

Does the preopening period facilitate price discovery? An experimental investigation

Research proposal submitted to the Europlace Institute of Finance

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Abstract

Price discovery at the opening of the market is a delicate and crucial time in the trading day. To facilitate price discovery at the opening, several exchanges have introduced a preopening period. Indicative prices formed during this period could facilitate price discovery by helping investors figuring out the new equilibrium and determining their optimal strategies. On the other hand, since there are no actual trades until the opening of the market, investors could be tempted to manipulate prices.

To test these hypotheses, we will run several experimental financial markets under two treatments: In the first treatment, the price is set in a call auction. In the second treatment, there is a preopening period before the call auction. Comparing the informational efficiency of prices and the convergence of order placement strategies to equilibrium in these treatments will shed light on whether the preopening period is useful for price discovery.

To obtain clear-cut predictions, we will design the experiment so that the Milgrom and Stokey (1982) theorem applies: investors start the game with private signals, and cash endowments but no endowment in risky asset, thus the risky asset is in zero supply. Of course we will allow short sales, so that trades will be possible. However, in this context, the initial allocation is Pareto optimal. Hence the Milgrom and Stokey (1982) theorem implies there should be no trades, except possibly at fully revealing prices. Thus, in equilibrium no investors should incur losses. This suggests a simple metric to quantify how far the data is from equilibrium: the total amount of losses in the marketplace.

The project will shed light on the role of the preopening in price discovery. This is an important issue for exchanges, ECNs and financial institutions which could take a preopening approach in other contexts, such as IPO, auctions to sell bonds or other products, or energy markets. The project will also be a step in the development of an expertise in experimental finance in France. While this field is quite developed in the US, and a very dynamic research area, it is less prevalent in France, in part due to the fact that the experimental methodology can be rather heavy and demanding.

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1) Research objectives and literature review

1.1 Research objectives

Price discovery at the opening of the market is a delicate and yet crucial time in the trading day. Market participants need to take into account the flow of orders since the previous day, the evolution of valuations in other markets, such as New York or Tokyo, and the strategic and tactical information generated by their analysts. Investors thus need to adjust their demand to the new state of the market, and figure out the new equilibrium. Later in the day they will be able to rely on recent prices and trades as well as on the limit order book, but at the opening it is impractical to rely on such reference points. Reflecting the difficulty of price discovery at the opening of the market, empirical microstructure research has shown that opening prices are particularly noisy (see e.g., Amihud and Mendelson, 1987 and 1991).

To cope with these difficulties and facilitate price discovery at the opening of the market, several exchanges have introduced a preopening period. For example, on Euronext, during 90 minutes before the opening, indicative prices, crossing supply and demand are displayed in continuous time. While these prices reflect what the market clearing price would be if the market were to open at this point in time, they are not actual transaction prices. Until the opening of the market, investors can observe these prices and place new orders or cancel or modify previous orders. This rich flow of information could facilitate price discovery by helping investors to figure out the new equilibrium and determining their optimal strategies. On the other hand, since there are no actual trades until the opening of the market, investors could be tempted to manipulate prices. For example an investor desiring to buy could place

large sell orders, to drive indicative prices down, and then cancel these orders just before the opening while placing large buy orders to purchase the stock at a relatively low price. Thus one can posit two alternative hypotheses: on the one hand the preopening period could enhance price discovery, on the other hand it could hinder it.

Relying on field data from the Paris Bourse, Biais, Hillion and Spatt (1999) try to disentangle these two hypotheses. They find empirically that during the last 15 minutes of the preopening period, indicative prices have significant information content. These findings are consistent with the hypothesis that the preopening facilitates price discovery. Yet, this field data analysis cannot tell us what would have happened if there had been no preopening period. Would price discovery have been less efficient in that case? Taking an experimental approach enables one to answer this question. Such is the aim of the present research project.

Our approach is to run several experimental financial markets under two treatments:

. In the first treatment, there is no preopening. The price is set in a call auction. Investors place schedules of limit orders to buy or to sell. The price is set to maximise trading volume. This is similar to the trading mechanism used to set the opening price in Euronext.

. In the second treatment, there is a preopening period before this call auction. For simplicity we consider the following market structure: In the preopening, investors are invited to place limit orders and the price is set exactly as in the call auction, but there is no trade at this price. Investors are told the indicative price and how their orders would have been executed at this price, then the regular opening call auction takes place.

By comparing the informational efficiency of prices and the convergence of order placement strategies to equilibrium in these two treatments, we hope to shed light on whether the preopening period is useful for price discovery.

1.2 Literature

Obviously, the present research project is related to the empirical microstructure studies mentioned above (Amihud and Mendelson, 1987-1991, and Biais, Hillion and Spatt, 1999).

Our project is also in the spirit of Plott and Smith (1978), who compare the efficiency of two different market structures (a continuous auction and a fixed posted price auction) and Bronfman et al. (1996) who compare double oral auctions and Walrasian tâtonnement. Other experimental studies investigating the consequences of market structure for prices and trades include Schnitzlein (1996) and Krahen and Weber (1999). Our project is different from these papers, since they do not consider a preopening period.

We plan to analyse the extent to which market participants deviate from equilibrium strategies in a call market. This is related to Cason and Friedman (1997). In the context of a one shot call market, they analyze the extent to which subjects in the laboratory follow the equilibrium strategies theoretically derived by Rustichini, Satterthwaite and Williams (1994).

The hypothesis that the preopening period facilitates the discovery of prices and equilibrium strategies can be interpreted in the line of Camerer (1999): possibly the preopening period modifies the mental representation of the game. By enabling the investors to play a warming round, it could make it less difficult for them to accurately evaluate the consequences of their actions and understand their interactions with the others. In some sense, the preopening could reduce the cost of thinking efficiently about trading strategies.

2) Research method and expected results

2.1 Theoretical background: predictions and issues

To provide a benchmark for the experimental market, and for the analysis of the data, we will rely on a (simple) model of the financial market. We plan to consider a model with common values, a technical term meaning that if the fundamental value of the asset is greater

for one agent, it should also be greater for the other agents. Indeed, increases in the profits to be generated by the company which issued the stock should increase the valuation of this stock by all investors. More specifically, we will consider a setting similar to that analysed by Plott and Sunder (1988), in which agents start with heterogeneous private signals. An important difference between their experiment and ours is that they considered a continuous double auction while we plan to consider a call market, preceded or not by a preopening period.

One of the points we plan to address in this context is the extent to which transaction prices will aggregate private signals, that is the informational efficiency of prices. Note that the experimental context is particularly adequate to analyse the informational efficiency of prices, since the experimentalist knows exactly what information the agents have and what the full information price is, in contrast with field data analyses. Another, related, issue we will address is whether the informational efficiency of prices is enhanced by the preopening period.

To obtain clear-cut predictions, we will structure the experimental market so that the Milgrom and Stokey (1982) theorem applies: investors start the game with private signals, and cash endowments but no endowment in risky asset, thus the risky asset is in zero supply. Of course we will allow short sales, so that trades will be possible. However, in this context, we start from a Pareto optimal initial allocation. Hence the Milgrom and Stokey (1982) theorem implies that there should be no trades, except at the fully revealing price. Thus, in equilibrium no investors incur losses in the marketplace. This suggests a simple metric to quantify how far the data is from equilibrium: the total amount of losses in the marketplace.

2.2 Experimental design

The experimental analysis will be conducted on computers. We have already designed the experiment, and we are currently programming the experimental market. To do so we are using the experimental software Z-tree, developed at the University of Zurich. One of the coauthors of this project, has obtained a grant from his university (Georgia State) to compensate and incentivise the participants to the experiment.

Each experiment will involve 12 markets and 8 participants. At the beginning of each round participants will receive initial cash endowments and signals. Signals will be iid draws. In the treatment without preopening the participants will have 4 minutes to place their orders. In the treatment with a preopening they will have two minutes to place their orders in the preopening, and then two minutes to place their orders in the call auction. Thus the amount of time available to the participants to conduct reasoning about order placement will be the same in the two treatments. This enables one to reason *ceteris paribus*.

2.3 Practical value of the project

The project will shed light on the role of the preopening in price discovery. This is an important issue for market organisers. These involve exchange officials (Euronext, Xetra, etc...) as well as ECNs managers (Island), and also financial institutions in charge of matching orders and setting prices. For example, a preopening approach could be taken in other contexts, such as IPO, auctions to sell bonds, or energy markets.

The project will also be an important step in the development of an expertise in experimental finance in France. While this field is quite developed in the US, and a very dynamic research area (which has just received the Nobel price), it is less prevalent in France. This is in part due to the fact that the experimental methodology can be rather heavy and demanding: you need computer networks, people able to program the experiment, money to incentivise participants, etc...

3) Timetable

As mentioned above we have already completed the design of the experiment, secured resources and started programming the experiment. We can hope to have a first draft of the paper and to be able to participate in a workshop in the Spring of 2004.

4) References

Amihud, Y, and H. Mendelson, 1987, Trading mechanisms and stock returns: an empirical investigation, *Journal of Finance*, p 533--553.

Amihud, Y, and H. Mendelson, 1991, Volatility, efficiency, and trading: evidence from the Japanese stock market, *Journal of Finance*, 1765--1789.

Biais, B., P. Hillion and C. Spatt, 1999, Price discovery and learning during the preopening period in the Paris Bourse, forthcoming *Journal of Political Economy*.

(www.jstor.org)

Bronfman, C., K. McCabe, D. Porter, S. Rassenti and V. Smith, 1996, An experimental examination of the Walrasian tâtonnement mechanism, *RAND Journal of Economics*, 681--699.

Camerer, C., 1999, Mental representations of games, Paper presented at the IDEI--GREMAQ conference on Psychology and Economics held in Toulouse University.

Cason, T., and D. Friedman, 1997, Price formation in single call markets, *Econometrica*, 311--345.

Krahen, J. P., and M. Weber, 1999, Does information aggregation depend on market structure ? Market makers versus double auction, *Zeitschrift für Wirtschafts- und Sozialwissenschaft*, 119, 1-22.

Milgrom, P., and N. Stokey, 1982, Information, trade and common knowledge, *Journal of Economic Theory*, 17--27.

Plott, C., and V. Smith, 1978, An experimental examination of two exchange institutions, *Review of Economic Studies*, 133--153.

Plott, C., and S. Sunder, 1988, Rational expectations and the aggregation of diverse information in laboratory security markets, *Econometrica*, 1085--1118.

Rustichini, A., M. Satterthwaite, and S. Williams, 1994, Convergence to efficiency in a simple market with incomplete information, *Econometrica*, 1041--1064.

Schnitzlein, C., 1994, Call and continuous trading mechanisms under asymmetric information: an experimental investigation, *Journal of Finance*, 613--636.