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RESEARCH ARTICLE

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# 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 Financial Times Stock Exchange futures contracts provided by the Intercontinental Exchange, which eliminated the ability of market participants to request a delay in reporting smaller sized off-market trades in 2018. We find 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, such delays encourage informed trading and potentially increase the informativeness of trading and, therefore, information efficiency.

**KEYWORDS**

block trades, deferred publication, informed trading, market microstructure, price impact

**JEL CLASSIFICATION**

C58, D82, G13, G14, G18

## 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 United States (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 they are executed by informed traders. Another strand of the literature has examined the effect of the delay in reporting off-market trading including Gemmill (1996) and Frino (2021). Gemmill (1996) examines the impact of block trades on the London Stock Exchange (LSE) 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 behavior following a change in rules, which allows a delay in reporting off-market trades, and is unable to find any evidence of a change in price behavior at the time that they are executed.[1] This implies that the price behavior 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. First, 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 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 is 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.[2]

The Intercontinental Exchange (ICE) changed its rules relating to the publication of block trades in 2018 (ICE circular number 18/026). For Financial Times Stock Exchange (FTSE) 100 index futures—one of the most actively traded equity futures contracts on the ICE—any block trade (which needed to be greater than 500 lots) could be reported with a delay of up to 1 h. However, on February 19, 2018 the threshold for delayed reporting of block trades was increased to 3328 lots. This meant that trades whose size was between 500 and 3328 lots, which previously could be reported with a delay of up to 1 h, 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. Sections 2 and 3 review the description of the data and method used, and empirical findings, respectively. Section 4 concludes, and the appendices provide institutional details and descriptive graphics.

## 2 | DATA AND METHOD

### 2.1 | Data and trade direction

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 transactions data

[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).

[2]Frino and West (1999) provide evidence that informed traders are present in futures markets, while Frino et al. (2009) identify a group of traders (hedgers) that are likely to be uninformed traders and significant users of futures contracts that are not present in equities markets. Frino et al. (2004) identify a possible weakness in stock index futures stemming from their underlying index that limits their effectiveness to informed and uninformed traders.

for the FTSE 100 index futures contracts traded on the ICE. The sample spans a 1-year period extending from August 21, 2017 to August 17, 2018, and covering a symmetrical pre- and postperiod of nearly 6 months around the change in the Block Trade Facility (BTF) amended by ICE on February 19, 2018, which follows the introduction of the MiFID II Transparency Auction.[3] The unique microstructure data set 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 Reuters Identification Code (RIC) of the instrument.[4] 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 data set allows us to distinguish between block trades and strategy[5] block trades through the exchange information provided to Refinitiv indicating the off-market trade type. We finally merged the two data sets by RIC and date–time to the nearest hundredth of a second.

Contrary to many studies in the empirical microstructure literature, our data identify the direction of the transactions that determines which side of the market initiated a trade. While on-market transactions have 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.[6] Because we eliminate trades and quotes transactions that occur out of the exchange trading hours for the FTSE 100 index futures contract (from 1 a.m. to 9 p.m. London time), each off-market block trade in the sample can be classified[7] using the so-called "tick" rule (see Holthausen et al., 1987, 1990; Kraus & Stoll, 1972; Lee & Ready, 1991): (i) up-ticks are trades executed at a premium price with respect to the price of the on-market trades; (ii) down-ticks are trades executed at a discount price; and (iii) zero-ticks are trades executed at the same price of the on-market trades. Hence, this study compares the block trade prices with the price of the on-market trade (not classified as a block) in the limit order book being executed 1 h 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 categorize the side of the block transaction as premium (discount), while we classify block trades as zro-tick if those prices are equals.[8] This approach is similar to the Lee and Ready (1991) algorithm, which is consistently used in a large number of previous studies examining the price impact of block trades in upstairs markets (e.g., Bessembinder & Venkataraman, 2004; Booth et al., 2002; Frino, 2021; Gemmill, 1996; Keim & Madhavan, 1996; Madhavan & Chen, undefined; Smith et al., 2001). In addition, we delete any quotes where the bid price is higher than the ask price, or the bid or ask is lower than zero. As the last step of our cleaning procedure, for higher accuracy, we rely on the autoregressive conditional duration of Engle and Russell (1998), following Brownlees and Gallo (2006), and eliminate all outlier observations. This enables us to avoid any biases from abnormal peaks or misleading observations erroneously recorded in our high-frequency data set.

## 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 posttrade 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 1 h after the counterparties

[3]MiFID II stands for Markets in Financial Instruments Directive 2 and it is the new directive (2014/65/EU) regulating the financial markets of the European Union from the 3 January 2018.

[4]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.

[5]A "strategy" happens when a Block Trade involves more than one contract month of the same or different IFEU futures contracts. It also has a 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 types of trades and got similar results.

[6]Which records them in a separate database not shared with third parties.

[7]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, which is neither symmetrically opposite.

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

agreed upon the transaction. While before the 19th of February 2018 every block trade could be deferred (i.e., the threshold for requesting a delayed publication was 500 lots), after that day, the minimum size increased to 3328 lots. The delay duration of 1 h, however, remained the same.

By using this change in the BTF, we divide the sample period into two subperiods of nearly 6 months each[9] 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 allowed 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, hence, being more likely to be information motivated. Thus, this study defines the control samples as the ones comprising all the block trades that remain, in both periods, into the delayed reporting regime, namely, those with a size greater than 3328 lots. We finally define the experimental sample as the set of trades 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.

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, do not contain information, we exclude from the sample the 10 trading days preceding the delivery of the contract.[10] From 6321 observations, additionally, we also eliminate all the trades classified as strategy[11] to avoid any other transactions lacking information that could bias our findings, leaving a sample of 3466 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 on the same day at the same time (to the nearest hundredth of a second) and price. This is known as VWAP, the volume-weighted average price (see Foucault et al., 2013):

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

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

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

$$Total\ \ Effect = \frac{(OffbookPrice_{0} - Price_{-1\,\mathrm{h}})}{Price_{-1\,\mathrm{h}}}, \tag{3}$$

where $Price_{+30\,\mathrm{min}}$ is the trade price 30 min after the off-market trade, $Price_{-30\,\mathrm{min}}$ is the trade price 30 min before the off-market trade, $Price_{-1\,\mathrm{h}}$ is the trade price 1 h before the off-market trade, and $OffbookPrice_0$ is the off-market trade[12] price taken as time 0. The same price effects are computed around the trade execution time by assuming that block

[9]This is done to reduce any biases arising from different broad seasonal patterns in the microstructure.

[10]This is consistent with Frino and McKenzie (2002) and Frino and Oetomo (undefined) that find smaller price effects, lower spreads, and increased activities in the period preceding the contract delivery. Frino et al. (2007) also proxy 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 Section 3. These findings are available from the authors on request.

[11]We run a robustness test also in this case, to include those transactions in the analysis and get similar results as those shown in Section 3. These findings are available from the authors on request.

[12]If two off-market trades are found within our 2-h range, we exclude from the calculation of the price effects the previous off-market trade and carry the analysis around the last block containing more information (which also carries the information of the previous trades).

trades with a size larger than the minimum LIS threshold and in a delayed publication regime actually occurred 1 h before the observation of our data set 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.

Table 1 illustrates the different samples in terms of trade count and distinguishes between block trades executed before (panel A) and after (panel B) February 19, 2018, which is when the change in the LIS threshold for deferred publication requests was amended by ICE. The overall sample consists of 1763 premium off-market trades, of which 974 were executed before the change in the policy of ICE and 789 after, and 1703 discount trades, of which 936 were executed before and 767 after the change in the BTF. Table 1 also shows that the mean of off-market block trades executed before and after the minimum threshold change are, respectively, 1041 and 1200 for premium transactions and 1250 and 1129 for discounts. This suggests that the two samples are roughly balanced. The same inference is supported by the distribution profiles of standard deviations. Although the control samples (lot size higher than 3328) are significantly different from the experimental samples (lot size between 500 and 3328), it still offers an important albeit limited form of control.

Table 2 documents the description of premium and discount transactions. We measure the total impact as the return, in relative terms, from 1 h before the off-market block trade is reported (thus the time we assume it is executed) to the time in which it was actually reported. The reporting of premium and discount block trades at any level shows a significant total price reaction. Total effect for premium averages between 1 and 4 basis points (for control and treatment sample, respectively), while for a discount between −3 and −6 basis points. The magnitude of off-market block trades in our sample is therefore slightly smaller than previous research examining futures markets (Frino, 2021), and other studies examining equity markets (Keim & Madhavan, 1996; Madhavan & Cheng, 1997). However, all the *t* tests carried out are statistically significant at the 1% level, implying the existence of a market impact between the time off-market block trades are executed and the time they are later reported to the market.

**TABLE 1** Descriptive statistics of volume for off-market trades

| | **Premium** | | | **Discount** | | |
|---|---|---|---|---|---|---|
| **Lot size** | **500–3328** | **>3328** | **All** | **500–3328** | **>3328** | **All** |
| Panel A: Before change in posttrade LIS threshold | | | | | | |
| Median | 1000 | 4637 | 1041 | 1150 | 4434 | 1250 |
| Mean | 1259 | 5227 | 1568 | 1334 | 5215 | 1657 |
| SD | 713.709 | 1722.836 | 1353.754 | 698 | 2089 | 1400 |
| *n* | 898 | 76 | 974 | 858 | 78 | 936 |
| Panel B: After change in posttrade LIS threshold | | | | | | |
| Median | 1001 | 4427 | 1200 | 1023 | 4621 | 1129 |
| Mean | 1278 | 4840 | 1612 | 1305 | 5297 | 1638 |
| SD | 707.172 | 1703.898 | 1342.240 | 741 | 2101 | 1444 |
| *n* | 715 | 74 | 789 | 703 | 64 | 767 |

*Note*: This table describes the distribution of volumes of premium and discount off-market trades executed in FTSE 100 futures on the ICE during normal daytime trading hours between August 2017 and August 2018. Premium and discount off-market trades have been estimated by comparing the off-market trade prices, at the time they are reported, to the prices of the on-market trades at the time off-market trades are executed. Volume is the number of contracts executed in the trade.

Abbreviations: FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange; LIS, Large in Scale.

**TABLE 2** Statistics of premium and discount off-market trades

| Sample (lots size) | Premium Mean | t test | N | Discount Mean | t test | N |
|---|---|---|---|---|---|---|
| Panel A: Before change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.0494 | 13.03*** | 898 | −0.079 | −13.03*** | 858 |
| Control (>3328) | 0.0283 | 2.64*** | 76 | −0.078 | −5.31*** | 78 |
| Panel B: After change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.11 | 22.78*** | 697 | −0.124 | −24.07*** | 681 |
| Control (>3328) | 0.0597 | 4.63*** | 73 | −0.111 | −5.25*** | 64 |
| Panel C: Differences before and after change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.06 | 139.26*** | 1595 | −0.05 | −76.70*** | 1539 |
| Control (>3328) | 0.03 | 8.09*** | 149 | −0.03 | −5.44*** | 142 |

*Note*: This table reports statistics for returns around a sample of premium and discount off-market trades executed in FTSE 100 futures on the ICE between August 2017 and August 2018 during the 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 prices, at the time they are reported, to the prices of the on-market trades at the time off-market trades are executed. Reported in the table are the *t* test on the mean return computed from 60 min before 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 $Total\ \ Effect = \frac{(OffbookPrice_0 - Price_{-1\,h})}{Price_{-1\,h}}$. All returns are in percent.

Abbreviations: FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange; LIS, Large in Scale.

*Significant at 0.10.

**Significant at 0.05.

***Significant at 0.01.

## 3.2 | Price impact around execution times of off-market trades

Table 3 documents the permanent price impact around block trades at execution time. Trades are executed in FTSE 100 index futures on the ICE between February 2017 and February 2019 during the normal daytime trading sessions (1:00 a.m.–9:00 p.m.). In this analysis, for trades greater than 500 lots that occur before the change in the BTF and trades larger than 3328 lots occurring after February 19, we assume that block trades were actually executed 1 h before the reporting time indicated in our data set. By comparing the off-market trade prices, at the time they are reported, to the prices of the on-market trades at the time off-market trades are executed, we estimate the premium and discount transactions. The event study is then carried out on those block trades following Gemmill's (1996) methodology. Mean excess returns are, therefore, computed in a 10-min window by subtracting the normal return from −5 to +5 a benchmark return measured over trades −19 to −10 (see Gemmill, 1996).

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), although the magnitude reported in Table 2 of Gemmill (1996) is slightly greater. In other words, regardless of the reporting time of block trades, there is evidence of a statistically significant positive premium price adjustment and negative and statistically significant price reaction at the time that discount block trades are executed. This price behavior is consistent with the 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. Figure 1 reports the exact same results of Gemmill's (1996) event study around execution times of block trades under different publication regimes. Hence, those findings, prima facie, imply that reporting delays have no relevance for competition across market participants since exploiting any information advantages is prevented.

## 3.3 | Price impact around reporting times of off-market trades

Table 4 illustrates the permanent price impact around off-market block trades at reporting time. The permanent impact is computed as the return from 30 min before the off-market block trade is reported to 30 min after. Trades are executed

**TABLE 3** Event study around the time that off-market trades are executed

| | Premium | | | | | Discount | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Median | Mean | SD | *t* test | *n* | Median | Mean | SD | *t* test | *n* |
| *Panel A: Before change in posttrade LIS threshold* | | | | | | | | | | |
| −5 | 0.001 | 0.047 | 0.001 | 16.90*** | 2310 | 0.006 | 0.002 | 0.003 | 1.04 | 3054 |
| −4 | 0.001 | 0.049 | 0.002 | 14.77*** | 2310 | 0.007 | 0.011 | 0.002 | 2.32** | 3054 |
| −3 | 0.002 | 0.048 | 0.001 | 15.72*** | 2310 | 0.007 | 0.005 | 0.003 | 0.84 | 3054 |
| −2 | 0.001 | 0.022 | 0.001 | 16.87*** | 2310 | 0.006 | −0.002 | 0.003 | −0.48 | 3054 |
| −1 | 0.003 | 0.050 | 0.002 | 15.07*** | 2307 | 0.007 | 0.026 | 0.003 | 5.59*** | 3054 |
| 0 | 0.087 | 0.141 | 0.002 | 36.64*** | 2307 | −0.086 | −0.144 | 0.003 | −24.54*** | 3054 |
| 1 | −0.060 | −0.048 | 0.002 | −13.79*** | 2307 | 0.102 | 0.153 | 0.003 | 24.17*** | 3054 |
| 2 | 0.002 | 0.043 | 0.001 | 13.00*** | 2307 | 0.004 | 0.010 | 0.003 | 2.44** | 3053 |
| 3 | 0.001 | 0.047 | 0.001 | 14.52*** | 2307 | 0.007 | 0.014 | 0.002 | 1.31 | 3053 |
| 4 | 0.002 | 0.047 | 0.001 | 14.26*** | 2306 | 0.007 | 0.018 | 0.002 | 5.09*** | 3053 |
| 5 | 0.001 | 0.043 | 0.001 | 15.44*** | 2306 | 0.006 | 0.016 | 0.002 | 4.71*** | 3053 |
| *Panel B: After change in posttrade LIS threshold* | | | | | | | | | | |
| −5 | 0.000 | −0.003 | 0.003 | 0.42 | 1528 | 0.000 | −0.004 | 0.001 | −1.97** | 1414 |
| −4 | 0.000 | 0.015 | 0.004 | 1.66* | 1523 | 0.000 | 0.002 | 0.001 | 0.95 | 1412 |
| −3 | 0.000 | 0.004 | 0.002 | 0.21 | 1523 | 0.000 | −0.009 | 0.002 | −1.61 | 1413 |
| −2 | 0.000 | 0.010 | 0.003 | 1.83* | 1523 | −0.003 | −0.007 | 0.001 | −3.91*** | 1413 |
| −1 | 0.000 | −0.001 | 0.003 | −0.74 | 1517 | 0.000 | −0.002 | 0.001 | −0.33 | 1414 |
| 0 | 0.079 | 0.170 | 0.003 | 12.92*** | 1517 | −0.119 | −0.146 | 0.002 | −29.01*** | 1413 |
| 1 | −0.078 | −0.103 | 0.003 | −13.80*** | 1517 | 0.085 | 0.138 | 0.002 | 31.20*** | 1414 |
| 2 | 0.000 | 0.000 | 0.002 | 0.14 | 1517 | 0.000 | −0.010 | 0.001 | −2.73*** | 1414 |
| 3 | 0.000 | 0.002 | 0.002 | 0.04 | 1517 | 0.000 | −0.001 | 0.001 | −1.54 | 1414 |
| 4 | 0.000 | 0.001 | 0.001 | 1.07 | 1517 | 0.000 | 0.003 | 0.001 | 2.41** | 1412 |
| 5 | 0.000 | 0.001 | 0.002 | 1.65* | 1517 | 0.000 | −0.006 | 0.001 | −2.28** | 1414 |

*Note*: This table reports statistics for returns around a sample of premium and discount off-market trades executed in FTSE 100 futures on the ICE between August 2017; and August 2018; 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 prices, at the time they are reported, to the prices of the on-market trades at the time off-market trades are executed. Reported in the table are the *t* tests on the mean excess return computed in a 10-min window by subtracting to the normal return from −5 to +5 a benchmark return measured over trades −19 to −10 (see Gemmill, 1996). Distinction is given for samples of trades executed before and after the amended new policy for delayed reporting of block trades. All returns are in percent.

Abbreviations: FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange; LIS, Large in Scale.

*Significant at 0.10.

**Significant at 0.05.

***Significant at 0.01.

in FTSE 100 index futures on the ICE between August 2017 and August 2018 during the normal daytime trading sessions (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 and 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 0.05% and −0.05%,

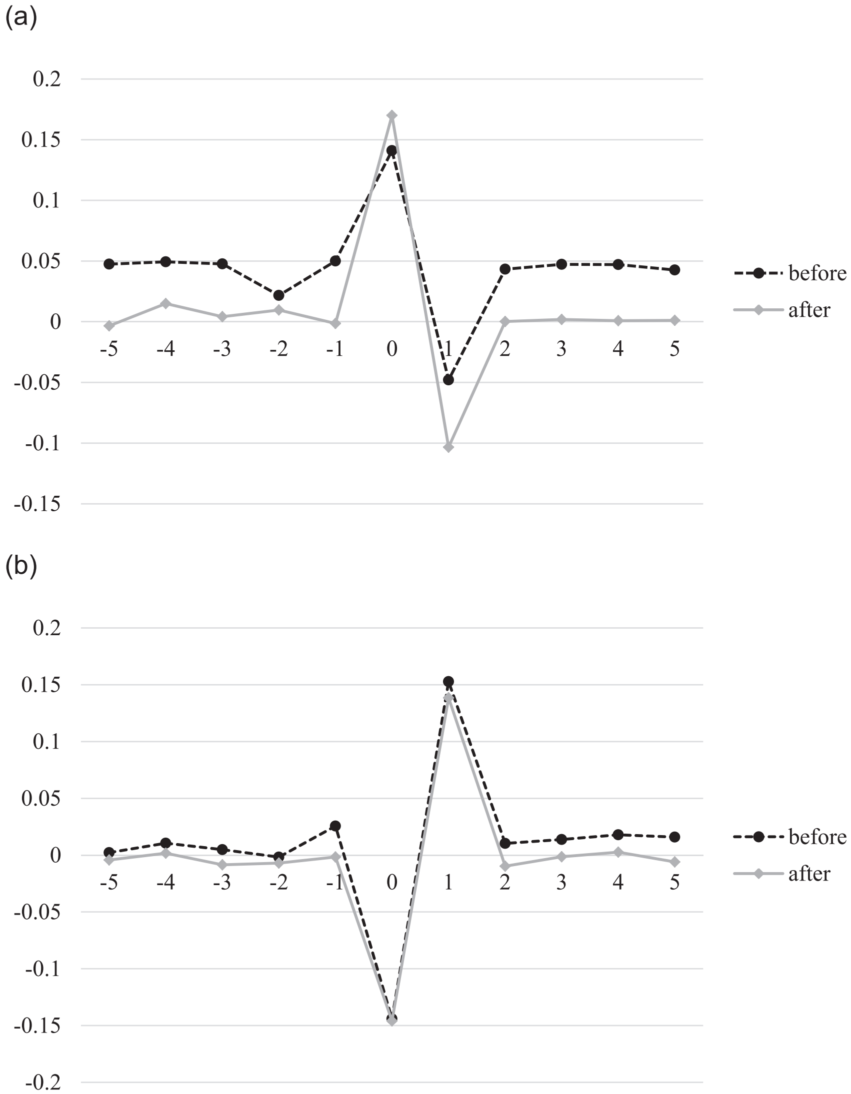


**FIGURE 1** Mean impact of excess returns around the time off-market trades are executed. (a) Premium off-market block trades by publication regimes and (b) discount off-market block trades by publication regimes

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. The permanent price impact drastically decreases when off-market trades are forced to be reported immediately after being executed.

Panel C of Table 4, indeed, exhibits a statistically significant decrease for the permanent impact at the premium and a statistically significant increase for the permanent impact at the discount. However, this is true only for the experimental sample. There is no significant change in the information component of off-market block trades being always under a delayed publication regime (see control samples). The *t* tests of panel C are carried out on the difference between the two permanent impacts, 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 samples. 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 immediately published. As documented in previous research cited above, this effect indicates that block trades carry (asymmetric) 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 price knowledge, and hence that they are more likely to use off-market trades. This, in turn, implies that informed traders are less likely to use off-market trades and, therefore,

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

| Sample (lots size) | Permanent effect | | | | | |
|---|---|---|---|---|---|---|
| | Premium | | | Discount | | |
| | Mean | t test | N | Mean | t test | N |
| Panel A: Before change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.0532 | 13.55*** | 903 | −0.047 | −9.20*** | 865 |
| Control (>3328) | 0.066 | 6.43*** | 76 | −0.094 | −4.77*** | 79 |
| Panel B: After change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.0014 | 0.20 | 698 | −0.024 | −3.28*** | 693 |
| Control (>3328) | 0.0508 | 2.95*** | 74 | −0.091 | −4.92*** | 64 |
| Panel C: Differences before and after change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | −0.0518 | −92.96*** | 1601 | 0.023 | 36.22*** | 1558 |
| Control (>3328) | −0.0152 | −3.29*** | 150 | 0.003 | 0.46 | 143 |

*Note*: This table reports statistics for returns around a sample of premium and discount off-market trades reported in FTSE 100 futures on the ICE between August 2017 and August 2018 during the 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 prices, at the time they are reported, to the prices of the on-market trades at the time off-market trades are executed. Reported in the table are the *t* test on the mean return computed from 30 min before the off-market trade is reported to 30 min 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 $Permanent\ \ Effect = \frac{(Price_{+30\ min} - Price_{-30\ min})}{Price_{-30\ min}}$. All returns are in percent.

Abbreviations: FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange; LIS, Large in Scale.

*Significant at 0.10.

**Significant at 0.05.

***Significant at 0.01.

seek other (more costly) ways of concealing their information, or otherwise leave the market in the presence of immediate reporting.

In Table 5 we carry out the same price impact analysis by computing the permanent effect from 1 h and 30 min before the off-market trade is reported to 30 min after. This enables us to measure the market impact of both execution and reporting times taken together. As for Table 4, there is an even greater, and significant, permanent price effect for both premium and discount transactions when block trades are allowed to be reported with a delay. This is not true when the latter are forced to be instantaneously published, as there is a statistically significant decrease in the price impact of the treatment sample, being even smaller than the one shown in Table 4 that does not incorporate the execution effect with the reporting. The control samples in both tables, in addition, demonstrate that, as expected, there is no change in the information effects when trades are always under the same posttrade 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 h of delay in both periods before and after the change in the block trade policy), always have a statistically significant permanent price impact.

This inference provides even stronger robustness to the findings of the experimental samples and, more importantly, to our assumption of informed traders leaving the market once forced to report their information advantage immediately. Stated differently, 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 threshold, thus, informed traders will profit by selecting larger trade sizes. 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 the deferred reporting regime is more likely to encourage informed trading, and hence information efficiency. 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 posttrade LIS threshold for deferred publication of block trades in the UK futures markets.

**TABLE 5** Permanent price impact around reporting and execution times of off-market trades

| | Permanent effect | | | | | |
|---|---|---|---|---|---|---|
| | Premium | | | Discount | | |
| **Sample (lots size)** | **Mean** | ***t* test** | ***N*** | **Mean** | ***t* test** | ***N*** |
| Panel A: Before change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.0747 | 13.40*** | 902 | −0.087 | −12.73*** | 864 |
| Control (>3328) | 0.107 | 7.86*** | 76 | −0.125 | −4.91*** | 79 |
| Panel B: After change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | 0.002 | 0.20 | 695 | −0.027 | −2.67*** | 693 |
| Control (>3328) | 0.129 | 5.46*** | 74 | −0.125 | −5.28*** | 64 |
| Panel C: Differences before and after change in posttrade LIS threshold | | | | | | |
| Experimental (500–3328) | −0.0727 | −91.38*** | 1597 | 0.06 | 69.19*** | 1557 |
| Control (>3328) | 0.022 | 3.50*** | 150 | 0.00 | 0.00 | 143 |

*Note*: This table reports statistics for returns around a sample of premium and discount off-market trades reported in FTSE 100 futures on the ICE between February 2017 and February 2019 during the 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 prices, at the time they are reported, to the prices of the on-market trades at the time off-market trades are executed. Reported in the table are the *t* test on the mean return computed from 1 h and 30 min before the off-market trade is reported to 30 min 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 $Permanent\ \ Effect = \frac{(Price_{+30\text{ min}} - Price_{-90\text{ min}})}{Price_{-90\text{ min}}}$. All returns are in percent.

Abbreviations: FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange; LIS, Large in Scale.

*Significant at 0.10.

**Significant at 0.05.

***Significant at 0.01.

## 4 | CONCLUSION

By examining price behavior around a sample of off-market block trades of FTSE 100 index futures, this paper aimed to understand the information role played by the deferred publication of off-market block trades in market efficiency. Using a powerful natural experiment, our results contribute to the existing literature by documenting that, when the information associated with off-market trades is forced to be impounded in prices because immediate reporting is required, then upstairs traders are squeezed out of the market. Consequently, deferring the information revelation process in off-market trades suggests, prima facie, that delayed reporting reduces information efficiency. However, on the other hand, it fosters informed trading by allowing upstairs traders to protect their information and, hence, make prices more efficient. One reason markets prices are generally efficient is because traders invest in information searches, and, thus, become informed. If there is too much transparency (immediate disclosure is forced) on block trades, then the ability to recover the cost of becoming informed is reduced, which, in turn, implies that the incentive to seek information that will make prices efficient is almost removed, making prices more inefficient. Our results are consistent with the Grossman and Stiglitz (1980) proposition that market prices need to be sufficiently noisy to allow the costs of information searches to be recovered.

Our findings also provide practical insights for both regulators—by suggesting how to implement a more transparent market design for their exchanges—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 also relies on the examination of a significant policy change, which relates to an area that has been underresearched in the last decades in contrast with the proliferation of block trade facilities in futures markets (Frino, 2021).

To conclude, this study opens further areas for future research. Colocations could be further assessed in terms of both permanent and total price impact, with a test examining how long the temporary price impact is observed for different trade sizes. It may be useful to also test any contagion effects of the block trading issue that may be caused by overseas markets which trade on the FTSE 100 index futures. We ultimately suggest examining the consistency of these results around major macroeconomic information disclosures, which are relevant for index futures trading platforms.

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## DATA AVAILABILITY STATEMENT

Research data are not shared. The data that support the findings of this study are available from Refinitiv, an LSEG business, and Rozetta Institute (formerly CMCRC-SIRCA). 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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## APPENDIX A: INSTITUTIONAL DETAILS OF ICE AND FTSE 100 INDEX FUTURES

The ICE 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[13] has introduced interest rates and equity derivatives following the acquisition of the London International Financial Futures and Options Exchange (LIFFE)[14] and is considered the third-largest futures exchanges in the globe.[15] In its open electronic and automated trading platforms, the exchange has the independent ICE Block[16] that allows clearing members to submit solely off-market (away from the central order book) trades. Blocks are prenegotiated 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 BTF) to ease the trading of futures contracts contained in its franchise and to minimize the price impact that usually occurs when large orders are transacted in the central markets.

FTSE 100 index futures, one of the three most traded future in Europe, is a derivative contract with daily cash settlement, whose underlying (FTSE 100 stock index of the UK's most highly capitalized companies) is traded from 8 a.m. to 4:30 p.m. London time for order book trading, and from 7:30 a.m. to 5:30 p.m. London time for trade reporting. The listing day for this 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 a.m. London time, but the daily settlement price is calculated on the closing value of the FTSE 100 index computed each trading day 5 min after the closing auction (4:35 p.m. London time) on the LSE. Finally, the expiration settlement price is determined on the value of FTSE 100 index at 10:15 a.m. (London time) or as soon as reasonably practicable, following the intraday auction on LSE, plus 30-s random intervals and any price monitoring extensions or market order extensions in any of the constituent stocks. Despite the fact that the underlying contract is traded on LSE, trading of FTSE 100 index futures takes place on ICE during different trading hours: from 1 a.m. to 9 p.m. London time with a preopen at 12:45 a.m., which corresponds to the New York time from 8 p.m. to 4 p.m., with a preopen at 7:45 p.m., and Singapore time from 8 a.m. to 4 a.m., with a preopen at 7:45 a.m.

[13]Registered exchange and regulated by the Financial Conduct Authority (FCA) in the UK and Commodity Futures Trading Commission for the US linked products.

[14]The LIFFE was actually acquired by Euronext in 2002 before the merger activity between Euronext and New York Stock Exchange (NYSE) in 2007. In 2013 ICE purchased NYSE Euronext including the LIFFE business, although Euronext exited in 2014.

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

[16]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.

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 the UK 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 a 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 a.m.–5:30 p.m. 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 h 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,[17] but it also must meet the posttrade LIS value, which is 3328 for FTSE 100 index futures.[18] 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 must take place during trading hours, with the above-mentioned reporting timeline for qualified delays, and not overnight (from 9 p.m. to 1 a.m. London time). 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 applied to them.[19]

## APPENDIX B: BLOCK TRADES DISTRIBUTION OF FTSE 100 FUTURES

Figure B1 illustrates the intraday distribution of our complete 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 underlying 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 B2, 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 prematurity period of the contract is excluded from the analysis).

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

[18]In 2014 there was a minimum volume threshold of 500 lots even for a nonpublication request, while the differed publication was introduced just with the MiFID II in February 2018 with a (higher) posttrade LIS of 3328 lots (decreased to 2048 lots in September 2020).

[19]According to 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.

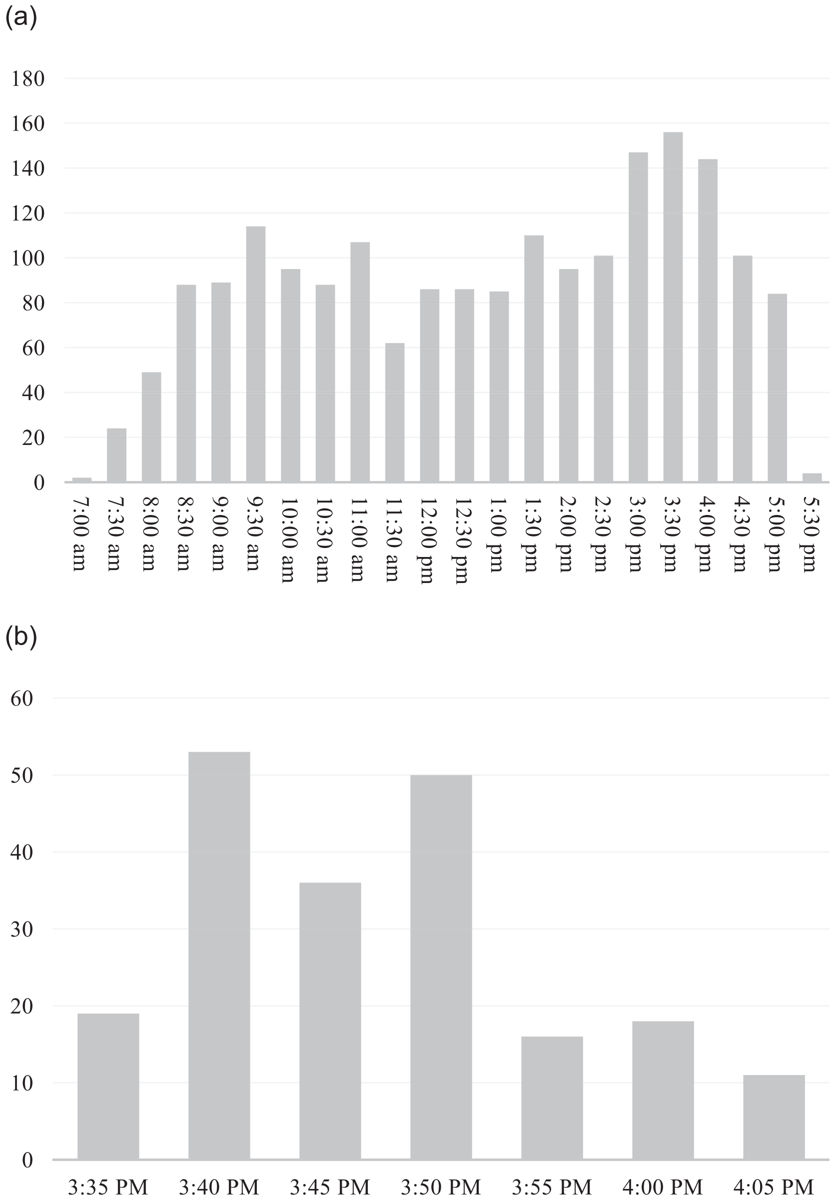


**FIGURE B1** The intraday distribution of block trades executed on ICE in FTSE 100 index futures. (a) For trades that occur in the underlying FTSE 100 daytime trading and (b) for trades that occur in the busiest hour of the underlying FTSE 100 daytime trading. FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange

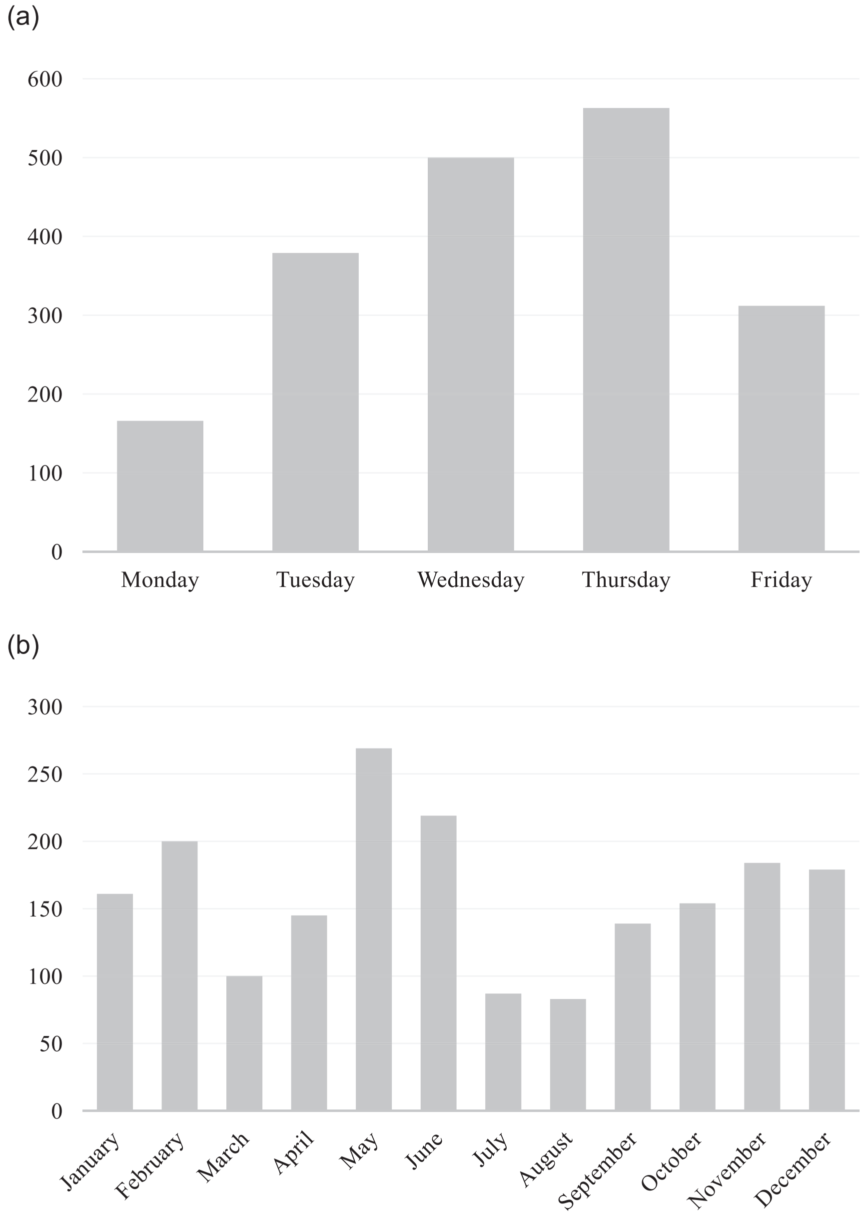


**FIGURE B2** The weekly and monthly distribution of block trades executed on ICE in FTSE 100 index futures. (a) The day of the week distribution of block trades and (b) the monthly distribution of block trades. FTSE, Financial Times Stock Exchange; ICE, Intercontinental Exchange