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Call auction frequency and market quality: Evidence from the Taiwan Stock Exchange

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ABSTRACT

Financial market quality is generally assessed with respect to efficiency, liquidity, and stability. The frequency of trading contributes to these attributes. The Taiwan Stock Exchange uses a periodic call auction as its main trading mechanism. From 2010 to 2014 the call auction interval was reduced four times, from 25 to 5 s, providing a natural experiment to test the impact on market quality. Using multiple measures of efficiency, liquidity, and stability we provide evidence that the reductions in call auction interval have improved overall market quality. We find that higher auction frequencies are associated with a lower trade-to-auction ratio and less aggressive trading behaviour. The evidence suggests that there are more gains to be made through further reduction in the call auction interval to around 2 s.

1. Introduction

Call (or batched) auction is a trading arrangement where orders from buyers and sellers are batched for simultaneous execution at a single transaction price at a pre-specified time. The time interval between call auctions is one of the most important features of call auction trading. Based on a series of increases in call auction frequency on the Taiwan Stock Exchange (TWSE), this study conducts an examination of how call auction frequency affects stock market efficiency, liquidity, and stability. It provides new empirical evidence on several long-standing theoretical predictions, and sheds new light on the microstructure of call auction trading.

Call auctions have a long history in financial markets, going back at least to commodity futures trading in 17th century Japan (Schaede, 1989). In the modern history of stock markets, trading on exchanges in London and New York is continuous: a transaction can occur anytime when a buyer is willing to pay a price equal to or higher than the sell price. Call auction was the main trading method on stock exchanges in Frankfurt, Paris, and Tel Aviv (Amihud, Mendelson, & Lauterbach, 1997; Kalay, Wei, & Wohl, 2002; Muscarella & Piwowar, 2001). The switch from call auction to continuous trading in the 1990s and early 2000s was largely motivated by enhancing liquidity and was often accompanied by computerization of the trading process. In some cases, call auction is retained as an alternative for trading less liquid stocks (Hoffmann & van Bommel, 2009). Within Asia, most stock exchanges adopted continuous trading at inception. Only Bursa Malaysia and the TWSE were established as call auction markets, with Bursa Malaysia switching to continuous trading in 2008. Currently call auction is used by major

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stock exchanges to conduct the opening and/or closing trades on a trading day. To the best of our knowledge, the TWSE is the only remaining call auction-based exchange in the world.

Recent years have seen a renewed interest in call auction as a replacement for continuous trading, motivated by some adverse effects of high-frequency trading on market quality. In continuous trading, there is always a delay in price reaction to new information due to the latency of electronic data transmission. Budish, Cramton, and Shim, (2015) show that such latency at millisecond level creates mechanical arbitrage profits for high-speed arbitragers at the expense of liquidity providers, thus increasing the cost of liquidity provision. The mechanical arbitrage opportunities come from the serial-processing design of continuous trading, and will not be eliminated by the arms race in high-speed trading technology.[1] The solution proposed by Budish et al. (2015) and many others, e.g. Farmer and Skouras (2012), Wah and Wellman (2013), and McPartland (2015), is to replace continuous trading with call auction. The fixed time interval between call auctions, however small, eliminates the arms race and forces traders to compete on price.

The literature on call auction frequency is mostly theoretical. Two particular strands are closely related to the current study. The first focuses on the optimal auction frequency. Early studies such as Garbade and Silber (1979) and Goldman and Sosin (1979) provide analytical solutions to the optimal auction frequency by minimizing price deviation from the equilibrium value. Motivated by the renewed interest on call auction as a replacement for continuous trading, Fricke and Gerig (2018) derive the optimal auction frequency in a modified and extended version of Garbade and Silber (1979). Du and Zhu (2017) solve the optimal auction frequency for a dynamic model of sequential auctions. We examine the impact of call frequency and explore the optimal frequencies proposed by Fricke and Gerig (2018) and Du and Zhu (2017). The second strand of related literature examines investor behaviour and equilibrium price under call auction. Ho, Schwartz, and Whitcomb, (1985) analyse the optimal trading strategy of an individual investor under call auction. Madhavan (1992) shows that call auction offers greater efficiency and greater robustness than continuous trading. Brennan and Henry Cao (1996) predict that in call auction, uninformed investors behave as rational trend followers while informed investors follow a contrarian strategy. In a model with dynamic strategic behaviour, Vayanos (1999) shows that agents trade slower and suffer greater welfare loss when the time between auctions decreases. Our study provides direct evidence on a key assumption in theoretical studies, i.e., every auction results in a new price signal. We show that trading is endogenous to auction frequency. As auction frequency increases, investors trade less aggressively as predicted by Vayanos (1999).

Empirical studies on call auction frequency are limited. Lang and Lee (1999) examine the switches from 120 to 90 then to 50 s auction intervals on the TWSE and find higher auction frequency is associated with higher volatility but no significant change in market efficiency. Webb, Muthuswamy, and Segara, (2007) study the reductions of call interval from 30 to 20 to 10 s in 1998–1999 on the Taiwan Futures Exchange (TAIFEX). They show volatility increased after the switch from 30 to 20 s but had no significant change after the switch to 10 s. A number of studies examine the impact of switching to continuous trading on the Tel-Aviv Stock Exchange (Amihud et al., 1997; Lauterbach, 2001; Kalay et al., 2002), the Paris Bourse (Muscarella & Piwowar, 2001), the Frankfurt Stock Exchange (Kehr, Krahnen, & Theissen, 2001), the Warsaw Stock Exchange (Henke & Lauterbach, 2005), and the TAIFEX (Cheng & Kang, 2007; Kuo & Li, 2011). Many show greater liquidity after switching to continuous trading. The higher liquidity justifies the one-off increase in asset returns after the switch. Large stocks appear to benefit more from continuous trading. Studies do not find significant changes in stock volatilities. Several studies have examined the role of designated market makers in call auction, e.g. Venkataraman and Waisburd (2007) and Theissen and Westheide (2017). There is a growing literature examining the effect of opening and closing calls on investor behaviour and market quality (see references in studies by Cordi, Foley, and Putniņš, (2015) and Bellia, Pelizzon, Subrahmanyam, Uno, and Yuferova (2016)).

In this study, we make three contributions to the limited empirical literature on the impact of call auction frequency. First, we provide a comprehensive examination on the impact of call auction frequency on market efficiency, liquidity, and stability. As indicated in Fig. 1, the TWSE reduced the auction interval from 25 s to 20 s (May 2010) to 15 s (July 2013) to 10 s (Feb 2014) and to 5 s (Dec 2014). These changes provide a unique opportunity to examine investor behaviour and market quality under different auction frequencies. Unlike Lang and Lee (1999) and Webb et al. (2007), we deploy multiple measures for each aspect of market quality to provide robust empirical results. We aggregate each aspect of market quality to measure changes in the overall market quality. Further, we control for the impact of other factors at levels of the individual stock, the overall market, and the macroeconomy in order to isolate the effect of auction frequency. We find that market efficiency is highest when the call interval is 25 s, liquidity is highest when the call interval is 5 s, and stability is highest when the call interval is 10 s. Combining two or three measures across efficiency, liquidity, and stability, overall market quality is highest under the current 5 s interval.

Second, we provide the first empirical support to the prediction by Vayanos (1999) that investors become less aggressive when there are more opportunities to trade and less (time for) new information between trades. In almost all theoretical studies of call auction, auction frequency and trading frequency are assumed to be the same and the two terms are usually interchangeably. We show that the two are very different: the ratio of the number of trades to the number of auctions monotonically decreases as auction interval decreases: at the current 5-s interval, only 37% of call auctions result in a trade.

[1] If the value change is one cent and is reflected in the next quote change, the fastest trader earns one cent per share by "sniping" the stale quote. Although the arbitrage opportunity declined from 97 milliseconds in 2005 to 7 milliseconds in 2011, the per arbitrage profitability remained stable (Budish et al., 2015).

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