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THE EFFECT OF STOCK EXCHANGE TRADING MECHANISM ON MARKET EFFICIENCY

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Financial equity market is an efficient mechanism of information aggregation and price discovery. However, due to the specifics of modern equity exchange implementations, a market participant has to maintain an open order to display his demand/supply. The less the market price deviates from the equilibrium price, the less incentive one has to display it. Combined, this adds a time dimension to market equilibrium and challenges the notion of market efficiency.

By examining the recent findings in the field of metaorder trading and market infrastructure, we can prove that although this effect impairs market

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efficiency in the short term, in the long-term, the market is consistent with the definition of long-term efficiency.

Modern equity markets are efficient systems that facilitate the exchange of equity shares in publicly held companies. The equity market provides a way for the demand for a particular stock to meet the supply. Demand is driven by buyers, who operate on the belief that company should be valued higher, while supply is provided by sellers who hold the opposite opinion. The market aggregates the convictions of both parties and sets an equilibrium price – price which reflects all information available to market participants.

Currently, scientists outline three forms of market efficiency based on the type of information reflected in equilibrium market prices: 1) weak-form efficiency – market prices reflect all available historical market data (prices and trades); 2) semi-strong form of market efficiency – market prices reflect all available public data; 3) strong-form efficiency – market prices reflect all available public and private data [1].

The economics of a market concept easily translates into the mechanism of how stock exchanges operate: when a market participant wants to increase demand/supply quantity at a particular price, he can send a buy/sell limit order of the desired quantity at the desired price to the stock exchange. There is a large body of research dedicated to studying the instantaneous effect of a single order on market prices [2; 3].

However, once the order of the market participant is filled, he needs to send a new order to display his demand or supply and continue influencing the price formation. A market agent may be limited in sending orders continuously due to many reasons: liquidity or risk constraints, limitations of his portfolio, etc. In result, he may eventually contribute to the formation of demand/supply, but for now it may be hidden from other market participants. In addition, the more the price deviates from his desired price in a favorable direction, the more incentive he has to act and send an order again.

In result, the plain model of static demand and supply fails to incorporate the time and incentive dimension of this relation. This leads to an important outcome: price discovery is not instantaneous and the current price may deviated from «fair price» for some time after large trades because agents have idiosyncratic constraints which prevents them from displaying their demand or supply right away. Therefore, seeing a trade, one may conclude that the market response is initially muted and attempt to guess where the equilibrium price will end up in the future. Then the argument could be made that this issue denies the notion of weak-form market efficiency: following the timing of the trade and how market agents display their supply/demand may provide information about future supply/demand and future price movements.

Our **goal** is to address this contradiction and prove that even when market participants are limited in their ability to display their supply and demand, the timing of their trades does not provide an indication of future long-term price movement.

In order to do so we will accomplish the following **tasks**:

- We will analyze several studies of metaorders – orders, which are sliced into smaller orders and executed over extended period of time [4]. One of the particular areas of focus in these studies is how to split up the large order into smaller child orders across some period of time to receive the best possible price.

- By generalizing several aspects of these findings, we will be able to draw a conclusion on how to incorporate the timing of the trades into market efficiency.

- We will outline the future area for research.

There is a significant portion of literature dedicated to the study of how different patterns of metaorder trading impacts the instantaneous and long-term market equilibrium price [5; 6]. In general, these studies break down the effect of the order executed on a price into two components [7]:

$$\text{Total impact} = \text{permanent impact} + \text{temporal impact}$$

In this equation, *total impact* – the aggregate change to the price caused by trading the order; *permanent impact* – the effect the order has on the long-term market equilibrium price; *temporal impact* – transitory deviation from the equilibrium price caused by the order.

Originally, *Almgren et al.* [7] postulated that there is a permanent impact caused by the informational content caused by buy/side imbalances. This implicates that the buy/sell imbalances indicate where the price is about to move. They have empirically proven that permanent impact is linearly related to how large the slices are relative to the overall displayed demand (normalized trade size).

However, *Toth et al.* [8] challenged these statements. In his research he showed that the resulting impact function is a consequence of trading conducted by a set of homogeneous market participants; and it leads to market equilibrium with a statistically efficient price.

Additionally, recent findings by *Bazylevych et al.* [9] proved that the linear relation between the normalized trade size and market impact exists even when market participants disregard the information provided by the trade. Moreover, this relation can be fully explained by the mechanical rules of supply and demand interactions on exchanges.

Therefore, no additional evidence of supplementary informational content embedded in the timing of the trade exists.

This proves an important outcome: the timing of an order submission (the act of person displaying own supply or demand) is irrelevant to the price

formation mechanism. Trading does not provide any additional information to market participants in the long term besides the mere indication of the overall supply and demand. The additional predictive information that the market participants receive is fully contained in the temporal impact which dissipates in a short period of time (~30 minutes after the order is executed [7; 10]).

Therefore, based on the aforementioned statements, we come to the **conclusion** that in the short-term, historical patterns of trading do provide some informational disturbances and deviations from weak-form efficiency. However, in the long-term, the market remains consistent with the weak form.

This raises an interesting question from both the market efficiency and market microstructure standpoint: in the case of no external restrictions for when and how market participants could send their orders, would the temporal impact completely disappear? We believe this question can potentially provide a fruitful area for future research.

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