Reporting Delays and the Information Content of Off-Market Trades

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Abstract

This paper examines the impact of reporting delays in off-market trades on informed trading and information efficiency. We examine this issue using a natural experiment in FTSE futures contracts provided by the ICE Exchange which eliminated the ability of market participants to request a reporting delay in smaller sized off market trades in 2018. We find strong evidence of a decrease in the permanent price impact of experimental trades whose reporting could no longer be delayed. In contrast, we find no evidence of a change in the permanent price reaction of a control sample that experienced no change in reporting delays. This evidenced is consistent with the proposition that the elimination of reporting delays squeezes informed traders out of the market. We conclude that while reporting delays increase the time taken to release information to the market by the length of the reporting delay, thereby *prima facie* reducing information efficiency, that such delays encourage informed trading and therefore potentially increase the informativeness of trading and information efficiency.

KEYWORDSS block trades, deferred publication, futures markets, market microstructure, post-trade transparency, price impact.

JEL CLASSIFICATION C58, D82, G13, G14, G18

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1. INTRODUCTION

This study examines the impact of reporting delays that off market trades have on informed traders and price adjustment to informed trading. A small but rich body of literature has examined the price impact of off market or upstairs trades. These include studies examining off market trading in stock markets such as the U.S.A. (Keim & Madhavan, 1996; Madhavan & Cheng, 1997), Canada (Smith et. al., 2001) Finland (Booth et al., 2002) and France (Bessembinder & Venkataraman, 2004). These studies provide evidence that off market trades have a small but permanent effect on stock prices implying that it is executed by informed traders. Another strand of the literature has examined the effect of the delay in reporting of off market trading including Gemmill (1996) and Frino (2021). Gemmill (1996) examines the impact of block trades on the London Stock Exchange subject to delayed reporting and finds that they have a small permanent price impact at the time that they are executed – even though they are yet to be reported. Moreover, he also examines whether there is a change in this price behaviour following a change in rules which allow a delay in reporting off market trades and is unable to find any evidence of a change in price behaviour at the time that they are executed[1]. This implies that the price behaviour around the time that off market trades are executed is not influenced by any reporting delays.

Frino (2021) extends the work of Gemmill (1996) in two ways. Firstly, by examining futures markets and second by examining the impact of trades subject to delayed reporting at the time that they are reported. He finds that there is an additional price impact at the time that the trades are reported, implying that the delay in reporting off market trades introduces an

[1] Specifically, in relation to the permanent effect of trades at the time that they are executed, the evidence presented suggests that block trades are informed and concludes that "we do not find any simple effect of publication regime" (Gemmill, 1996, p. 1781).

informational inefficiency. However, this conclusion is only true if immediate reporting squeezes informed traders out of the upstairs market. If a portion of informed trades are squeezed out of the upstairs market because immediate reporting is required, then the information associated with such trades would not be impounded in prices, suggesting that delayed reporting may actually enhance market efficiency by encouraging informed trading. Hence, while delaying the reporting of these (informed) trades results in a delay in the revelation of information equivalent to the reporting delay, on the other hand it encourages informed trading by allowing them to protect their information. This study therefore contributes to the literature by testing whether the publication regime for off market trades squeezes informed traders out of the market.

While previous research examines the price impact of trades at the time that they are executed with and without delayed reporting (Gemmill, 1996), as well as the impact of delayed trades at the time that they are reported (Frino, 2021), it does not examine the change in the impact of trades when they are reported and when there is a change in the delayed reporting regime. As such, this paper fills the gap in the literature and extends both Gemmill (1996) and Frino (2021) as it enables us to examine whether informed traders are squeezed out of the upstairs market as a consequence of the inability to delay reporting of trades.

The Intercontinental Exchange (ICE) changed its rules relating to the publication of block trades in 2018 (ICE circular number 20/118). For FTSE 100 index futures – one of the most actively traded equity futures contracts on the ICE Exchange – any block trade (which needed to be greater than 500 lots) could be reported with a delay of up to one hour. However, on 19 February 2018 the threshold for delayed reporting of block trades was increased to 3,328 lots. This meant that trades whose size was between 500 and 3,328 lots, which previously could be reported with a delay of up to one hour, subsequently needed to be reported immediately. This rule change provides a natural experiment which allows us to examine the effect of delayed reporting of off market trades on informed trading. Importantly, we are able to examine whether there is a change in the information content of trades after the introduction of delayed reporting.

We hypothesize that delayed reporting of off market trades allows traders with private information time to exploit their information, and hence that they are more likely to use off-market trades. However, in the presence of immediate reporting of off-market trades, the ability of an informed trader to exploit their information declines. Therefore, they are less likely to use off-market trades and seek other (more costly) ways of concealing their information, or otherwise leave the market. This implies that block trades are more likely to be informed in a regime with delayed reporting and less likely to be informed when there is an immediate reporting regime of large trades. We test this proposition using the approach in the previous literature cited earlier by examining whether the permanent impact of off-market trades declines when they move to a more transparent regime.

The remainder of this paper is structured as follows. Section 2 and 3 review the description of the data and method used, and empirical findings, respectively. A final part concludes.

2. DATA AND METHOD

2.1. Data and manipulation process

Supplied by Refinitiv (formerly Thomson Reuters), a London Stock Exchange Group (LSEG) business, and sourced from the Thomson Reuters Tick History (TRTH) database, our analysis uses intraday trade and quote (TAQ) transactions data for the FTSE 100 index futures contract traded on the Intercontinental Exchange (ICE). The sample spans a 2-year period extending from February 20, 2017, to February 22, 2019, and covering a symmetrical pre- and post-period of nearly one year around the change in the Block Trade Facility amended by ICE on February

19, 2018. The unique microstructure dataset consists of trades prices and volumes, bid and ask prices and sizes of the quotes that triggered the trade, the date and time stamp to the nearest thousandth of a second, and the RIC (that stands for Reuters Identification Code) number of the instrument[2]. From the TRTH database we also extracted the transactions information of block trades, which presents the same date-time stamp recording the block trade execution and fields containing the RIC, and both the volumes and prices of the actual block trades. This dataset allows us to distinguish between block trades and strategy[3] block trades through the exchange FID provided by Refinitiv indicating the off-book trade type. We finally merged the two datasets by RIC and date-time to the nearest hundred of a second.

Contrary to many studies in the empirical microstructure literature, our data does identify the direction of the transactions that determines which side of the market initiated a trade. While on-market transactions have the information regarding the buy/sell side, block trades have no such information, as they are executed away from the order book and report this information solely to the exchange[4]. Since for the trades and quotes tick data we eliminate transactions that occur out of the exchange trading hours for the FTSE 100 index futures contract (from 1 am to 9 pm London time), each off-market block trade in the sample can,

[2] It is noticed as few transactions could omit part of the data required in the tick observation, but this did not sabotage the analysis and had no impact on its relative findings.

[3] A "strategy" happens when a Block Trade involves more than one contract month of the same or different IFEU futures contracts. It also has different threshold for deferred publication requests. Members of ICE are, subject to F.7.1 trading rule, permitted to enter into Block Trades which involve the trading of two or more different contracts or Block Trades that involve the trading of two or more different contract months and/or strike prices of the same contract. We repeated the analysis, for robustness, including those type of trades and get the same results.

[4] which records them in a separate database not shared with third parties.

therefore, be classified[5] as up-tick (trades executed at a premium price), down-tick (trades executed at a discount price), or zero-tick (trades executed at the same price) using the so-called "tick" rule (see Kraus & Stoll, 1972; Holthausen et al., 1987-1990; Lee & Ready, 1991). Hence, this study compares the block trade prices with the price of the on-market trade (not classified as block) in the limit order book being executed 1 hour before the reporting time recorded for the block trade. If the price of the off-market block trade is higher (lower) than the price of the on-market trade, then we categorise the side of the block transaction as premium (discount), while we classify block trades as zero-tick if those prices are equals[6]. This approach is similar to the Lee & Ready (1991) algorithm, which is consistently used by a large number of previous studies examining the price impact of block trades in upstairs markets (e.g., Gemmill, 1996; Keim & Madhavan, 1996; Madhavan & Chen, 1997; Smith et al., 2001; Booth et al., 2002; Bessembinder & Venkataraman, 2004; Frino, 2021). In addition, we delete any quotes where the bid price is higher than the ask price, or the bid or ask are lower than zero. As a last step of our cleaning procedure, for higher accuracy, we rely on the autoregressive conditional duration of Engle & Russell (1989), following Brownlees & Gallo (2006), and eliminate all the outlier observations (*i.e.*, those that have an absolute difference between quote prices and the mean quote price exceeding three times, from the mean, the standard deviation of the quotes distribution). This enables us to avoid any biases from abnormal peaks or misleading observations erroneously recorded in our high-frequency dataset, eventually.

[5] This is important to know given that, according to the literature, buyer-initiated trades are more likely to be information motivated by "good news" (positive price impact), while seller-initiated trades are more likely to be information motivated by "bad news" (negative price effect) as per equities markets studies in market microstructure. In distinguishing between discounted and premium off-market trades we also avoid biases in the cross-section regression findings since these markups and discounts do not convey the same information.

[6] We exclude (9) zero-ticks from the analysis since those trades are less economically significant.

2.2. Sample description

The threshold that defines a trade as a block on ICE is 500 lots. All block trades of our sample are entirely traded off-market. However, in February 2018 there was a change in the Post Trade Large in Scale (LIS) threshold, which is the minimum size that determines whether traders can request to defer the publication of a block trade on ICE. We exploit a natural experiment that enables us to distinguish between block trades that are executed upstairs and simultaneously reported to the central market, and block trades that are instead published to the market one hour after the counterparties agreed upon the transaction. While before the 19th of February 2018 a deferred publication for a block trade could be requested if its size was greater than 500 lots (and so every block trade), today the minimum volume is increased to 3328 lots. The delay remained with the same duration of one hour, however.

By using this change in the Block Trade Facility (BTF), we divide the sample period into two subperiods of nearly one year each[7] around the change in the minimum delaying threshold, to look for any price impact differences between samples based on similar size ranges. If a trade size is first supposed to be reported with a delay and then falls into a range in which a delay is not permitted, we should see a different price impact according to our assumptions. More specifically, a delayed block trade should have a greater impact on the market and so being more likely to be information motivated. Thus, this study defines the control samples as this comprising all the block trades that remain, in both periods into the delayed reporting regime, namely those with a size higher than 3328 lots. We then define the experimental sample as the one including transactions with a volume within 500 and 3328 lots, which are the trades that fell into the immediate reporting regime after the 19th of February 2018 and into the delayed reporting regime before the change in the BTF.

[7] to avoid any biases eventually arising from different broad seasonal patterns in microstructure.

The number of off-market block trades executed on ICE during our sample period is 12,912. Since the expiration days of block trades are likely to be rollover transactions (Frino & McKenzie, 2002) – traders switching from the deferred to the near contract – and hence are informationless, we ultimately exclude from the sample the 10 trading days preceding the delivery of the contract[8]. From 6,321 observations, additionally, we also eliminate all the trades classified as strategy[9] in order to avoid any other transactions lacking information that could bias our findings, leaving a sample of 874 off-market block trades.

2.3. Price impact of off-market trades

We first use a measure to incorporate all the divided orders, in terms of size, indicating transactions happening in the same day at the same time (to the nearest hundred of a second) and price. This is known as VWAP, the volume weighted average price (see Foucault, Pagano & Roell, 2013):

$$VWAP_{d,t}= \frac{\sum Price_{d,t}^{i} * Volume_{d,t}^{i}}{\sum Volume_{d,t}^{i}} \quad (1)$$

where $Price_{d,t}^{i}$ and $Volume_{d,t}^{i}$ are the price and size of the i^{th} trade at time t of day d. For each trade category and lot size, we then calculate price impact as the permanent and total effect around the execution and reporting time of block trades for the two subsamples periods. The

[8] This is consistent with Frino & McKenzie (2002) and Frino & Oetomo (2005) that find smaller price effects, lower spreads, and increased activities in the period preceding the contract delivery. Frino, Kruk & Lepone (2007) also proxies per those rollover strategies by excluding trades occurring within 10 days of contract maturity. However, we run a robustness test by also including those transactions in the analysis and get similar results as those shown in the results section. These findings are available from the authors on request.

[9] We run a robustness test also in this case to include those transactions in the analysis and get the same results as those shown in the results section. These findings are available from the authors on request.

permanent and total price effects are estimated around trade reporting time, consistently with Holthausen et al. (1990), Chan & Lakonishok (1993), Gemmill (1996), and Frino, Jarnecic & Lepone (2007), as:

$$Permanent\ Effect = \frac{(Price_{+30min} - Price_{-1hour})}{Price_{-1hour}} \tag{2}$$

$$Total\ Effect = \frac{\left(OffbookPrice_{0} - Price_{-1hour}\right)}{Price_{-1hour}} \tag{3}$$

where $Price_{+30min}$ is the trade price 30 minutes after the off-market trade; $Price_{-1hour}$ is the trade price 1 hour before the off-market trade; and $OffbookPrice_{0}$ is the off-market trade[10] price taken as time 0. The same price effects are computed around the trade execution time by assuming that block trades with a size larger the minimum LIS threshold and in a delayed publication regime actually occurred one hour before the observation of our dataset and taking this as time 0. We finally compute, together with the mean inference, a t-test for each premium/discount block transaction on the null hypothesis of whether the mean return was equal to 0.

3. EMPIRICAL FINDINGS

3.1. Descriptive statistics

For each of the size categories of our samples (both control and experimental) and the trade directions mentioned above, we calculate descriptive statistics for the number of observations and mean size of off-market block trades in terms of volume and notional size. The overall sample consists of 435 premium off-market trades and 429 discount trades, of which 518 being executed in before the change in the policy of ICE and 355 after. Table 1, section (a), also

[10] If two block or off-market trades are found within our 1.5 hours range, we exclude from the calculation of the price effects the previous off-market trade and carry the analysis around the last one containing more information (which also carries the information of the previous trades).

shows that the mean and median of the off-market block trades distribution are, respectively, 1,000 and 1,451 for premium transactions and 1,000 and 1,405 for discount. The standard deviation for premium trades is 1,246.839 and 1,102.146 for discount. This suggests that the two samples are roughly balances, and the same inference is supported by the distribution profiles of trades notional value with an overall mean and median of respectively £107,200,000 and £75,000,000 for premium and £103,403,368 and £74,267,500 for discount transactions.

[INSERT TABLE 1 ABOUT HERE]

Section b of table 1 illustrates the different samples in terms of trade count and distinguishing between block trades executed before (panel A) and after (panel B) 19 February 2018, which is when the change in the LIS threshold for deferred publication requests was amended by ICE. In regard to trades subject to immediate reporting, there are 14 off-market trades and 27 off-market trades before and after the change in LIS respectively. The experimental samples are composed of 504 off-market allowed for delay publication and 328 off-market trades forced to an immediate trade reporting.

[INSERT TABLE 2 ABOUT HERE]

Table 2 documents the description of premium and discount transactions. We measure the total impact as the return, in relative terms, from 1 hour before the off-market block trade is reported to 30 minutes after. The reporting of premium and discount block trades at any level shows a significant total price reaction. Total effect for premium averages between 2 and 7 basis point (for control and treatment sample respectively), while for discount between -3 and -4 basis points. Magnitude of off-market block trades in our sample is therefore slightly smaller previous research examining futures markets (Frino, 2021), and other studies examining equity markets (Keim & Madhavan, 1996; Madhavan & Cheng, 1997). However, all the t-test carried out are statistically significant at the 1% level.

3.2. Price impact around execution times of off-market trades

Table 3 documents the permanent price impact around off-market block trades at execution time. Trades are executed in FTSE100 index futures on the ICE between February 2017 and February 2019 during normal daytime trading session (from 1:00 a.m. to 9:00 p.m.). In this analysis, for trades which occur before the change in the block trade facility that were greater than 500 lots and trades larger than 3328 lots occurring after the 19 February, we assume that block trades were actually executed 1 hour before the reporting time indicated in our dataset. By comparing the off-market trade prices to the prices of the basis on-market trades executed at the same time of the off-market trade, we estimate the premium and discount transactions. Permanent impact is then computed as the return from 1 hour before the off-market block trade is executed to 30 minutes after.

[INSERT TABLE 3 ABOUT HERE]

As can be seen in table 3, the execution of block trades at any level implies a significant price reaction. Those findings are consistent with prior research as both delayed and not delayed samples behave like Gemmill (1996). In other words, regardless of the reporting time of block trades, there is evidence of a statistically significant positive price adjustment and negative and statistically significant price reaction at the time that premium block trades are executed. This price behaviour is consistent with leakage of information associated with block trades likely as the block is shopped, or as broker-dealers who have facilitated the block trades unwind their positions.

3.3. Price impact around reporting times of off-market trades

Table 4 documents the permanent price impact around off-market block trades at reporting time. Permanent impact is computed as the return from 1 hour before the off-market block trade is reported to 30 minutes after. Trades are executed in FTSE100 index futures on the ICE between February 2017 and February 2019 during normal daytime trading session (from 1:00 a.m. to 9:00 p.m.). Contrary to Gemmill (1996) who based his analysis on data indicating execution times of off-market block trades, we possess the opposite data showing reporting times of those trades and overcame Gemmill's (1996) limitation by measuring the additional market impact when publication of block trades actually occurs. By computing the permanent price effect at the reporting time of off-market trade, we are able to determine whether those trades convey incremental information content to the market when they are made publicly available for all traders. The experimental sample in table 4 (trades between 500-3328 lots) shows, in the period in which block trades were allowed to be reported with a delay (panel a), a statistically significant permanent price effect of 0.01% and -0.01% respectively for premium and discount transactions. Conversely, there is no such evidence for off-market trades executed in the period after the change in the policy (panel b), where block trades were not allowed to be reported with a delay.

[INSERT TABLE 4 ABOUT HERE]

Panel C of table 4 exhibits a statistically significant decrease for the permanent impact at the premium and a statistically significant increase for the permanent impact at the discount, only for the experimental sample (500 – 3328) though. There is no significant change in the information component of off-market block trades always under a delayed publication regime. The t-tests of panel C are carried out on the difference between the two permanent impact respectively before and after the change in the block trade policy, showing that the mean return in panel A is significantly greater than the mean return in panel B both for premium and discount transactions of the treatment sample. This implies that when the ICE allowed traders to report block trades with a delay those were majorly transacted by informed traders, and the reverse is true when ICE made a change in its rules by forcing the same trades to be publish immediately. As documented in previous research cited above, this effect indicates that block trades carry information content to the market when delayed and cause an information leakage before the price moves to the block trade through the unwinding process of informed traders' positions. These findings, hence, are consistent with the hypothesis that delayed reporting of off-market trades allows traders with private information time to exploit their information, and hence that they are more likely to use off-market trades. This in turn implies that the latter are less likely to use off-market trades and, therefore, seek other (more costly) ways of concealing their information, or otherwise leave the market, in the presence of immediate reporting.

The control sample, on the other hand, demonstrates that, as expected, there is no change in the information effects when trades are always under the same post-trade transparency regime (i.e., deferred publication of off-market block trades). Therefore, regardless of the publication time requirements, trades greater than 3328 lots (reported with 1 hour of delay in both periods before and after the change in the block trade policy), have always a statistically significant permanent price impact. This inference provides robustness to the findings of the experimental sample and, more importantly, to our assumption of informed traders leaving the market once forced to report their information immediately. In other words, informed traders are squeezed out of the upstairs market as a consequence of the inability to delay the reporting of their trades. In this environment of free choice set by the change in LIS, thus, informed traders will profit by selecting larger trade size. Once the trade has to be reported immediately, the whole market will know about the trade and any information advantage is prevented. In contrast with Gemmill's (1996) argument, we find that deferred publications do make a difference for information efficiency and price level, implying that the immediate publication regime for off-market block trades squeezes informed traders out of the market while deferred reporting regime is more likely to encourage informed trading. We thus extend the work of Gemmill (1996) and Frino (2021) by documenting the impact of the natural experiment we exploit in this study around the change in the post-trade LIS threshold for deferred publication of block trades in U.K. futures markets.

4. CONCLUSION

The impact of block trades on market efficiency has been extensively researched (Kraus & Stoll, 1972; Scholes, 1972; Holthausen et al., 1987, 1990; Chan & Lakonishock, 1993, 1995, 1997) as it plays a major role in understanding the benefits of one of the fundamental features in market design: transparency. Most findings evidence information effects block trades have on securities prices, implying that transparency leakage enhances price inefficiency, reducing investors wealth. Furthermore, most of the literature documents the relevance of policy reforms effects in post-trade transparency. One of the focus lies on the effectiveness of deferred publication facilities of trades prices, especially for transactions executed in opaque trading platforms, to understand implications on market liquidity. Several studies (e.g., Keim & Madhavan, 1996; Madhavan & Chen, 1997; Smith et al., 2001; Booth et al., 2002; Bessembinder & Venkataraman, 2004) aim to understanding the impact of upstairs (or off-market) trading on information efficiency. In the specific, block trades could lead to increasing information advantage exclusively for informed participants who are able to learn from the order flow, taking profitable position before the delay is applied.

At the time of writing this article, very few empirical studies have been conducted on the difference between the time of executing trades and the time of reporting the publication of prices for block trades with a delay). Frino (2021) recently updated the literature by analysing the Australian futures market, where he addresses the question left unanswered by Gemmill (1996), showing that deferred publication of off-market block trades increases price adjustments by delaying the unwinding process of trades information. By comparing the impact of trades when they are executed with the impact of trades when they are later reported, Frino

(2021) provides further evidence to address this issue, which, accordingly, is controversial also in futures markets. While Frino (2021) looks at a market when all trades are reported with a delay, and Gemmill (1996) looks only the execution time, this paper provides further insights as it documents that once block trades are reported immediately there is no price impact. There is still, therefore, room for considerable improvements in re-exploring previous research, perhaps in a futures market setting, so that future works could provide a better understanding of the role played by reporting delays in information efficiency. Further evidence is also needed to see if Frino's (2021) findings hold under stricter market rules (i.e., with shorter time of delays).

By examining price behaviour around a sample of off-market block trades of FTSE 100 index futures, this paper aims to understand the information role played by deferred publication of off-market block trades into market efficiency. Using a powerful natural experiment, our results contribute to the existing literature by demonstrating that if upstairs traders are squeezed out of the market because immediate reporting is required, then the information associated with such trades would not be impounded in prices, suggesting that delayed reporting enhances market efficiency, consequently deferring the revelation of information equivalent to the reporting delay. On the other hand, it fosters informed trading by allowing upstairs traders to protect their information.

Our findings provide practical insights for both regulators, suggesting them more transparent design, and market participants, who are affected by the ability of strategic informed traders to observe and anticipate price information in the block trading process. The strength of our research relies in the examination of a significant policy change, which has been under researched in the last decades (see Frino, 2021; and Dang, De Blasis & Mollica, 2021).

This study opens further areas for future research. Co-locations could be further assessed in terms of both permanent and total price impact, and test how long the temporary impact is observed for different trade sizes. It may be useful to also test any contagion effects that may be caused by overseas markets which trade on the FTSE100 index futures. We also suggest examining the consistency of those results around major macro-economic information disclosure which are relevant for index futures trading platforms.

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DATA AVAILABILITY STATEMENT

Research Data is not shared. The data that support the findings of this study are available from Refinitiv, an LSEG business, and Rozetta Institute (formerly CMCRC). Restrictions apply to the availability of these data, which were used under license for this study. Data are available from the authors with the permission of Refinitiv and Rozetta Institute.

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TABLE 1 Descriptive statistics of volume and notional size for off-market trades

(a) *Premium and discount trades*

	Volume (contracts)			Notional Size (£)		
Lot size	500 - 3328	>3328	All	500 - 3328	>3328	All
Panel A: Premium						
Median	1,000	5,000	1,000	74,660,000	355,000,000	75,000,000
Mean	1,257	5,478	1,451	92,703,616	408,200,000	107,200,000
SD	730.542	2,448.343	1,246.839	53,915,832	194,076,707	93,804,885
n	415	20	435	415	20	435
Panel B: Discount						
Median	1,000	4,250	1,000	73,588,750	303,970,000	74,267,500
Mean	1,228.6	4,836	1,405	90,392,473	356,186,482	103,403,368
SD	711.463	1,642.004	1,102.146	52,911,313	121,107,641	81,512,201
n	408	21	429	408	21	429

Note: This table describes that distribution of volume and notional turnover of premium and discount off-market trades executed in FTSE100 futures on the ICE during normal daytime trading hours between February 2017 and February 2019. Premium and discount off-market trades have been estimated by comparing the off-market trade price to the price of the on-market (on the orderbook) trades executed one hour before the off-market trade. Volume is the number of contracts executed in the trade and Notional size is the value (in millions of pounds) of exposure obtained using the off-market trade (price × volume × £10).

(b) *Before and after the change in the block trade policy*

	Volume (contracts)			Notional Size (£)		
Lot size	500 - 3328	>3328	All	500 - 3328	>3328	All
Panel A: Before change in post-trade LIS threshold						
Median	1,000	4,162	1,000	73,700,000	308,383,420	73,970,000
Mean	1,214	5,268	1,324	89,451,794	395,478,434	97,722,785
SD	697.803	2,223.378	1,015.385	51,429,894	170,615,790	75,979,422
n	504	14	518	504	14	518
Panel B: After change in post-trade LIS threshold						
Median	1,000	4,800	1,000	76,116,250	344,000,000	76,900,000
Mean	1,289	5,088	1,578	94,848,054	374,400,000	116,100,000
SD	751.938	2,033.055	1,357.490	55,982,542	158,626,789	101,239,276
n	328	27	355	328	27	355

Note: This table describes that distribution of volume and notional turnover of premium and discount off-market trades executed in FTSE100 futures on the ICE during normal daytime trading hours between February 2017 and February 2019. Premium and discount off-market trades have been estimated by comparing the off-market trade price to the price of the on-market (on the orderbook) trades executed one hour before the off-market trade. Volume is the number of contracts executed in the trade and Notional size is the value (in millions of pounds) of exposure obtained using the off-market trade (price × volume × £10).

TABLE 2 Statistics of premium and discount off-market trades

	Premium			Discount		
Lot size	**Mean**	**T-test**	**N**	**Mean**	**T-test**	**N**
Panel A: Before change in post-trade LIS threshold						
500 - 3328	0.07	7.44***	1,423	-0.04	-10.85***	1,511
>3328	0.02	4.00***	120	-0.03	-3.67***	200
Panel B: After change in post-trade LIS threshold						
500 - 3328	0.03	8.30***	1,113	-0.03	-5.94***	1,039
>3328	0.04	2.91***	131	-0.03	-2.72***	110

Note: This table reports statistics for returns around a sample of premium and discount off-market trades executed in FTSE100 futures on the ICE between February 2017 and February 2019 during normal daytime trading session (from 1:00 a.m. to 9:00 p.m.). Premium and discount off-market trades have been estimated by comparing the off-market trade price to the price of the on-market (on the orderbook) trades executed one hour before the off-market trade. Reported in the table are the t test on the mean return computed from 1 hour before the off-market trade is reported to time the off-market trade is reported, with the distinction of samples of trades executed before and after the amended new policy for delayed reporting of block trades. Returns for the total price effect are computed as $\textit{Total Effect} = \frac{(OffbookPrice_0 - Price_{-1hour})}{Price_{-1hour}}$. All returns are in percent.

*Significant at 0.10.
**Significant at 0.05.
***Significant at 0.01.

TABLE 3 Permanent price impact around the time that off-market trades are executed

	Permanent Effect					
	Premium			Discount		
Lot size	**Mean**	**T-test**	**N**	**Mean**	**T-test**	**N**
Panel A: Before change in post-trade LIS threshold						
500 - 3328	0.02	3.21***	1,316	-0.02	-4.41***	1,569
>3328	0.42	2.81***	132	-0.01	-4.79***	183
Panel B: After change in post-trade LIS threshold						
500 - 3328	0.09	2.99***	1,085	-0.1	-3.62***	1,025
>3328	0.21	3.44***	125	-0.17	-3.88***	111

Note: This table reports statistics for returns around a sample of premium and discount off-market trades executed in FTSE100 futures on the ICE between February 2017 and February 2019 during normal daytime trading session (from 1:00 a.m. to 9:00 p.m.). Premium and discount off-market trades have been estimated by comparing the off-market trade price to the price of the on-market (on the orderbook) trades executed at the same time of the off-market trade. Reported in the table are the t test on the mean return computed from 1 hour before the off-market trade is reported to 30 minutes after the off-market trade is reported, with the distinction of samples of trades executed before and after the amended new policy for delayed reporting of block trades. Returns for the permanent price effect are computed as $\textit{Permanent Effect} = \frac{(Price_{+30min} - Price_{-1hour})}{Price_{-1hour}}$. All returns are in percent.

*Significant at 0.10.
**Significant at 0.05.
***Significant at 0.01.

TABLE 4 Permanent price impact around the time that off-market trades are reported

	Permanent Effect					
	Premium			Discount		
Lot size	**Mean**	**T-test**	**N**	**Mean**	**T-test**	**N**
Panel A: Before change in post-trade LIS threshold						
500 - 3328	0.10	25.46***	1,423	-0.10	-26.27***	1,511
>3328	0.13	7.78***	120	-0.12	-12.47***	200
Panel B: After change in post-trade LIS threshold						
500 - 3328	0.03	0.22	1113	-0.05	-1.12	1,039
>3328	0.10	6.62***	131	-0.13	-7.37***	110
Panel C: Differences before and after change in post-trade LIS threshold						
500 - 3328	-0.07	-9.60***	-	0.05	21.28***	-
>3328	-0.03	-1.52	-	-0.01	0.20	-

Note: This table reports statistics for returns around a sample of premium and discount off-market trades reported in FTSE100 futures on the ICE between February 2017 and February 2019 during normal daytime trading session (from 1:00 a.m. to 9:00 p.m.). Premium and discount off-market trades have been estimated by comparing the off-market trade price to the price of the on-market (on the orderbook) trades executed one hour before the off-market trade. Reported in the table are the t test on the mean return computed from 1 hour before the off-market trade is reported to 30 minutes after the off-market trade is reported, with the distinction of samples of trades executed before and after the amended new policy for delayed reporting of block trades. Returns for the permanent price effect are computed as $Permanent\ Effect = \frac{(Price_{+30min} - Price_{-1hour})}{Price_{-1hour}}$. All returns are in percent.

*Significant at 0.10.
**Significant at 0.05.
***Significant at 0.01.

APPENDIX 1

The Intercontinental Exchange Future Europe (also called IFEU) was established in 1981 as the International Petroleum Exchange (IPE) for regulating trades of future contracts with underlying commodities such as crude and refined oil, natural gas, coal, power and emissions. More recently, IFEU[11] has introduced interest rates and equity derivatives following the acquisition of the London International Financial Futures and Options Exchange (LIFFE)[12] and is considered the third largest futures exchanges in the globe[13]. In its open electronic and automated trading platforms, the exchange has the independent ICE Block[14] that allow clearing members to submit solely off-market (away from the central order book) trades. Blocks are pre-negotiated large volume transactions that are submitted with all the information details entered by at least one of the counterparties. For those particular trades, ICE provides some facilities (so-called Block Trade Facility – BTF) to ease the trading of futures contracts contained in its franchise and to minimise the price impact that usually occurs when large orders are transacted in the central markets.

FTSE 100 index future, one of the three most traded future in Europe, is a derivative contract with daily cash settlement, whose underline (FTSE 100 stock index of U.K. most highly capitalised companies) is traded from 8 am to 4:30 pm London time for order book trading, and from 7:30 am to 5:30 pm London time for trade reporting. The listing day for this

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[11] Registered exchange and regulated by the Financial Conduct Authority (FCA) in U.K. and Commodity Futures Trading Commission (CFTC) for U.S. linked products.

[12] The LIFFE was actually acquired by Euronext in 2002 before the merge activity between Euronext and NYSE in 2007. In 2013 ICE purchased NYSE Euronext including the LIFFE business, although Euronext exited in 2014.

[13] After the CME (Chicago Mercantile Exchange) Group and the National Stock Exchange of India (NSE).

[14] ICE Block application is designed to easily connect traders to clearing and provides advanced functionality that streamlines the submission of off-exchange trades for clearing.

instrument is the Monday preceding expiration day each month (or the previous day when this is not a trading day), while the expiration day is the 3rd Friday of the delivery month (or the previous day when this is not a trading day), namely following the March, June, September and December quarterly maturity cycle. Once the expiry value is determined, trading finishes at 10:15 am London time, but the daily settlement price is calculated on the closing value of the FTSE 100 index computed each trading day five minutes after the closing auction (4:35 pm London time) on the London Stock Exchange (LSE). Finally, the expiration settlement price is determined on the value of FTSE 100 index at 10:15 am (London time) or as soon as reasonably practicable, following the intraday auction on LSE, plus 30 seconds random intervals and any price monitoring extensions or market order extensions in any of the constituent stocks. Despite the underline contract is traded on LSE, trading of FTSE 100 index futures takes place on ICE during different trading hours: from 1 am to 9 pm London time with a pre-open at 12:45 am, which corresponds to the New York time from 8 pm to 4 pm, with a pre-open at 7:45 pm, and Singapore time from 8 am to 4 am, with a pre-open at 7:45 am.

When it comes to off order book (off-market) trading and trades with large volumes, however, there are some rules that need particular attention. While U.K. futures were traded even before ICE acquired IPE in 2001 and LIFFE in 2013, Block Trade Facilities were first introduced by the end of May 2002, incorporating FTSE 100 index futures only in November 2014 from the LIFFE commodities. According to the new rules of the ICE Futures Europe Block Trades and Asset Allocation released on February 2018, members are enabled to report for clearing high volume trades arranged and executed away from the order book in FTSE 100 index futures designated by the exchange. The period for the submission of a block trade to the exchange commences as soon as verbal agreement on the terms of the block trade is reached between the parties. Where a trade is executed during a trade reporting period (7:30 am – 5:30 pm London time), the trading system will immediately publish a trade report unless deferred publication is requested by one of those members, and the trade qualifies for a delay. As per the current ICE Futures Europe Block Trades Rules, block trades of FTSE 100 index futures can be reported to the market by the exchange 1 hour after the trade is actually executed. However, for trade to be eligible for deferred publication, the trade size not only has to be classified as block and hence meet the minimum volume threshold of 500 lots[15], but it also must meet the Post Trade Large in Scale (LIS) value, which is 2048 for FTSE 100 index futures[16]. All the details of block trades must be then entered into the exchange after agreement on the terms reached between the parties within the reporting time limit requirement, but not after the contract expires. The time of arrangement of the block trade must also be recorded by the arranging members on the order slip. Block trades may take place during trading hours, with the above-mentioned reporting timeline for qualified delays, and overnight (from 9 pm to 1 am London time) with. Off-market block trades of FTSE 100 index futures can occur at prices other than those occurring on the order book of ICE, since there are no price limits applying to them[17].

[15] In order to meet the block trade threshold, brokers are not allowed to aggregate separate orders from different clients.

[16] In 2014 there was a minimum volume threshold of 500 lots even for a non-publication request, while the differed publication was introduced just with the MiFID II in February 2018 with a (higher) Post Trade LIS of 3328.

[17] According to the rule F.7.5, traders on ICE shall ensure that the price of the block trade being quoted represents the fair market value for that trade, but it relates to the block trade and not necessarily the prevailing market price.

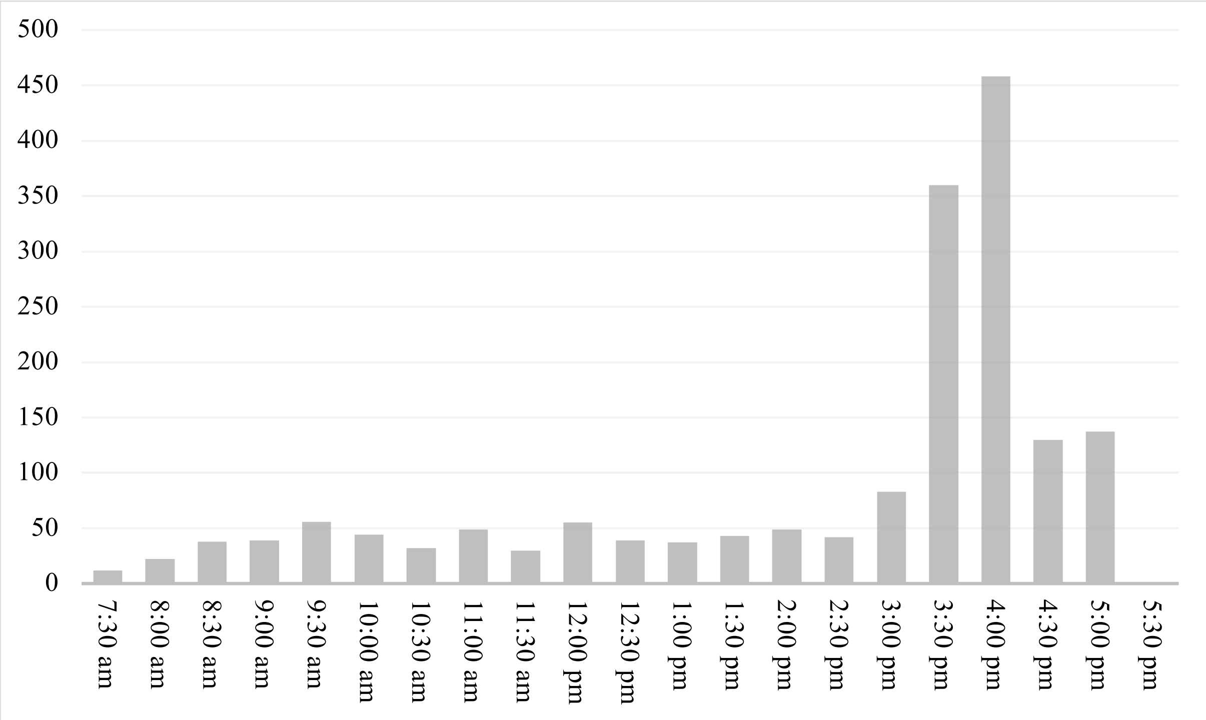
APPENDIX 2

Figure 1 documents the intraday distribution of our full sample showing an intriguing pattern of block trades evenly distributed around the last hours of normal daily trading activities (both trading and reporting times) for the underline FTSE 100 stock index contract. This is interesting since it is completely different from what can be seen in equity markets analyzed by previous research. Figure 2, instead, shows both the weekly and monthly distribution of those block trades executed on ICE in FTSE 100 index futures, with a general trend of being transacted more in the middle of the week and in the second quarter of the year once the busy period of the quarterly maturity cycle is excluded.

[INSERT FIGURE 1 AND FIGURE 2 ABOUT HERE]

FIGURE 1 The intraday distribution of block trades executed in our full sample on ICE in FTSE 100 index futures

(a) *For trades which occur in normal daytime trading*



(b) *For trades which occur in the busiest hour of normal daytime trading*

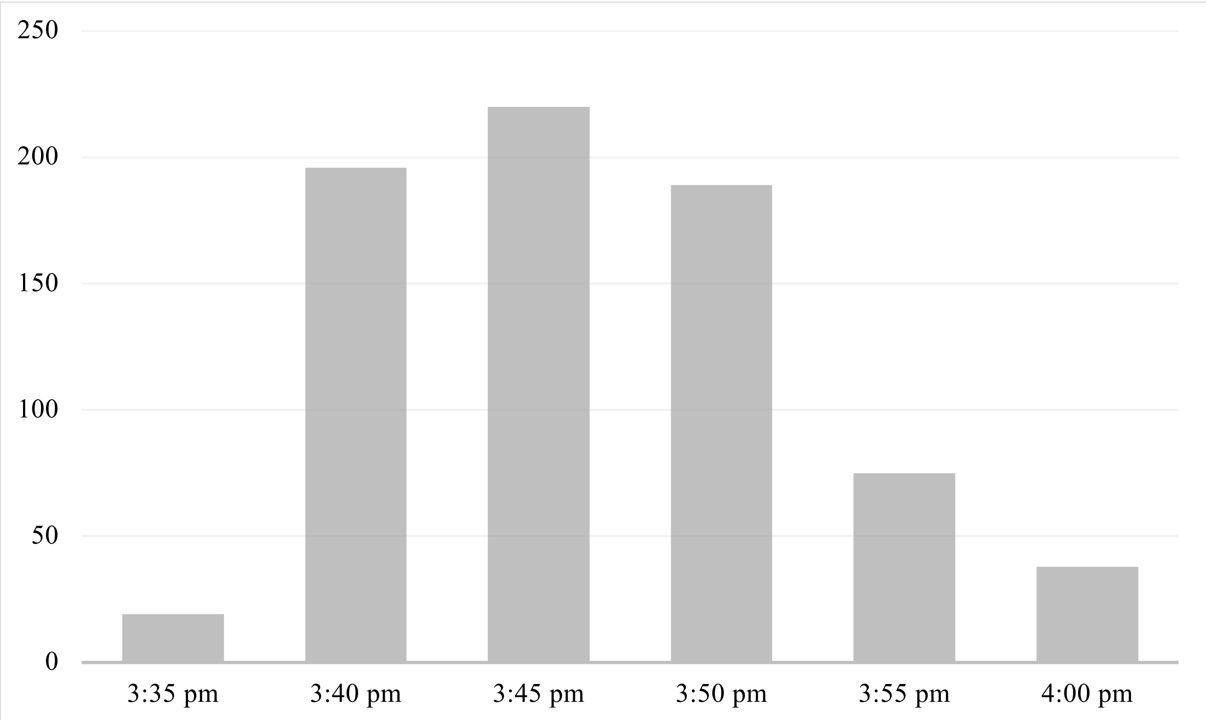
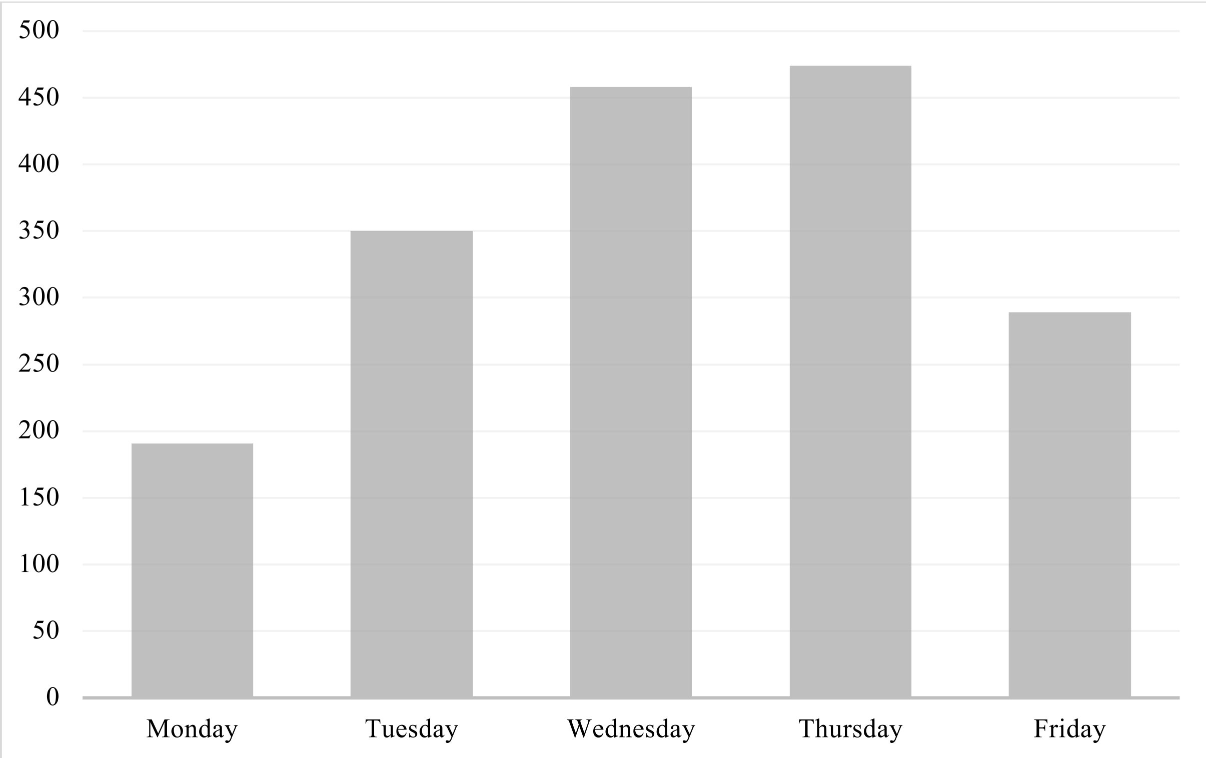


FIGURE 2 The weekly and monthly distribution of block trades executed in our full sample on ICE in FTSE 100 index futures

(a) *The day of the week distribution of block trades*



(b) *The monthly distribution of block trades*