frequency of cascades in the experiment was lower than in the theoretical model.

Most of the experimental research on herd behaviour tests predictions of theoretical models in fixed-price environments. Drehmann – Oechssler - Roiderc (2005), and Cipriani - Guarino (2005) test experimentally herd behaviour in asset markets with flexible prices. The most important issue is that in both experiments the competitive price mechanism significantly reduces the occurrence of informational cascades. While this evidence is in line with the theory,[40] other experimental results seem to contradict some theoretical predictions of the Avery - Zemsky (1998) model. In particular, in contrast to theory, Drehmann – Oechssler - Roiderc (2005) find that subjects frequently act against the market and their private information, whereas Cipriani - Guarino (2005) report that subjects often disregard their private information and, in some cases, choose not to trade, while, in other cases, trade against the market.

In the experiment conducted by Drehmann – Oechssler - Roiderc (2005), a sequence of subjects had to choose between two assets labelled, respectively, A and B. Only one asset had positive payoff, while the other was worth zero. Subjects privately received an imperfect signal about the successful asset. The prices of the two assets reflected all publicly available information. The behaviour observed in the laboratory supports predictions of the theoretical models: the presence of a flexible market price prevents herding. In many cases, however, subjects decided to buy asset B when the price of asset A was high, even if their own private signal and past trades supported asset A, and vice versa. To explain this behaviour, the authors argue that subjects could have doubts about the rationality of others and, then, mistrust their choices. Drehmann - Oechssler - Roiderc (2005) describe a model which explicitly considers the possibility of mistakes and is able to partly explain the observed contrarian behaviour.

In the experiment implemented by Cipriani - Guarino (2005), subjects could buy or sell a risky asset, or refrain from trading. In tune with theoretical predictions, in the laboratory market informational cascades actually developed when prices were fixed, but not in the setup with flexible prices. However, subjects frequently decided to refrain from trading or to trade against the market, ignoring their private information. This reduced the capability of the price to aggregate private information. This result suggests

[40] Both papers test herding in a setting where both the signals space and the possible states of the world are binary. Drehmann is currently preparing a project to test experimentally the more complex theoretical setup proposed by Park – Sabourian (2006).

that the informational inefficiency of asset markets may be partially explained by the limited market participation of informed traders.

In a recent working paper, Cipriani - Guarino (2005) run an experiment similar to Cipriani - Guarino (2005), but with fixed transaction costs. In the paper they develop a sequential trading model *á la* Glosten - Milgrom (1985) where individuals have to pay a fixed cost to trade. The main theoretical prediction is that transaction costs led to informational cascades in which all traders refrain from trading, regardless of their private signal. This prediction tended to describe observed behaviour although, in the experiment, the transaction cost did not affect, in a significant way, the capability of the price to reflect all publicly available information.

Finally, it is interesting to mention the analysis proposed by Alevy - Haigh - List (2007). Most of the experimental studies of herding use subject pools of students. Yet, professional behaviour in the field may differ from student behaviour in laboratory experiments.[41] Alevy - Haigh - List (2007) conducted an experiment by using a subject pool of financial markets professionals. To ensure comparability of their results to the extant literature, they use experiment protocols similar to Anderson and Holt (1997). They find that, on average, the frequency of cascades is not significantly different for market professionals and students, although market professionals engage more rarely in incorrect cascades. A possible explanation for this result could be that market professionals infer the precision of signals observed by their predecessors better than students. Finally, the experiment reveals that the choices of market professionals are unaffected by the gain and loss domains, while students behave according to the concept of loss aversion.

In conclusion, we can observe that the results of experimental works on herd behaviour reduce the severity of price misalignment due to informational cascades and point out that, to explain imitative behaviour of traders in asset markets, we should also focus on other mechanisms, such as reputation or payoff externalities.

5. Concluding remarks

We presented a review of recent theoretical and empirical papers on herding behaviour and informational cascades in capital markets.

To begin with, we have shown that if prices adjust continuously to incorporate all available information or if investment decisions are continu-

[41] An important debate exists about the significance of experimental evidence from student subjects for studying phenomena in the field (see Harrison – List (2004), Locke - Mann (2005) and Bikhchandani

ous, then herds tend to disappear and prices are strong-form efficient in the long run. However, several interesting models of rational herding suggest that, in many situations, even if prices are flexible, traders are likely to disregard their private information and act alike. On the contrary, there are only a few papers studying factors able to generate informational cascades in financial markets with continuous investment. To investigate this aspect is an important task for future theoretical research.

In the second part of the paper, we have briefly described empirical evidence of herding in capital markets. We have stressed that empirical analysis does not estimate theoretical models, but tests herding indirectly by means of statistical measures of clustering of investment decisions. As a consequence, there is a lack of a direct link between the theoretical discussion of herding behaviour and the empirical specifications used to test for herding .[42]

Thus, the foremost challenge to the empirical literature seems to be the evaluation of theoretical models of herding, by using field data. One possible method of addressing this could be the strategy suggested by Cipriani - Gale - Guarino (2006). They adopt the methodological approach proposed by Easley, Kiefer and O'Hara (1997), and use transaction data to estimate the parameters of the Avery - Zemsky (1998) model with maximum likelihood.

A further important step in this direction is to empirically disentangle the different effects which induce traders to herd, such as reputational concerns, informational effects, payoff externalities, and imperfect rationality. This should allow also to test whether the predictions about spreads, trading volume, prices volatility, and propensity for crashes of different theoretical models are correct.

Finally, existing measures of herding need to be improved to allow to differentiate between herding due to informational externalities and spurious herding due to common reactions to changes in fundamentals.

In the last part of the paper we have illustrated recent findings of experimental analysis on informational herding. The main result of this literature is that, in accordance with theoretical predictions, market prices reduce the incidence of informational cascades. This result suggests that imitative behaviour due to informational externalities should not be a concern in capital markets. Therefore, an important direction for future research is to examine whether herding in actual markets is driven by factors other than purely information driven ones.

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[42] Bikhchandani - Sharma (2001).

To conclude, we have described the experiment conducted by Alevy - Haigh - List (2007), who investigate the behaviour of a pool of market professionals (rather than students) in a laboratory environment. The aim of their analysis is to evaluate whether the behaviour observed in a laboratory market is representative of behaviour in the actual capital market. To this purpose, it would be interesting to explore whether the other dimensions of the laboratory environment -such as the abstract task, the stakes, the good, and the institution- can lead to differences in behaviour.

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