The Impact of Overnight Options Introduction: Evidence from the Sydney Futures Exchange

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Introduction

The Sydney Futures Exchange (SFE) is the first futures exchange in the world to successfully launch overnight options on the interest rate futures contracts. The SFE introduced overnight options on 3-Year and 10-Year Treasury Bond futures contracts on 15th of November 1993. Overnight options are only valid for one SYCOM (Sydney Computerized Market) session and will expire if they are at-the-money or out-of-the-money, or will be exercised at the end of the session if they are in-the-money. There is no margin requirement for trading overnight options, thus, they are considered as lower cost products. These overnight options provide local investors an opportunity to manage short term risk whenever overseas markets are open, and in particular to hedge positions when US economic announcements occur. Thus, it provides investors additional tools to take positions before anticipated events, hedge the underlying futures position, or even the physical bond position, and profit from speculation.

The impact of option listing on the underlying securities has attracted great attention in the academic literature. Many previous studies have focused on the impact of the introduction of stock options or index options, and those options are longer-dated options. However, the SFE overnight options are shorter-dated options that last for one night, and their underlying securities are futures contracts, namely this is a

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derivative on derivative contract. So it is unclear whether investors will react the same way on such a contract as they do when the underlying is a cash or physical contract. There is no day of the week effect and no capital is tied up in trading overnight options market, thus, it is worth examining the impact of overnight option introduction on the underlying 3-Year and 10-Year T-Bond futures, to see if previous findings hold for this unique product.

Previous studies have suggested that the derivatives market may draw uninformed traders away from the underlying market, and thus decrease the liquidity of the underlying market. The liquidity of the underlying market could also be negatively affected if the introduction of the derivative on the market causes an increase in formation-based trading. On the other hand, the introduction of options may encourage greater speculative trading of the options. Informed traders will be likely to shift from the underlying markets to options market, due to the leverage effects and lower transaction costs for trading in the options market. The migration of informed traders from the underlying markets would also reduce the informational asymmetry problem faced by market makers, as suggested by the adverse selection model found in market microstructure theory. In turn, this will increase the liquidity of the underlying market. In addition, the lower speculative activities in the underlying market will result in a decrease in the volatility generated by speculators in the underlying market who create noisy trading. However, this may simultaneously decrease the trading volume in the underlying market. But at the same time that derivatives markets may destabilize the cash market by encouraging arbitrage related activities which increase short-run price swings. Thus, the theoretical arguments behind the impacts of the options listing on the underlying market are in conflict.

Each market has its own characteristics and market structure, hence an empirical study on this issue will be useful in order to understand the impact of the overnight options introduction.

We analyze the impact of overnight options introduction on the underlying 3-Year and 10-Year T-Bond futures, by measuring changes in liquidity, changes in trading volume, and changes in volatility for the underlying futures contracts. As bid-ask spreads are widely used as a proxy for liquidity, trading volume used as a proxy for order flow, thus, we use bid-ask spreads to measure the change of liquidity, trading volume to measure order flow, and bid-ask midpoint to measure volatility. If the previous theoretical arguments hold, we would expect to see an increase in liquidity, a decrease in order flow and volatility for the underlying 3-Year and 10-Year T-Bond futures after the overnight options introduction.

Literature Review

There is extensive debate among investors, practitioners, and academics on whether or not derivative trading is beneficial to the operation of the financial markets. Investors would like to know the impact of the derivative instrument use on the risk and return of the underlying securities, as risk and return are the fundamental issues in any financial market. Thus, they are more likely to be interested in the impact of market microstructure related issues, i.e. bid-ask spread, trading volume, and volatility.

There are three closely related ways in which derivative markets improve underlying markets. Ross (1976), Breeden and Litzenberger (1978), Hakansson (1978) and

Arditti and John (1980) provide a detailed examination of the subject. First, they examine the role derivative securities have in making their underlying markets more complete. They suggest that the introduction of options expands the opportunities faced by investors, thus making the markets more complete. Second, they examine the role of derivative securities in making the operation of their underlying markets more efficiency. As option trading allows investors to use leverage, short-selling and transaction costs are relatively low. This will make the market's operation more efficient. Third, they examine the role of derivative securities in providing their underlying markets with more informational efficiency. The existence of an options market gives investors an effective means to trade and profit on information, the options market may provide the price discovery role.

An options market may also have negative impacts on the underlying market. Firstly, Choi and Subrahmanyam (1994), Gorton and Pennacchi (1993), Harris (1990), and among others have suggested that the derivatives market may draw uninformed traders away from the underlying market, investors may shift away from the underlying market, and thus decrease the liquidity of the underlying market (also see Kumar, Sarin and Shastri, 1998). Secondly, because option markets are ideally suited for speculation, trading tends to be noisy and this noise may transmit to the underlying market. This will increase the volatility of the underlying market. Thirdly, options trading can be used to generate either a long or a short position in their underlying securities. This may increase noisy trading in the underlying market. The liquidity of the underlying market could also be negatively affected if the introduction of the derivative on the market causes an increase in formation-based trading. It has been argued in Kumar, Sarin and Shastri (1998) that derivatives markets destabilize

the cash market by encouraging arbitrate-related activities that increase short-run price swings.

Option listings may cause informed traders to migrate to the options market. Informed traders migrate to options markets on the option's listings because they view options as superior speculative vehicles. This superiority stems from an option's leverage and the fact that investors may use options to avoid short sale restrictions on stocks. The reduction in the proportion of informed traders in the underlying market lowers the market maker's adverse selection costs, thereby lowering the spread and improving market liquidity.

Options may also improve the efficiency of the underlying market by increasing the level of public information in the market. Specifically, the marginal benefit of becoming informed after the introduction of options is greater given the option's superiority as a speculative vehicle. This increase in marginal benefit results in greater information symmetry, lowers the spread, improves liquidity, and reduces pricing error variance, thereby making the underlying market more efficient.

Branch and Finnerty (1981), Conrad (1989), and Deptemple and Jorion (1990) studied the impact of introducing options on stock return in the US markets. The overall results are mixed. There was some evidence that stocks showed excess returns when call options on the stocks were listed, and that negative returns occurred when put options were listed.

There were also some previous studies about the impact of option listings on the underlying stock's risk. For example, Whiteside, Duke and Dunne (1983), Ma and Rao (1988), Skinner (1989), and Mckenzie, Brailsford and Faff (2001) examined the risk of the underlying security in association with the option's listing in the US markets. They found that the stock market volatility is lower after the introduction of options.

Skinner (1989), Damodaran and Lim (1991), and Fedenia and Grammatikos (1992) examined the microstructure impacts of option listing in the US markets. These studies examine the impacts of option introduction on bid-ask spreads and trading volume of the underlying security. Overall results suggest that spreads are lower after the introduction. But results for trading volume are mixed. Overall there are no significant effects of option listings on the trading volume of the underlying stock.

Kumar, Sarin and Shastri (1998) claim that options listings may have a beneficial impact on the quality of the underlying asset market. As suggested by Ross (1976) and Hakansson (1982), options improve the efficiency of incomplete asset markets by expanding the opportunity set facing investors. This in turn suggests that option listings reduce underlying stock volatility. Sahlstrom (2001) investigates the impact of stock option introduction on the return and risk characteristics of underlying stocks in Finland. Results suggest that volatility and bid-ask spread levels are lower after the option listing. Kumar, Sarin and Shastri (1998) found that option listings are associated with a decrease in the variance of the pricing error, a decrease in the adverse selection component of the spread, and an increase in the relative weight placed by the specialist on public information in revising prices for the underlying

stocks. They also found a decrease in the spread and increase in quoted depth, trading volume, trading frequency, and transaction size after option listings.

Previous studies mainly focused on the impact of underlying cash or physical market with regarding to the derivative product's introduction. Hence, it is worth while examining what the underlying futures behavior with the introduction of the overnight options in the SFE.

Hypothesis, Data, and Methodology

Hypothesis

As discussed earlier, derivative markets may draw uninformed traders away from the underlying market and decrease the liquidity of the underlying market. On the other hand, due to leverage effect and lower transaction costs for trading in the derivative market, informed traders will be likely to shift from the underlying markets and reduce the information asymmetry problem faced by market makers, this in turn will increase the liquidity of the underlying market. Therefore, we test whether or not the liquidity is increased or decreased for the underlying 3-Year and 10-Year T-Bond futures after the overnight options introduction.

The introduction of the derivative products would encourage greater speculative trading. Investors will be likely to shift from the underlying markets to derivative markets, thus, a decrease in trading volume normally occurs in the underlying market following the introduction of a derivative product. Thus, we may expect a decrease in trading volume of the underlying 3-Year and 10-Year T-Bond futures, as the overnight options are considered to be a lower cost product.

The introduction of the derivative market may draw both informed and uninformed traders away from the underlying market, thus, lower the speculative activities in the underlying market. This may result in a decrease in the volatility generated by speculators in the underlying market who crease noisy trading. Therefore, we use the bid-ask midpoint volatility to test if there is any decrease in volatility for the underlying 3-Year and 10-Year T-Bond futures.

Data

The data for 90-Day Bank-Bill futures, 3-Year and 10-Year T-Bond futures consisted of intra-day data between November 1991 and November 1993. Intra-day data included the time-stamped raw data for each quoted bid and ask, timed in seconds. The completed trade data contained the time of the trade, the trading price, and the trading volume. All data was provided by the Security Industry Research Centre, Asia Pacific (SIRCA).

Methodology

We calculate the time-weighted average relative bid-ask spreads, trading volume and return volatility (using bid-ask midpoint) before and after the overnight options introduction for the underlying 3-Year and 10-Year T-Bond futures, in order to test changes in market liquidity, order flows, and volatility for the underlying 3-Year and 10-Year T-Bond futures.

The 90-Day Bank Bill futures is a short-term debt instrument, it has similar characteristics with 3-Year and 10-Year T-Bond futures. During the 3-Year and 10-

Year T-Bond overnight options introduction, there were no major events occurred for 90-Day Bank Bill futures, thus, we use the time-weighted average relative bid-ask spreads, trading volume, and return volatility as confounding factors when we calculate those variables for the 3-Year and 10-Year T-Bond futures.

Binomial Sign Test, Wilcoxon Signed Ranks Test, and Van der Waerden (normal scores) Test

We use the Binominal Sign Test, the Wilcoxon Signed Ranks Test, and the Van der Waerden Test as suggested by Conover (1980) and Sheskin (1997) to test ratios of the time-weighted relative bid-ask spreads, trading volume and volatility before and after the overnight options introduction for 3-Year and 10-Year T-Bond futures.

Conover (1980) and Sheskin (1997) carried out the null hypothesis test that test the median of a series X is equal to a specified value y against the two-sided alternative that is not equal to y, which is:

$$H_0: \text{median}(X) = y$$

$$H_1: \text{median}(X) \neq y$$

Three rank-basked nonparametric test statistics are reported as the Binomial Sign Test, the Wilcoxon signed ranks test, and the Van der Waerden (normal scores) test.

Impacts on Liquidity

The method adopted by Mcinish and Wood (1992), Skinner (1989), and Kumar, Sarin and Shastri (1998) is used to calculate time-weighted average relative bid-ask spreads for the 3-Year and 10-Year T-Bond futures.

A relative bid-ask spread (BAS) is calculated for each quotation as: BAS=$\left[(ask-bid)/(ask+bid)/2\right]$. Thus time-weighted average relative bid-ask spreads will be calculated as follows:

$$\sum_{i=0}^{N}\frac{BAS_i(t_{i+1}-t_i)}{(t_{i+1}-t_i)}$$

where $(t_{i+1}-t_i)$ is the time interval between quotations.

More specifically, the time-weighted quoted relative bid-ask spreads for both 3-Year and 10-Year T-Bond futures will be obtained 100 days before the listing date of overnight options (day –110 to day –11 relative to the listing date) and 100 days after the listing date (day 11 to day 110 relative to the listing date). Also we are going to obtain the time-weighted average quoted relative bid-ask spreads for 90-Day Bank-Bill futures 100 days before and after the listing date of overnight options as we did for 3-Year and 10-Year T-Bond futures. Then we adjust the quoted time-weighted average relative bid-ask spread for 3-Year and 10-Year T-Bond futures by dividing them using the time-weighted relative bid-ask spread for the 90-Day Bank-Bill futures[2]. This gives us a relative time-weighted bid-ask spreads after adjusting for 90-Day Bank-Bill futures time-weighted bid-ask spreads. Finally, we derive the relative bid-ask spreads ratio by dividing the pre-introduction bid-ask spreads (adjusted for 90-Day Bank-Bank futures bid-ask spreads) by the post introduction bid-ask spreads (adjusted for 90-Day Bank-Bill futures bid-ask spreads).

[2] We use the relative bid-spread for the 90-Day Bank-Bill futures as a control variable whenever we calculated the 3-Year and 10-Year T-Bond time weighted average bid-ask spreads.

Impacts on Order Flows

As was the case when the impacts on liquidity were analysed, the daily trading volume for the 3-Year and 10-Year T-Bond futures will be obtained 100 days before the listing date of the overnight options (day –110 to day –11 relative to the listing date) and 100 days after the listing date (day 11 to day 110 relative to the listing date). Also we are going to obtain the daily trading volume for 90-Day Bank-Bill futures 100 days before and after the listing date of overnight options as we did for 3-Year and 10-Year T-Bond futures. Then we adjust the daily trading volume for 3-Year and 10-Year T-Bond futures by dividing them using the daily trading volume for the 90-Day Bank-Bill futures[3]. This gives us a relative trading volume after adjusting for 90-Day Bank-Bill futures trading volume. Finally, we derive the relative daily trading volume ratio by dividing the pre-introduction trading volume (adjusted for 90-Day Bank-Bank futures trading volume) by the post introduction trading (adjusted for 90-Day Bank-Bill futures trading volume).

Impacts on Volatility

We use the bid-ask midpoint to calculate the return volatility before and after the overnight options introduction, in order to test if there is any decrease in volatility for the underlying 3-Year and 10-Year T-Bond futures. The daily standard deviation of the bid-ask midpoint for the 3-Year and 10-Year T-Bond futures will be obtained 100 days before the listing date of the overnight options (day –110 to day –11 relative to the listing date) and 100 days after the listing date (day 11 to day 110 relative to the listing date). We define the volatility ratios as the daily bid-ask midpoint volatility (adjusted for the 90-Day Band Bill futures bid-ask midpoint volatility) for the post-

[3] We use the relative bid-spread for the 90-Day Bank-Bill futures as a control variable whenever we calculated the 3-Year and 10-Year T-Bond time weighted average bid-ask spreads.

introduction period, divided by the daily bid-ask midpoint volatility (adjusted for the 90-Day Bank Bill futures bid-ask midpoint volatility) for the pre-introduction period.

Analysis

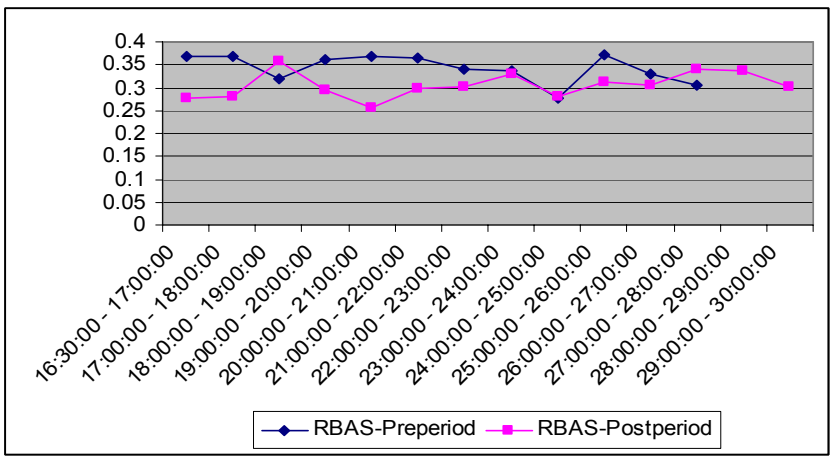
Liquidity Impacts

Figure 1 Panels A and B illustrate the mean relative time-weighted average bid-ask spreads (adjusted for 90-Day Bank-Bill futures relative bid-ask spreads) for different time interval during the trading night for the underlying 3-Year and 10-Year T-Bond futures. From Panel A in Figure 1, we observed that the mean time-weighted average relative bid-ask spreads for the post overnight options introduction period is lower than that for the pre period for most of the intervals during the trading night, particularly for the first half of the trading night. This indicates that the introduction of the overnight option may increase the liquidity of the underlying futures market for the 3-Year T-Bond future.

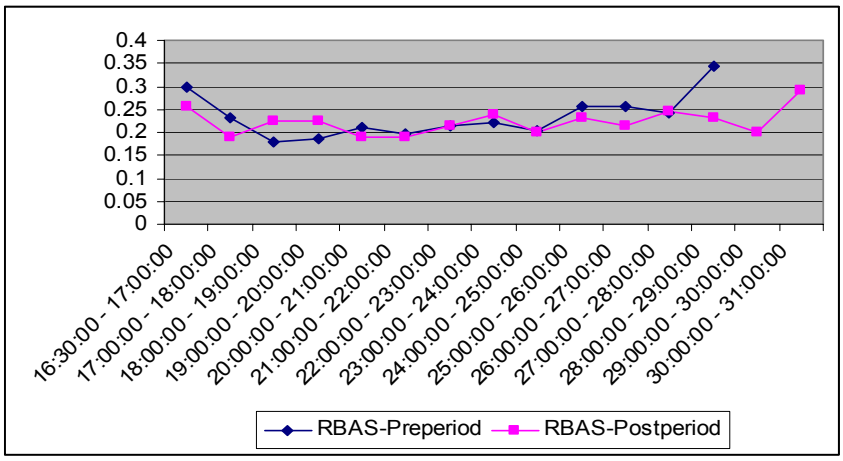
Figure 1 Mean Relative Bid-Ask Spreads Before and After the Overnight Option Introduction

The graphs show the mean relative time-weighted average bid-ask spreads (adjusted for 90-Day Bank-Bill futures relative bid-ask spreads for confounding problem) for different time interval during the trading night for the underlying 3-Year and 10-Year T-Bond futures.

Panel A 3-Year T-Bond Futures



Panel B 10-Year T-Bond Futures



Panel B in Figure 2, however, we observed that the mean time-weighted average relative bid-ask spreads for the post overnight options introduction period is greater than that for the pre period for most of the intervals during the trading night. This indicates that the introduction of the overnight option may not increase the liquidity of the underlying 10-Year T-Bond future. But the conclusion we draw here might be subjective, thus, we use the Binomial Sign Test, the Wilcoxon One-Tailed Signed Ranks Test, and the Van der Waerden (normal scores) tests to statistically test whether the liquidity of the underlying futures market has been improved.

Table 1 reports the daily time-weighted average relative bid-ask spread ratios for the underlying 3-Year and 10-Year T-Bond Futures. The relative bid-ask spread ratios are defined as the ratio of daily time-weighted average relative bid-ask spreads in the post-introduction period, divided by daily time-weighted average relative bid-ask spreads in the pre-introduction period (all adjusted for the 90-Day Band Bill futures daily time-weighted relative bid-ask spreads). A ratio less than one implies a decrease

in the bid-ask spread in the post-introduction period, suggesting the possibility of a liquidity improvement.

The results, illustrated in Table 1, suggest that for the 3-Year T-Bond futures, bid-ask spreads decreased after the introduction period, as the daily median time-weighted average relative bid-ask spread ratio is less than one and we observe a 52% decrease in bid-ask spreads in the sample. The Binominal Sign Test indicates that the result is not statistically significant. However, the Wilcoxon Signed Rank Test indicates that the result is statistically significant at the 10% level as the p value is 0.0978, and the Van der Waerden (normal scores) tests is statistically significant at the 5% level, indicating that the improvement of the liquidity with the introduction of overnight options for the 3-Year T-Bond futures.

For the 10-Year T-Bond futures, we observe that the daily median relative bid-ask spread ratio is greater than one and 52% of the sample have increased bid-ask spreads. The Binominal Sign Test is not statistically significant. But the Wilcoxon Signed Rank Test is statistically significant at the 5% level, and the Van der Waerden Test is statistically significant at the 1% level, indicating a significant increase of bid-ask spreads after the overnight options introduction. This indicates there is no evidence that bid-ask spreads decreased for the 10-Year T-Bond futures. Overall, there is no evidence of market quality improvement when using bid-ask spreads as a measurement of liquidity for the underlying 10-Year T-Bond futures market after the overnight options' introduction. There is some evidence of market quality improvement when using bid-ask spreads as a measurement of liquidity for the underlying 3-Year T-Bond futures market after the overnight options introduction.

Table 1 Relative Bid-Ask Spread Ratios for 3-Year and 10-Year T-Bond Futures

Bid-ask spreads for futures are calculated as the daily time-weighted average relative bid-ask spreads. Bid-ask spread ratio is the daily time-weighted average relative bid-ask spreads in the post-introduction period, divided by the daily time-weighted average relative bid-ask spreads in the pre-introduction period, all relative bid-ask spreads are adjusted by the control variable (the 90-Day Bank-Bill time-weighted relative bid-ask spreads).

Futures	Median BAS Ratios	Median Ratio[4] (Obs<1:Obs>1)	Binominal Sign Test	Wilcoxon Signed Ranks Test	Van der Waerden Test
3-Year T-Bond	0.9331	52:48	0.7664	0.0978*	0.0153**
10-Year T-Bond	1.0328	48:52	0.7664	0.0244**	0.0033***

*Significant at the 10% level.
**Significant at the 5% level.
***Significant at the 1% level.

Order Flows Impacts

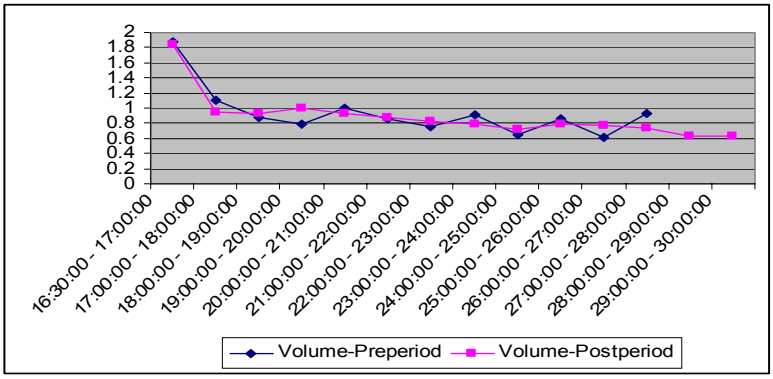
First, we graphically illustrate the difference between the mean trading volume for the different time interval during the trading night before and after the overnight options introduction, for both 3-Year and 10-Year T-Bond futures. Figure 2 Panels A and B illustrates the mean volume (adjusted for 90-Day Bank-Bill futures volume) for different time interval during the trading night for 3-Year and 10-Year T-Bond futures. From Panels A and B in Figure 2, we observed that the mean time-weighted average trading volume for the post overnight options introduction period is lower than that for the pre period for most of the intervals during the trading night. This indicates that the introduction of the overnight option decreases the order flow of the underlying 3-Year and 10-Year T-Bond futures.

[4] This is the proportion with post-period to pre-period relative bid-ask spreads ratios less than 1, to the proportion with post-period to pre-period relative bid-ask spreads ratios greater than 1.

Figure 2 Mean Volume Before and After the Overnight Option Introduction

Figure 2 illustrates mean trading volume (adjusted for 90-Day Bank-Bill futures volume) for the different time interval during the trading night before and after the overnight options introduction, for both 3-Year and 10-Year T-Bond futures.

Panel A 3-Year T-Bond Futures



Panel B 10-Year T-Bond Futures

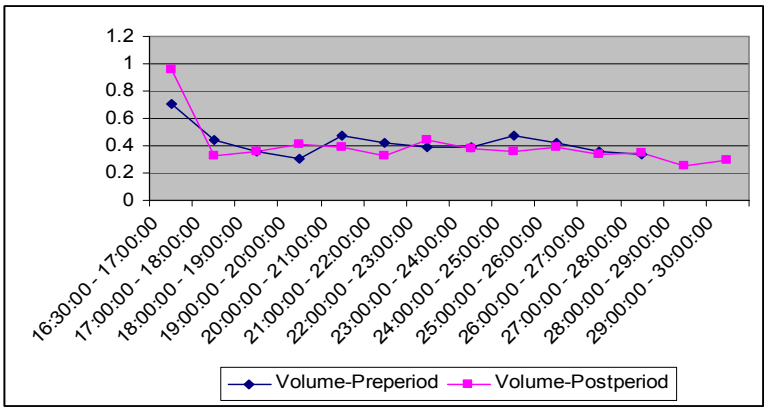


Table 2 Panels A and B summarizes the results for the trading volume ratios. Results show that the trading volume became smaller at the time of the overnight option's introduction for both the 3-Year and 10-Year T-Bond futures. There are 57% decreases of trading volume for the 3-Year T-Bond futures, and there are 58% decreases of trading volume for the 10-Year T-Bond futures. But the Binominal Sign Test, the Wilcoxon Signed Rank Tests, and the Van der Waerden Tests are statistically insignificant.

Table 2 Trading Volume Ratios for 3-Year and 10-Year T-Bond Futures

The trading volume ratios are defined as the post-introduction period trading volume divided by the pre-introduction period trading volume. Daily trading volume is calculated as the time-weighted average trading volume in a day.

Futures	Mean Volume Ratios	Median Ratio[5] (Obs<1:Obs>1)	Binominal Sign Test	Wilcoxon Signed Ranks Test	Van der Waerden Test
3-Year T-Bond	0.9333	57:43	0.1933	0.9383	0.4938
10-Year T-Bond	0.8603	58:42	0.1332	0.6661	0.7928

Volatility Impacts

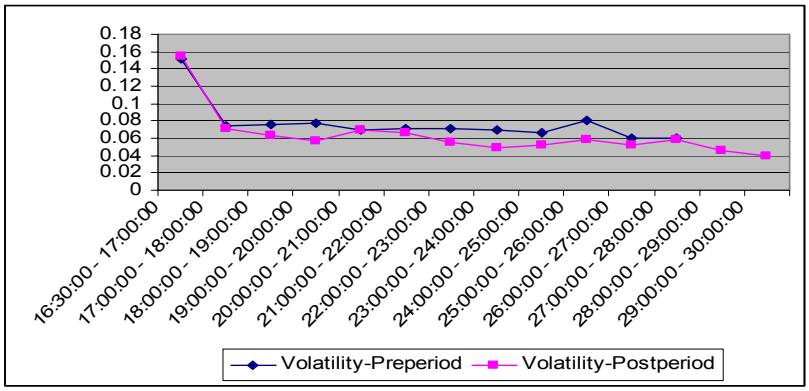
First, we illustrate the difference between the standard deviation for different time interval during the trading night before and after the overnight options introduction, for both 3-Year and 10-Year T-Bond futures. Figure 3 Panels A and B illustrates the mean return volatility (adjusted for 90-Day Bank-Bill futures volume) for different time interval during the trading night for 3-Year and 10-Year T-Bond futures. From Panels A and B in Figure 3, we observed that the return volatility for the post overnight options introduction period is lower than that for the pre period for most of the intervals during the trading night. This indicates that the introduction of the overnight option decreases the volatility of the underlying 3-Year and 10-Year T-Bond futures.

[5] This is the proportion with post-period to pre-period relative bid-ask spreads ratios less than 1, to the proportion with post-period to pre-period relative bid-ask spreads ratios greater than 1.

Figure 3 Volatility Before and After the Overnight Options Introduction

Figure 3 illustrates the mean return volatility (adjusted for 90-Day Bank-Bill futures volume) for different time interval during the trading night before and after the introduction of overnight options for 3-Year and 10-Year T-Bond futures. The time intervals for the pre-period is shorter than that for the post-period, as there is no quotes for those time intervals.

Panel A 3-Year T-Bond Futures



Panel B 10-Year T-Bond Futures

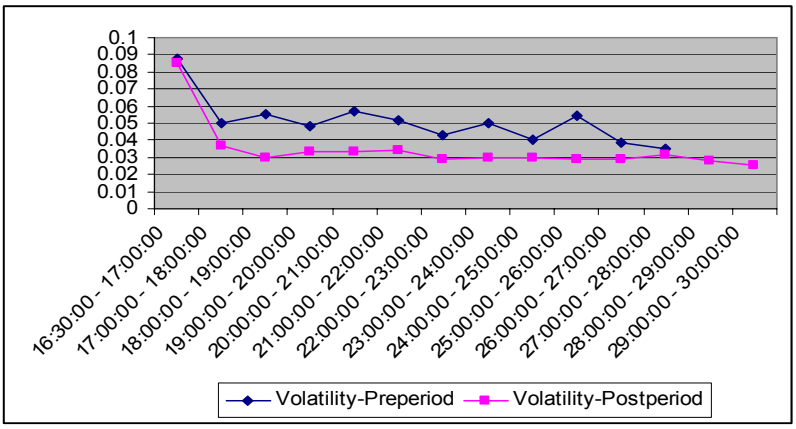


Table 3 summarizes the results for volatility ratios. Results show that volatility became lower at the time of the overnight option's introduction for both the 3-Year and 10-Year T-Bond futures. There are 62% decreases of volatility for the 3-Year T-Bond futures, and there are 59% decreases of volatility for the 10-Year T-Bond futures. The Binominal Sign Test is significant at the 5% level for the 3-Year T-Bond futures, and at the 10% significant level for the 10-Year T-Bond futures. The Van der Waerden Tests are significant at the 10% level for 3-Year T-Bond futures, and significant at the 5% level for the 10-Year T-Bond futures.

Table 3 Volatility Ratios for 3-Year and 10-Year T-Bond Futures

The volatility ratios are defined as the post-introduction period standard deviation of bid-ask midpoint return, divided by the pre-introduction period standard deviation of bid-ask midpoint return. The volatility has been adjusted for the standard deviation of bid-ask midpoint return from the 90-Day Bank Bill futures.

Futures	Volatility Ratios	Median Ratio[6] (Obs<1:Obs>1)	Binominal Sign Test	Wilcoxon Signed Ranks Test	Van der Waerden Test
3-Year T-Bond	0.4834	62:38	0.0210*	0.5214	0.0938*
10-Year T-Bond	0.7160	59:41	0.0886*	0.1674	0.0222**

*Significant at the 10% level.
**Significant at the 5% level.

Conclusions

Typically, new product introduction, particularly in derivative markets, will impact underlying markets. However, previous work focused on the underlying cash or physical market, and the new introduction of the derivative products are mainly futures or longer dated options. There were no such studies based on the shorter dated options on the futures market. Thus, the impact of the introduction of overnight options on the underlying Australian T-Bond futures was tested in this study. Changes in quoted bid-ask spread, trading volume, and bid-ask midpoint volatility for the underlying 3-Year and 10-Year T-Bond futures, before and after the introduction of the overnight options were examined to assess the impacts of the overnight options introduction to the underlying 3-Year and 10-Year T-Bond futures.

It was found that the liquidity as measured by the quoted bid-ask spreads increased after the overnight options introduction for the 3-Year T-Bond futures, as the bid-ask spreads became smaller. But the liquidity for the 10-Year T-Bond futures decreased after the overnight options introduction, as the bid-ask spreads became larger. Results for the liquidity apparent anomaly warrants further attention.

[6] This is the proportion with post-period to pre-period relative bid-ask spreads ratios less than 1, to the proportion with post-period to pre-period relative bid-ask spreads ratios greater than 1.

The results for order flows and return volatility became lower after the overnight options introduction. This indicated that the overnight options introduction may encourage greater speculative trading activities of this market, this may be likely to shift both informed and uninformed traders away from the underlying futures market. Thus, the lower speculative activities in the underlying market will result in a decrease in the volatility generated by speculators in the underlying market who create noisy trading. This in turn simultaneously decreases the trading volume (order flow) in the underlying market.

Previous empirical studies have drawn conflict conclusions based on the theoretical argument. Our conclusion in this study may suggest that investors do shift away from the underlying futures market to overnight options market, which result a lower order flow and a lower volatility, as overnight options market does provide an additional lower cost tool for investors to trade, hedge, and even speculate for the underlying securities.

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