A note Opening Call Auctions: International evidence

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Abstract

This paper examines the opening call auction mechanism in futures markets. We examine a controversial issue surrounding the reasoning of why open to open returns exhibit greater dispersion than close to close returns and present evidence regarding the opening price mechanism of nine international derivative exchanges. We find support for Amihud and Mendelson's (1991) proposition that the long halt in trading before the market opening results in greater uncertainty and more volatile prices and furthermore, we reject George and Hwang's findings that suggest that this result is driven by the liquidity of the contract through the inherent dimensions of the contracts surveyed.

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Introduction

Despite extensive research examining inter-daily return volatilities, there is to date, little consensus amongst academics and market designers why open to open returns exhibit greater dispersion than close to close returns. Amongst the reasons advocated are alternative trading mechanisms between the market's open and close (Amihud and Mendleson, (1987)), the monopoly power of the specialist (Stoll and Whaley, (1990)) the long halt in trading before the market opening (Amihud and Mendleson, (1991)), methodological issues related to the measurement of returns (Ronen(1997)) or a combination of the aforementioned factors.

This study contributes to the literature by empirically examining this issue across nine stock index futures contracts with varying opening market structures. Previous studies have specifically focused on U.S equity markets[1] and results have consistently indicated the presence of greater transitory volatility at the open. This study differs from existing studies in that we examine the issue within a futures market framework, where contracts are inherently more liquid than stocks traded in equity markets. By examining only international index futures contracts we are able to test George and Hwang's (1995) proposition that the presence of a higher open-to-open volatility component is related to the liquidity of the stock or contract. Furthermore, the sample of exchanges empirically tested includes contracts that trade in one or multiple trading session, which makes it possible to test the Amihud and Mendelson (1991) proposition that the higher volatility at the open of the trading day is a function of the preceding non-trading period rather than the trading mechanism.

[1] See studies of Amihud and Mendelson (1987), Stoll and Whaley (1990) , Amihud and Mendelson (1991) Gerety and Mulherin (1994)

The remainder of this paper is structured as follows. Section 2 provides a review of the literature. Section 3 describes the data and methodology and section 4 presents the results. Section 5 finally provides a summary and several future research avenues.

2. Literature Review

Early empirical studies conducted on the NYSE and other international stock exchanges indicates that open to open return volatilities are up to 20% higher than close to close return volatilities.[2] Originally documenting this aberration, Amihud and Mendelson (1987) (herein AM), ascribe the deviation in return volatilities to the different trading mechanisms used at the open and close. Stoll and Whaley (1990) corroborate the results of AM (1987), however, suggest that open to open returns display greater volatility due to the ability of the specialist to exploit their monopoly power at the open. The authors theorize that the specialist, operating in the capacity of his position, is able to observe the order book prior to setting the opening price which allows him to earn a monopoly profit that is not possible during the rest of the day. Ensuing research that has examined this deviation indicates that this result is not restricted to markets that open with a call-auction.[3] AM's (1990) findings on the Italian market, that open return volatility is higher when the market opens in a continuous rather than a call auction manner introduces a third and confounding effect – that is separating the effect of the trading mechanism from the non-trading hours effect.

[2] See Amihud and Mendelson (1987), Stoll and Whaley (1990)
[3] Amihud and Mendelson (1990)

In order to discern the confounding effects, AM (1991) examine the Japanese market which has two daily trading sessions, both characterised by a call auction at the open and a continuous session to the close. They find that the morning open to open return volatility is higher than the close but not the afternoon open to open volatility supporting their conjecture that the pronounced anomaly is a function of the preceding non-trading period rather than the trading mechanism. Young et al. (2002) who show that after introducing a 30 minute pre-trading routine prior to the market's opening, opening volatility fell by over 60%[4]. This suggests that minimising the period of non-trading or lengthening the period of price discovery in the pre-opening period may mitigate issues relating to the inconsistency between open to open and close to close return volatilities.

Additional results in this matter are however, mixed. Lam and Tong (1999) examine the Stock Exchange of Hong Kong (SEHK) which is an order-driven market with no specialist system and show that open to open volatility is slightly lower than the close to close volatility.[5] Their results yield similar conclusions to those found in Stoll and Whaley (1990) who suggest that monopoly pricing is the reason for the difference in volatilities. Chang et al. examine the Japanese market using the TOPIX index return and similarly do not observe higher open to open return volatility. On the other hand Choe and Shin (1993) study the Korean market and find that both the morning and afternoon opening volatilites are significantly higher than the market closing volatility even though auction clearing is used in all these occasions. George and Hwang (1995)

[4] Also see Gerety and Mulherin (1994) who estimate transitory volatility throughout the trading day over forty years of hourly Dow Jones price index data. They show that inter-day 24-hour volatility declines steadily following the opening which is reflectant of an information processing process. They conclude that the halt of trade seems likely to be the driving force of a higher transitory volatility opening component.

[5] The SEHK has two trading sessions and opens as a continuous market and remains so until up to and including the close of trading.

challenge AM(1991) findings by showing these results exist for only a few most actively traded stocks. Ronen (1997) further considers the methodological issues and suggests that conventional average variance ratio tests is shown to be biased against the null hypothesis in small samples.

3. Data and Methodology

The data used in this study are sourced from Reuters and contains all transactions in 9 stock index futures contracts from January 1, 2005 to December 31, 2006[6]. The sample of contracts include DAX, FTSE100, CAC40, Hang Seng Index, KOSPI 200, SPI 200, TOPIX, Nikkei 225 (OSE), S&P CNX Nifty stock index futures contracts. The fields available for analysis include date, time, price, volume, best bid and best ask. Bid and ask quotes are the prevailing best quotes immediately prior to the trade.

The sample is restricted to electronic trading in the near contract during daytime trading hours.[7] Trades occurring on the expiration day of the near contract are excluded and weekend effects are also eliminated. The importance of the opening is depicted by the trade volume executed at the open which we present in Table 1. We find that on average 3% of daily volume is executed using the opening price mechanism.

For our analysis we employ a variance ratio test using daily open and close prices. Open to open returns are defined in the following manner;

[6] Only quarterly contracts have been analysed.
[7] The exception for this is S&P500 stock index futures. This contract is traded on the floor during daytime hours, and traded electronically through Globex® overnight.

$$R_{o,t} = \log(P_{o,t} - P_{o,t-1})$$

Where $R_{o,t}$ is the open-to-open return at time *t* and $P_{o,t}$ is the daily open price at time *t.* Similarly, close-to-close returns are calculated in the following manner;

$$R_{c,t} = \log(P_{c,t} - P_{c,t-1})$$

Where $R_{c,t}$ is the open-to-open return at time *t* and $P_{c,t}$ is the daily open price at time *t.*

We obtain a sequence of open-to-open and close-to-close returns which cover the very same period of time. If any changes in the underlying futures values are due to the arrival of new information (permanent) then they should be equally incorporated in the open and close return series. Any observed difference in the variances of the price series, where the variance ratio exceeds one will reflect transitory price disturbances. Furthermore, given the absence of monopoly pricing in the outlined contracts, if monopoly pricing is the reason for higher open-to-open return volatility, we should not observe any abnormality of the open-to-open volatility in the outlined markets as per the analysis of Stoll and Whaley (1990).

4. Results

Table 1 provides a comparison of the dispersion of open-to-open returns, $Var(R_{01})$, and close-to-close returns, $Var(R_{C01})$. Specifically, Panel A shows the variance of returns during the opening and closing sessions (where multiple sessions on a trading day are denoted as $Var(R_{02})$ and $Var(R_{C02})$) for the trading year, 2006. Panel B

shows the variance ratios of the respective index contracts. We observe in Panel A of Table I that the distribution of returns at the open and close of trading are comparatively small across all exchanges.

<INSERT TABLE 1>

An examination of the variance ratios in Panel B indicates, as consistent with previous empirical studies, that traders who choose to transact at the opening are usually exposed to a higher implicit transaction costs. [8] We observe that in the morning session 6 out of 8 markets have positive variance ratios. As was highlighted earlier, there is a great mixture of findings surrounding the inter-daily volatility component. Whilst Chang et al. (1993) and George and Hwang (1995) show that the opening variance ratios were no different from one for the index and stocks, respectively, on the Japanese market Choe and Shin (1993) found that inter-daily volatility was not only higher in the morning open, but also in afternoon trading sessions. This analysis is further blurred by Amihud and Mendelson (1991) analysis, which shows that while a positive volatility in the morning opening period exists on the Japanese market, the afternoon opening period does not exhibit similar traits.

Our results appear consistent with the hypothesis of Amihud and Mendelson (1991) that the long halt in trading before the market opening results in greater uncertainty and more volatile prices. We find that in the three markets with afternoon trading sessions that the opening variance ratios associated with the afternoon trading period are either less or not significantly different from unity. This combined with the fact

[8] See Amihud and Mendelson (1987)

that most exchanges exhibit a greater transitory volatility component in the morning opening session is consistent with the long halt in trading process of Amihud and Mendelson (1991).

<INSERT TABLE 2>

We also find no evidence in regards to George and Hwang's (1995) proposition that the presence of a higher open-to-open volatility component is related to the liquidity of the stock or contract. We show that these inherently liquid contracts exhibit a higher opening volatility in the morning sessions, contrary to the findings of George and Hwang (1995).

5. Conclusion

This paper presents evidence regarding the opening price mechanism of international derivative exchanges, with specific references to futures index contracts. We find support for Amihud and Mendelson's (1991) proposition that the long halt in trading before the market opening results in greater uncertainty and more volatile prices. Furthermore, we reject George and Hwang's findings that suggest that this result is driven by the liquidity of the contract through the inherent dimensions of the contracts surveyed.

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Table 1

2005-2006 Percentage of Daily Volume Executed At Open

This table reports the average volume executed at the opening (including morning and afternoon sessions, respectively) for the Osaka, Tokyo, Sydney, Nifty , HK, Korean, Deutsche and Euronext markets. Also reported is the average across exchanges between January 1, 2005 and December 31, 2006. No figure is recorded for the S&P CNX Nifty as this market is not opened with an opening auction mechanism.

	Index Contracts	**Volume (%)**
1	Osaka – Nikkei 225 (Morning Session)	4.85
1	Osaka – Nikkei 225 (Afternoon Session)	1.84
2	Tokyo – TOPIX (Morning Session)	5.52
2	Tokyo – TOPIX (Afternoon Session)	1.39
3	SFE - SPI200	3.07
4	India - S&P CNX Nifty	-
5	HK - Hang Seng Index (Morning Session)	2.59
5	HK - Hang Seng Index Afternoon Session)	0.33
6	Canada (Bourse De Montreal) – SXF	4.41
7	Korea – KOSPI	0.77
8	Deutsche – DAX	5.52
9	Euronext – LIFFE	3.53
	Average	3.00

Table 2

2006 International Comparison of Dispersion of Returns

In this table, Panel A shows the variance of returns during the opening and closing sessions (where multiple sessions on a trading day are denoted as $Var(R_{02})$ and $Var(R_{C02})$) for the trading year, 2006. Panel B shows the variance ratios of the respective index contracts.

Table 1 - 2006				
Panel A – Variances				
	$Var(R_{01})$	$Var(R_{C01})$	$Var(R_{02})$	$Var(R_{C02})$
SFE - SPI200	8.78E-05	8.67E-05	-	-
India - S&P CNX Nifty	2.46E-04	2.29E-04	-	-
Canada (Bourse De Montreal) – SXF	9.57E-05	1.01E-04	-	-
Korea – KOSPI	2.53E-04	2.26E-04	-	-
Deutsche – DAX	1.01E-04	9.93E-05	-	-
Euronext LIFFE				
Osaka – Nikkei 225	1.75E-04	1.60E-04	1.45E-04	1.65E-04
Tokyo – TOPIX	1.65E-04	1.68E-04	1.68E-04	1.71E-04
HK - Hang Seng Index	9.74E-05	8.11E-05	8.72E-05	8.11E-05
Panel B - Variance Ratios				
	Opening Morning / Closing Afternoon	**Closing Morning / Closing Afternoon**	**Opening Afternoon/ Closing Afternoon**	
SFE - SPI200	1.013	-	-	
India – S&P CNX Nifty	1.072	-	-	
Canada (Bourse De Montreal) – SXF	0.946	-	-	
Korea – KOSPI	1.118	-	-	
Deutsche – DAX	1.013	-	-	
Euronext – LIFFE	1.021			
Osaka – Nikkei 225	1.062	0.973	0.881	
Tokyo – TOPIX	0.968	0.980	0.986	
HK - Hang Seng Index	1.201	1.000	1.015	
Average				

Appendix

Table I

Contracts Examined, contract specifications, and margins as at 30 September 2005

Contract Excahnge/Name	**Contract Size**	**Min Tick**	**Tick Value**	**Initial Margin**
National Stock Exchange ***S&P CNX Nifty***	INR 100 * Index	0.05 * Index Points	INR 5	No margin limits
Korea Exchange ***KOSPI 200 Futures***	KRW 500,000 * Index	0.05 * Index Points	KRW 25,000	KRW 12,596,250
Eurex DAX Futures	EUR 25 * Index	0.5 * Index Points	EUR 12.5	EUR 10,250
Euronext LIFFE ***FTSE 100 Index Futures***	GBP 10 * Index	0.5 * Index Points	GBP 5	GBP 2320
Osaka Securities Exchange ***Nikkei 225 Futures***	JPY 1,000 x index	10 index points	JPY 10,000	JPY 630,000
Canada (Bourse De Montreal) ***SXF Index Futures***	-	-	-	-
Hong Kong Exchanges and Clearing Limited ***Hang Seng Index Futures***	HKD 50 x index	1 index point	HKD 50	HKD 49,615
Tokyo Stock Exchange ***TOPIX Futures***	JPY 10,000 x index	0.5 index points	JPY 5,000	JPY 475,000
Sydney Futures Exchange ***SFE SPI 200 Index Futures***	AUD 25 x index	1 index point	AUD 25	AUD 4,500