# The Impact of a Tick Size Reduction on Market Quality: Evidence from the Sydney Futures Exchange

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**Abstract**

This paper examines the impact of a reduction in the minimum price increment on market quality in a futures market setting. On 15 December, 2006, the Sydney Futures Exchange halved the minimum tick in the 3 Year Commonwealth Treasury Bond Futures. Results indicate that bid-ask spreads are significantly reduced after the change. Quoted depth, both at the best quotes and visible in the limit order book, is significantly lower after the tick reduction. Both trading volume and price volatility are not significantly affected. Further analysis reveals that execution costs are reduced after the change, with large institutional buy orders experiencing the most significant reduction. These results hold in the overnight trading session, are robust to seasonal patterns in futures trading and are robust to trading in substitute contracts. We conclude that a tick size reduction improves market quality in a futures market setting.

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## 1. Introduction

The provision of liquidity in financial markets draws significant attention from both academics and market practitioners. One of the main aspects of liquidity is the minimum price increment allowable. Several financial exchanges worldwide have reduced the minimum tick to promote additional liquidity. This has led to considerable research examining the impact of a tick size reduction on market quality. In a seminal paper, Harris (1994) hypothesises that a reduction in tick size is dependant on the level of trading activity in a given security. Actively traded securities are more likely to benefit from a lower tick size, while market quality in infrequently traded instruments may be adversely affected by a tick size reduction.

Empirical studies in this area provide mixed evidence. Goldstein and Kavajecz (2000) examine a reduction in the minimum tick on the (NYSE), and find significant improvements in liquidity for highly liquid stocks, mainly in the form of reduced bid-ask spreads, while less liquid stocks are adversely affected, experiencing increased bid-ask spreads and lower quoted depth. Jones and Lipson (2001) also examine the June 1997 tick size reduction on the NYSE, and find that trading costs increase after the tick size is halved, indicating that quoted and effective bid-ask spreads are not an adequate measure of market quality. Orders exceeding 100,000 shares cost a third more after the tick size reduction. Isolating the effect of the tick size reduction from individual firm characteristics and order types, the authors find that across all firms, average execution costs increase by 22.5 basis points.

Bessembinder (2003) examines the 2001 move to decimal trading on the NYSE and Nasdaq. He finds that quoted spreads decline both across markets and across market capitalisation groups, with large capitalisation stocks in both markets experiencing the largest reductions. Quoted depth levels in both markets are substantially reduced. Average effective spreads for Nasdaq stocks remain unchanged after decimalisation, while NYSE stocks experience a decline in effective bid-ask spreads. While quoted depth is reduced, a fall in effective bid-ask spreads, lower volatility and a general decrease in the cost of trading lead Bessembinder to conclude that overall market quality is increased. Chakravarty, Panchapagesan and Wood (2005) examine trading costs after the move to decimal pricing on the NYSE and find that trading costs for institutional traders decrease by 32 percent. In contrast to Jones and Lipson (2001), Chakravarty, Panchapagesan and Wood find that total trading costs decline by 22.6 basis points, with the greatest decrease occurring in the largest size group.

Bacidore (1997) examines the move to decimal trading on the Toronto Stock Exchange (TSE) in April 1996. As the TSE had a tiered tick regime prior to the move to decimal trading, Bacidore examines differences in various levels of tick size changes. Results highlight that when ticks are reduced from an eighth to a cent, bid-ask spreads are reduced, with no adverse effect on market quality, while for stocks which move from five cents to one cent, the reduction does not impact on market quality.[1]

ap Gwilym, McManus and Thomas (2005) examine the move to decimal trading for UK Long Gilt Futures on LIFFE. Results indicate that quoted spreads increase after decimalisation, despite claims that the market was constricted at the minimum tick prior to the move to decimal trading. Further, the mean trade size across both markets is reduced, while daily traded volume increases only in the floor setting. The authors do not examine trading costs around the change to decimal trading.

While the hypotheses of Harris (1994) are generally supported in equities market literature, there is an absence of conclusive evidence on the impact of a tick size reduction in a futures market setting. Futures markets differ from equity markets in several important ways. Futures markets are more liquid than equity markets (Fleming, Ostdiek and Whaley,

[1] See Smith, Turnbull and White (2006) for further evidence from the TSE and Ahn, Cai, Chan and Hamao (2007) for evidence from the Tokyo Stock Exchange.

1996). Futures markets are also dominated by institutional investors and have a much lower probability of private information (Frino and Oetomo, 2005; Gorton and Pennacchi, 1993; Subrahmanyam, 1991). These factors are likely to affect liquidity and execution costs, and thus may affect the impact of a tick size reduction on market quality.

This paper extends the literature by examining market quality around a tick size reduction in a futures market setting. Specifically, this study examines the change in market quality for the 3 Year Commonwealth Treasury Bond Futures (3 year bond futures), trading on the Sydney Futures Exchange (SFE), around the reduction in minimum tick on 15 December, 2006. Traditional proxies of market quality, including bid-ask spreads, quoted depth, trading volume and price volatility are compared around the move to half basis point trading. As both the 10 Year Commonwealth Treasury Bond Futures (10 year bond futures) and 90 Day Bank Accepted Bill Futures (90 day BAB futures) are potential substitutes for the 3 year bond futures, they are used as control contracts to separate the effects of the move to half basis point trading from market-wide movements.

Using a proprietary data set, provided by the SFE, this study examines changes in price impact surrounding the tick size reduction. Chan and Lakonishok (1995) show that institutional investors separate large trade packages into smaller trades to control price impact. As this data set contains information on prices, volumes and trader identifiers, this study is able to reconstruct trade packages and determine how institutional investors are affected by the tick size reduction.

Results indicate that bid-ask spreads are significantly reduced, trading at the minimum tick after the reduction. Quoted depth is also significantly lower after the structural change. Trading volume and price volatility are not significantly affected. Execution costs are reduced after the change, with the largest buy orders experiencing the most significant reductions. These results are robust to changes in the control contracts. These results hold in the overnight market, and are robust to the seasonality in futures trading.

The remainder of this paper is structured as follows. Section 2 presents a brief outline of the institutional details of the Sydney Futures Exchange. Section 3 describes the data used and outlines the research design, Section 4 presents the results of the analysis, as well as several additional tests, and Section 5 concludes.

## 2. Institutional Details

The Sydney Futures Exchange (SFE) operates a fully automated electronic limit order book. It is ranked in the top 15 futures and options exchanges globally based on contract volume. Currently, there are over 50 different futures contracts traded on the SFE. The 3 Year Commonwealth Treasury Bond Futures and 10 Year Commonwealth Treasury Bond Futures trade on a quarterly cycle starting on either the $15^{th}$ of December, March, June or September. Also traded on the SFE are 90 Day Bank Accepted Bill Futures which trade on a quarterly cycle expiring on the second Thursday of the delivery month (again December, March, June and September). Settlement occurs within three days of the quarterly expiration date. As the underlying for all three contracts relates to interest rates in Australia, these contracts are viewed as potential substitutes for hedging purposes.

Prior to the change to half basis point trading, the minimum price increment for 3 year bond futures was one basis point. At the commencement of the March 2006 contract, the SFE introduced trading at half basis points for the last five days of the contract. This was to accommodate the increased trading volume during the rollover period. Prior to the move to half basis point trading, the best three prices on the bid and ask side of the limit order book were visible to all participants.

Starting with the March 2007 contract, the 3 year bond futures contract moved to permanent half basis point trading. The SFE states that the reason for this was primarily to accommodate the needs of traders but also because the contract was constricted by the minimum tick size. To retain a consistent level of visibility in the order book, transparency on both sides of the limit order book increased from three to five price steps.

**3. Data and Research Design**

This study employs two data sets to examine changes in market quality. The first is a trade-by-trade data set for the three interest rate futures contracts, provided by SIRCA. The data contain the contract code, date and time of each trade, along with the price and volume transacted. It also provides order book data, with information on the prices and volumes of prevailing bid and ask quotes for the entire limit order book. For consistency, 1-minute, 5-minute and 15-minute aggregate data sets are generated from this data. For each interval, the last trade price, interval high and low prices, the volume traded and the time-weighted bid-ask spread (explained below) are calculated. Further, the prevailing quotes and respective depth levels at the end of each interval are provided. The second data set, used to calculate price impact around the tick size reduction, is explained later in this Section.

As futures trade on a quarterly expiration cycle, analysis is based on comparing the March 2007 contract to the December 2006 contract. The primary measures used to proxy for market quality are bid-ask spreads, quoted depth, trading activity and price volatility. Frino and McKenzie (2002) find abnormal levels of liquidity-motivated trading approaching expiry, primarily driven by the need to roll over positions from near to deferred contracts. Consistent with Frino and McKenzie (2002), the last 10 days prior to contract expiry are excluded from the analysis. To control for potential market-wide events, the 10 Year Commonwealth Treasury Bond Futures and 90 Day Bank Accepted Bill Futures are also examined. These contracts are potential substitutes for the 3 year bond futures and provide an ideal control.

Two measures of the bid-ask spread are examined, including the time-weighted bid-ask spread measure from McInish and Wood (1992). The quoted spread, as per McInish and Wood (1992), is calculated as the difference between the best prevailing quotes in the market.[2] This is calculated for every single quote revision and then weighted for how long the quotes prevailing are "alive" in 1-, 5-, and 15-minute intervals. These time-weighted bid-ask spreads are averaged across the trading day and then averaged across each contract to determine the change in bid-ask spreads around the change in tick size. As the minimum tick in this market is considerably tighter than in equities markets, another spread measure commonly used in futures markets is calculated as follows[3]:

$$BAS_i = \frac{Ask_i - Bid_i}{Minimum\ Tick_i} \quad (1)$$

where $Ask_i$ and $Bid_i$ are the best prevailing quotes and $MinimumTick_i$ is the minimum price increment. Another integral component of liquidity is quoted depth. To examine quoted depth, this study focuses on (i) the change in depth at the best quotes, and (ii) the change in the total visible limit order book depth. The quoted best depth is calculated as follows:

$$BestDepth_i = PrevailingAskVolume_i + PrevailingBidVolume_i \quad (2)$$

where *PrevailingAskVolume* and *PrevailingBidVolume* represent the volume at the best prevailing bid and ask quotes at the end of each interval. Total visible depth is calculated similarly.

To examine changes in trading activity around the reduction in minimum tick, average daily traded volume and average trade size are compared before and after the

[2] Another spread measure commonly used is the effective spread. As the SFE operates a fully automated electronic limit order book, all transactions occur at the quoted prices, so the effective spread is equal to the quoted spread.

[3] See Frino, Lepone and Wearin (2007).

reduction in tick size. To examine if the reduction in minimum tick affects price volatility and, consistent with Bessembinder and Seguin (1992), volatility is calculated as follows:

$$Volatility_i = ln \frac{DailyHigh_i}{DailyLow_i} \quad (3)$$

where $DailyHigh_i$ is the highest and $DailyLow_i$ is the lowest traded price on day $i$.

Harris (1994) argues that there are several factors which impact on changes in bid-ask spreads, including the level of trading activity, volatility and volume. Chordia, Roll and Subrahmanyam (2000) find that market-wide factors can influence liquidity in financial markets. To develop a robust measure of the market-wide impact of volatility and traded volume in each contract, the factors derived by Harris (1994) are combined with the Chordia, Roll and Subrahmanyam (2000) specification. The resulting regressions (below) account for broad market-wide and contract-specific factors that affect market quality.

$$BAS_3 = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility + \varepsilon \quad (4)$$

$$Ln(BestDepth_3) = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility + \varepsilon \quad (5)$$

$$Ln(TotalDepth_3) = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility + \varepsilon \quad (6)$$

For each equation, the dependent variable is (i) the time-weighted average bid-ask spread, (ii) the average best depth or (iii) the average total depth. *Change* is a dummy variable equal to one for the period post-change and zero otherwise. *Ln(DailyVolume)* is the natural logarithm of the average daily volume and *Volatility* is the daily volatility, calculated as the log difference between daily high and low prices. The variables $Ln(ControlVolume_i)$ and $ControlVolatility_i$ represent daily volume traded and daily price volatility, respectively, in the 10 year bond futures and 90 day BAB futures contract. These three regressions are re-estimated using the control contracts (10 year bond and 90 day BAB) as dependant variables.

To provide a more robust analysis of the impact of a reduction in tick size on market quality, this study also examines price impact. As shown in Chan and Lakonishok (1995), institutions usually break up large orders into packages of several trades. Therefore, as found in Frino, Kruk and Lepone (2007), analysing individual trades leads to biased results. Using proprietary data from the SFE, this study constructs trade packages. The data contain fields for date, time, price, trade direction (buy or sell), and volume, as well as an alphanumeric account code that identifies the investor behind each trade. The sample is restricted to trades in the near contract during daytime trading hours. Consistent with prior analysis, trades executed within 10 days of expiration of the contract are excluded from the analysis. Also excluded are trades by locals, and single trade packages.[4]

Packages are constructed if (i) they are executed by the same account, (ii) in the same direction and (iii) are no more than one trading day apart. The total price impact of each package is calculated as follows:

$$PriceImpact_i = \frac{VWAPi - OpeningPricei}{0.01} \tag{7}$$

where VWAP is the Volume Weighted Average Price of package *i*, and $OpeningPrice_i$ is the opening price on the first day of package *i*. To maintain uniformity in each period, price impact is scaled per basis point. Consistent with previous studies, the total sample of packages is divided into four quartiles based on package size. The first group contains packages of 2-55 contracts, the second contains packages of 56-250 contracts, while the third and fourth group contain packages of 251-680 and 681-9000 contracts, respectively.

[4] See Frino, Kruk and Lepone (2007)

Chan and Lakonishok (1995) find that there are a number of factors that affect the total cost of executing trade packages. To control for factors which influence the price impact of trade packages, the following regression is estimated:

$$PriceImpact_i = \alpha_0 + \alpha_1 Change + \alpha_2 PackageLength_i + \alpha_3 Size_2 + \alpha_4 Size_3 + \alpha_5 Size_4 + \varepsilon \quad (8)$$

where $PriceImpact_i$ is as defined previously. *Change* is a dummy variable equal to one for the period post-change and zero otherwise. As shown in Chiyachantana, Jain, Jiang and Wood (2004), the longer the time taken to execute a package of trades, the greater the price impact. $PackageLength_i$ is calculated as the total number of hours taken to execute the package. As Frino and Oetomo (2005) show, the size of a futures trade package is linearly related to total cost. The dummy variable $Size_i$ takes the value of one if the package is in the *i*th size quartile and zero otherwise, *i* equals one to four. Sizegroup 1 is excluded from the regression to avoid non-singularity.

## 4. Results

### *4.1 Univariate Results*

Table 1 presents a comparison of market quality variables around the move to half basis point trading. The pre-period is the December 2006 contract, and the post-period March 2007 contract. The SFE conducts two trading sessions, with day trading between 8:30am and 4:30pm, and night trading between 5:10pm and 7am.[5] For robustness, this study compares market quality and price impact during both day and night trading sessions before and after the reduction in tick size for the 3 year bond futures (night session results are included in parentheses).

**<INSERT TABLE 1>**

[5] This is during US daylight savings time, with trading hours during US non-daylight saving time between 5:10pm and 7:30am.

Table 1 indicates that bid-ask spreads are significantly tighter after the reduction in minimum tick. Time-weighted bid-ask spreads fall from one basis point in the pre-period to 0.51 basis points in the post-period during day trading, and from 1.03 basis points to 0.57 basis points during night trading, consistent with previous studies including Goldstein and Kavajecz (2000) and Jones and Lipson (2001). With bid-ask spreads per minimum tick, there is a slight increase from 1.004 ticks in the pre-period to 1.021 ticks in the post period, although this change is not statistically different from zero. Looking at the control contracts, there is no significant change in either measure of bid-ask spreads for the 10 year bond futures or 90 day BAB futures contract after the change in the 3 year bond futures contract. The reduction in bid-ask spreads is isolated to the 3 year bond futures.

An analysis of quoted depth, both at the best prevailing quotes and throughout the visible limit order book, indicates a significant reduction. Depth at the prevailing bid and ask quotes decreases from 9,337 to 2,647, a significant decrease of 6,689 contracts (overnight best depth falls by 3,065 contracts). This reduction of 71.6 percent is consistent with previous literature in equities markets, such as Bessembinder (2003), who finds a 74 percent reduction in NBBO quoted volumes for the most liquid stocks on the NYSE.

It is worthwhile noting that this market is significantly more liquid than traditional equity markets. With an average trade size of 69.73 contracts, and over 96 percent of trading occurring at the best quotes (and all trades executed within the first two price steps), the fall in depth may not adversely affect the average trader. Looking at the control contracts, there is a decrease of 50 contracts at the best prevailing quotes in the 10 year bond futures (although this is not significantly different from zero), while the 90 day BAB futures experience a significant increase of 1,585 contracts at the best quotes. This could indicate that traders have moved to the 90 day BAB futures contract. Overall, this 71.6 percent decrease in depth at the prevailing quotes for the 3 year bond futures contract, while statistically significant, may not be as economically significant as an equivalent decrease in an equity market due to the significant levels of depth remaining at the best quotes.

Similar results exist for total visible depth in the 3 year bond futures contract, with depth more than halving from 29,901 contracts in the December quarter to 14,048 contracts in the March quarter. However, as most trades occur at the best quotes, depth away from the best bid and ask is rarely used in executing trades. There is a significant increase of 5,556 contracts in order book depth in the 90 day BAB futures market, confirming the results of depth at the best quotes, and again indicating that traders could be moving across contracts. Results from overnight trading are consistent. Therefore, while total visible depth is significantly lower, it is arguable that this reduction is not economically significant.

Average daily volume falls for the 3 year bond futures, from 53,901 contracts in the December quarter to 50,331 in the March quarter (although the reduction of 3,570 contracts is not significantly different from zero). There are minimal changes in volume traded in the control contracts. Volatility is higher for all three contracts in the March 2007 contract, although the changes are not significantly different from zero. Changes in these variables are also insignificant during night trading sessions for all three contracts.

### *4.2 Multivariate Results*

Regression results for bid-ask spreads are presented in Panel A of Table 2. After controlling for changes in volume and volatility in both the 3 year bond futures and 10 year bond futures contracts, the change dummy variable has a significantly negative coefficient of -0.0049 (significant at the one percent level). Volume traded in the 10 year bond futures contract has a significantly negative impact on bid-ask spreads. Estimating the model with the 90 day BAB futures contract as a control, the effects of the reduction in tick size have the same dummy variable coefficient of -0.0049, significant at the one percent level. The daily traded volume in the 90 day BAB futures has a negative impact on bid-ask spreads in the 3 year bond futures. Similar results exist for night trading regressions. Regression results for the 10 year bond futures indicates no significant difference around the structural change, while the move to half basis point trading adversely affects spreads in the 90 day BAB futures contract. All explanatory variable coefficients are in their expected direction.

**<INSERT TABLE 2>**

Controlling for the levels of trading activity and volatility in the 3 year bond futures contract, as well as for trading activity in the substitute contracts, Panel B of Table 2 presents results from the regressions for depth at the best prevailing quotes. The reduction in tick size has a significantly negative effect on depth at the prevailing quotes for the 3 year bond futures contract, with change dummy variable coefficients significantly negative for both day and night trading sessions. When controlling for traded volume and volatility in the 3 year bond futures and 90 day BAB futures, the move to half basis point trading results in a significant reduction in depth at the best quotes. The regression for prevailing depth in the 10 year bond futures contract indicates a slight reduction in depth (although this is not statistically significant), while there is no change in depth (coefficient on the dummy variable of 0.0001) in the 90 day BAB futures.

Panel C of Table 2 presents results for regressions on total depth. Controlling for traded volume and volatility in the 3 year and 10 year bond futures contracts, the move to half basis point trading has a significantly negative effect on total visible depth in the 3 year bond futures (significant at the one percent level), both during day and night trading sessions. Similar results exist when using the 90 day BAB futures as the control contract. The move to half basis point trading has no effect on total visible depth in the 10 year bond futures contract or the 90 day BAB futures. Overall, after controlling for both contract-specific and market-wide trading activity and price volatility, the reduction in bid-ask spreads and quoted depth is confined to the 3 year bond futures.

### *4.3 Price Impact Results*

To determine whether the reduction in bid-ask spreads dominates the reduction in quoted depth, price impact surrounding the change is examined. Results of the price impact analysis are reported in Table 3. All price impacts are in basis points. Looking at the descriptive statistics of packages, the average number of contracts traded per package, before and after the reduction in minimum tick, does not change significantly. There is a consistent improvement across each quartile in time taken to execute packages. However, packages are being broken into more trades in the post-period, suggesting investors are trading smaller lots.

**<INSERT TABLE 3>**

Looking at price impact results for purchases, there is no statistically significant change in the first two quartiles, with execution costs being insignificantly different from zero. Price impact in the pre-period is 0.0975 and 0.0660 basis points for the first and second quartiles, respectively. The post-period costs of executing packages in the first and second quartiles are 0.0725 and 0.0691 basis points, respectively. The main improvements in execution costs occur in the larger quartiles. In the third quartile, price impact is significantly reduced. Before the tick size reduction, there is a total cost of 0.2724 basis points. However, after halving the tick size, price impact is reduced to 0.1461 basis points, a significant reduction (at the five percent level) of 0.1263 basis points. The largest quartile exhibits the greatest reduction in price impact for purchases, falling from 0.4121 to 0.2784 basis points (significant at the one percent level). These results indicate that while there is no significant reduction in costs for small packages, larger traders benefit greatly from the reduction in tick size, incurring significantly lower execution costs and having shorter execution times.

The price impact of selling any package size in the 3 year bond futures contract does not change significantly after the reduction in minimum tick. Sales in the third quartile have a reduced price impact, falling from 0.0461 basis points to 0.0457 basis points, however, this reduction is statistically insignificant. Investors executing packages in the largest quartile of contracts experience no significant reduction in price impact after the move to half basis point trading, with price impact falling from -0.2176 to -0.2116 basis points.

The results presented in Table 3 suggest that execution costs are lower after the reduction in minimum tick, with the most significant improvements occurring for large purchases, while smaller purchases and sales exhibit no statistically significant change in price impact after the move to half basis point trading. However, it should be noted that price impact for small purchases and sales, in both periods, are not significantly different than zero, indicating an already extremely low price impact. Based on these results, we conclude that market quality is improved after the reduction in minimum tick.

To isolate the effects of the reduction in tick size on price impact from other influences, such as the time taken to execute a package and the size of the package, a regression is estimated. Results are presented in Table 4. Regression results for purchases indicate that the move to half basis point trading leads to a significant reduction in price impact. The change dummy variable has a significantly negative coefficient of -0.4066. There is a strong positive relationship between the time taken to execute a package and execution costs, and consistent with Chan and Lakonishok (1995) and Frino and Oetomo (2005), price impact increases with package size.

Regression results for sales indicate that the move to half basis point trading has no significant impact on price impact. There is a positive relationship between price impact and the time taken to execute packages. Further, the regression confirms that larger packages incur greater price impact. Overall, the regression results confirm the univariate results. Purchases are significantly cheaper to execute after the reduction in minimum tick, while sales are equally cheap to execute before and after the change.

**<INSERT TABLE 4>**

*4.4 Seasonal Control*

To control for seasonal patterns in futures trading, and to provide a more robust analysis of the impact of a reduction in minimum tick size on market quality, the March 2006 contract is compared to the March 2007 contract. Descriptive statistics are presented in Table 5. Results confirm original findings, with bid-ask spreads in the 3 year bond futures contract exhibiting a significant reduction of 0.49 basis points, while there is no change in the control contracts. The decrease in depth at the best prevailing quotes and in the visible limit order book supports earlier results. Depth in both substitute contracts increases from March 2006 to March 2007. After controlling for seasonal patterns in trading, there is still no significant change in volatility in any of the three contracts, while only volume in the 10 year bond futures contract significantly different, increasing by 7,736 contracts per day. When controlling for seasonal patterns in futures trading, results support the initial findings that the reduction in bid-ask spreads and quoted depth occurs only in the 3 year bond futures contract.

**<INSERT TABLE 5>**

Regression results are presented in Table 6. Panel A presents results for bid-ask spread regressions, and confirm the reduction in bid-ask spreads after the tick size reduction (change dummy variable is significantly negative). The move to half basis point trading has no effect on bid-ask spreads in either the 10 year bond futures contract or 90 day BAB futures, consistent with previous regressions. Panels B and C present results from the best depth and total depth regressions, respectively. After controlling for volume and volatility, the move to half basis point trading is associated with significantly lower depth levels (both best and total) in the 3 year bond futures. Depth at both the best quotes and visible in the order book in the control contracts are not significantly affected by the reduction in tick size, consistent with earlier findings.

**<INSERT TABLE 6>**

A comparison of execution quality and price impact of institutional trades between the March 2006 and March 2007 contract is provided in Table 7, with results supporting the findings of the improvement in execution quality and price impact from the traditional pre-post analysis. For purchases, all but the first quartile experience a statistically significant reduction in price impact for purchases, consistent with earlier findings. Execution costs for packages between 56 and 250 contracts are reduced by 0.1443 basis points, significant at the five percent level. This reduction increases uniformly, with execution costs decreasing by 0.2723 basis points for packages containing between 251 and 680 contracts, while the largest packages exhibit a decrease of 0.3895 basis points, both statistically greater than zero at the one percent level. Results for sales across all four size categories indicate that price impact is not significantly different after the reduction in minimum tick.

**<INSERT TABLE 7>**

In addition to controlling for seasonality in patterns of trading, the regression in Table 8 controls for the size of the package and the time taken to execute each package. Examining the buy-side regression, the move to half basis point trading has a significantly negative relationship with price impact, having a coefficient of -0.1606. The time taken to execute a package is positively related to execution costs, as is the size of the package, consistent with earlier findings. Results from sell-side regressions are consistent with earlier findings, with the move to half basis point trading having no significant impact on execution costs.

**<INSERT TABLE 8>**

## 5. Conclusions

The impact of a reduction in minimum price increment in financial markets draws considerable attention from academics and market practitioners. The majority of research in this area is centred on equities markets; however, evidence from this research is mixed. Actively traded securities generally benefit from a lower tick size, while market quality in infrequently traded instruments is adversely affected by a tick size reduction. Several studies find that execution costs for institutional investors are lower, while other studies find significant increases in trading costs. The single study in futures markets provides inconclusive evidence as to the impact on market quality.

This paper examines the impact of a reduction in the minimum price increment in 3 Year Commonwealth Treasury Bond Futures on the Sydney Futures Exchange. Results indicate that bid-ask spreads are significantly reduced after the change. Quoted depth, both at the best quotes and visible in the order book, is significantly lower after the tick reduction. Both trading volume and price volatility are not significantly affected. Execution costs are reduced after the change, with large institutional buy orders experiencing the most significant reduction. These results hold in the overnight trading session, are robust to seasonal patterns in futures trading and are robust to trading in substitute contracts. We conclude that a tick size reduction improves market quality in a futures market setting.

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**Table 1**
**Pre-Post Market Quality Indicators**

The table presents results for various market quality indicators around the move to half-basis point trading in the 3 year bond futures contract. The variable *Bid-Ask Spread* is the time-weighted bid-ask spread in each contract, while *BAS* standardises the spread, dividing by the minimum tick in each contract. *Best Depth* presents the average quoted volume at the prevailing quotes, while *Total Depth* represents the total depth in the visible limit order book. *Volatility* is calculated as the log difference between daily high and low prices. The average daily volume traded in each contract is represented by the *Volume* variable. The sample consists of the December 2006 and March 2007 contracts. Night trading results are presented in parentheses.

| | *Bid- Ask Spread* | *BAS* | *Best Depth* | *Total Depth* | *Volatility* | *Volume* |
|---|---|---|---|---|---|---|
| *Panel A – Pre-period (16 September 2006- 10 December 2006)* | | | | | | |
| 3 Year | 0.0100 | 1.004 | 9,337 | 29,981 | 0.0382 | 53,901 |
| | (0.0103) | (1.021) | (4,186) | (15,930) | (0.0507) | (21,101) |
| 10 Year | 0.0050 | 1.019 | 1,060 | 6,305 | 0.0366 | 24,543 |
| | (0.0056) | (1.126) | (340) | (2,417) | (0.0521) | (10,545) |
| 90 Day BAB | 0.0101 | 1.007 | 10,741 | 25,917 | 0.0252 | 33,641 |
| | (0.0105) | (1.044) | (6,107) | (18,376) | (0.0274) | (10,929) |
| *Panel B – Post-period (16 December 2006- 10 March 2007)* | | | | | | |
| 3 Year | 0.0051 | 1.021 | 2,647 | 14,048 | 0.0390 | 50,331 |
| | (0.0057) | (1.147) | (1,121) | (7,225) | (0.0444) | (18,052) |
| 10 Year | 0.0051 | 1.013 | 1,010 | 5,489 | 0.0413 | 27,273 |
| | (0.0058) | (1.156) | (342) | (2,419) | (0.0512) | (11,998) |
| 90 Day BAB | 0.0101 | 1.012 | 12,326 | 31,473 | 0.0256 | 32,742 |
| | (0.0107) | (1.057) | (7,498) | (26,427) | (0.0246) | (9,429) |
| *Panel C – Change from pre-period to post-period* | | | | | | |
| 3 Year | -0.0049** | 0.0170 | -6,689** | -15,933** | 0.0008 | -3,570 |
| | (-0.0046**) | (0.1260) | (-3,065**) | (-8,705**) | (-0.0063) | (-3,049) |
| 10 Year | 0.0001 | -0.0060 | -50 | -816 | 0.0047 | 2,730 |
| | (0.0002) | (0.0302*) | (2.0) | (2.0) | (-0.0009) | (1,453) |
| 90 Day BAB | 0.0000 | 0.0050 | 1,585** | 5,556** | 0.0004 | -899 |
| | (0.0002**) | (0.0124*) | (1,391**) | (8,051**) | (-0.0028) | (-1,500) |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

**Table 2**
**Pre-Post Regressions**

The table presents results from the following regression models:

$$BAS_i = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility$$

$$Ln(BestDepth_i) = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility$$

$$Ln(TotalDepth_i) = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility$$

Where $BAS_i$ represents the bid-ask spread in each futures contract, *Ln(BestDepth$_i$)* represents the depth at the best prevailing quotes and *Ln(TotalDepth$_i$)* represents the total visible depth. The binary variable, *Change,* takes the value of 1 after the reduction in tick size and 0 otherwise. *Ln(ControlVolume$_i$)* represents daily traded volume in each control contract and *ControlVolatility$_i$* represents daily volatility, calculated as the natural logarithm of the difference between daily high and low prices. *Ln(ThreeVolume)* and *ThreeVolatility* represent daily traded volume and volatility in the 3 year bond futures contract, respectively. The sample consists of the December 2006 and March 2007 contracts. Night trading results are presented in parentheses.

| | *Intercept* | *Change* | *Ln(Control Volume$_{10}$)* | *Ln(Control Volume$_{BAB}$)* | *Control Volatility$_{10}$* | *Control Volatility$_{BAB}$* | *Ln(Three Volume)* | *Three Volatility* | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|
| *Panel A: Bid-Ask Spreads* | | | | | | | | | |
| $BAS_3$ | 0.0105** | -0.0049** | -0.0001** | - | 0.0047 | - | 0.0000 | 0.0089 | 0.8986 |
| | (0.0138**) | (-0.0045**) | (-0.0004**) | - | (0.1395**) | - | (-0.0003**) | (0.0367) | (0.8733) |
| $BAS_3$ | 0.0103** | -0.0049** | - | 0.0000 | - | -0.0002 | -0.0001* | 0.0101 | 0.8988 |
| | (0.0129**) | (-0.0045**) | - | (0.0000) | - | (-0.0382) | (-0.0005**) | (0.0989**) | (0.8705) |
| $BAS_{10}$ | 0.0056** | 0.0000 | -0.0001** | - | 0.0170** | - | 0.0000 | 0.0014 | 0.2621 |
| | (0.0056**) | (0.0000) | (-0.0001**) | - | (0.0145**) | - | (0.0000) | (-0.0020) | (0.3020) |
| $BAS_{BAB}$ | 0.0107** | 0.0001* | - | 0.0000 | - | -0.0105 | -0.0002** | 0.0312** | 0.1382 |
| | (0.0145**) | (0.0002) | - | (0.0000) | - | (0.0346) | (-0.0008**) | (0.1131*) | (0.2252) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Panel B: Best Depth* | | | | | | | | | |
| Ln(BestDepth$_3$) | 4.063** | -1.606** | 0.6802** | - | -93.66** | - | 0.2419** | -65.42** | 0.8642 |
| | (4.227**) | (-1.391**) | (0.3925**) | - | (-105.4**) | - | (0.4088**) | (-30.85**) | (0.7971) |
| Ln(BestDepth$_3$) | 5.925** | -1.670** | - | -0.1199 | - | 8.748 | 0.6634** | -105.0** | 0.8159 |
| | (5.203**) | (-1.369**) | - | (0.0239) | - | (4.532) | (0.5301**) | (-68.78**) | (0.7782) |
| Ln(BestDepth$_{10}$) | 1.975** | -0.2711 | 0.9353** | - | -126.1** | - | -0.0395 | -12.77 | 0.4814 |
| | (1.887**) | (-0.1855) | (0.7837**) | - | (-133.5**) | - | (0.0634) | (-26.50) | (0.4114) |
| Ln(BestDepth$_{BAB}$) | 0.0107** | 0.0001 | - | 0.0000 | - | -0.0105 | -0.0002** | 0.0312* | 0.1382 |
| | (4.770*) | (-0.0211) | - | (-0.0107) | - | (-107.0) | (0.7362**) | (-92.90*) | (0.1920) |
| *Panel C: Total Depth* | | | | | | | | | |
| Ln(TotalDepth$_3$) | 5.598** | -1.026** | 0.6081** | - | -88.82** | - | 0.2239** | -41.52* | 0.7911 |
| | (5.831**) | (-0.9457**) | (0.4093**) | - | (-89.25**) | - | (0.3697**) | (-56.85*) | (0.7911) |
| Ln(TotalDepth$_3$) | 7.314** | -1.095** | - | -0.1407 | - | 11.30 | 0.6194** | -80.17** | 0.7192 |
| | (6.871**) | (-0.9029**) | - | (-0.0137) | - | (-0.2733) | (0.5328**) | (-86.15**) | (0.6812) |
| Ln(TotalDepth$_{10}$) | 3.798** | -0.3558 | 0.9466** | - | -124.9** | - | -0.0637 | -4.956 | 0.5538 |
| | (3.590**) | (-0.2167) | (0.7772**) | - | (-126.8**) | - | (0.1053) | (-26.59) | (0.4232) |
| Ln(TotalDepth$_{BAB}$) | 5.965** | -0.2582 | - | -0.0404 | - | 1.687 | 0.7030** | -79.49* | 0.2563 |
| | (6.091**) | (0.1232) | - | (-0.0545) | - | (-105.8) | (0.7424**) | (-90.55*) | (0.2184) |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

**Table 3**
**Pre-Post Price Impact**

The table presents the mean total price impact for the 3 year Commonwealth Treasury Bond Futures around the move to half basis point trading. Packages are divided into four quartiles based on total volume. In addition to price impact, the average number of contracts in each quartile, the time taken to execute each package and average number of trades per package are presented. The sample used is a proprietary SFE data set containing trade-by-trade information including volume and price of execution, as well as client codes, allowing for a construction of packages. The sample consists of the December 2006 and March 2007 contracts. Price impact is reported in basis points.

| | 2-55 | | 56-250 | | 251-680 | | 681-9000 | |
|---|---|---|---|---|---|---|---|---|
| | Buys | Sells | Buys | Sells | Buys | Sells | Buys | Sells |
| *Panel A – Pre-period (16 September 2006- 10 December 2006)* | | | | | | | | |
| *Price Impact* | 0.0975 | 0.0440 | 0.0660 | -0.0415 | 0.2724** | -0.0461 | 0.4121** | -0.2176* |
| *Average Package (Contracts)* | 15.12 | 12.19 | 128.3 | 124.5 | 452.7 | 429.5 | 1,966 | 1,958 |
| *Duration (Hours)* | 0.446 | 0.120 | 0.168 | 0.121 | 3.41 | 2.94 | 5.69 | 5.97 |
| *Average no. of Trades* | 3.56 | 4.39 | 4.64 | 5.05 | 6.14 | 5.67 | 13.14 | 13.29 |
| *Number of observations* | 570 | 640 | 586 | 513 | 591 | 548 | 653 | 660 |
| *Panel B- Post-period (16 December 2006- 10 March 2007)* | | | | | | | | |
| *Price Impact* | 0.0725 | 0.0690 | 0.0691 | -0.0521 | 0.1461* | -0.0457 | 0.2784** | -0.2116* |
| *Average Package (Contracts)* | 15.30 | 13.06 | 133.9 | 116.3 | 433.7 | 416.3 | 1,881 | 1,886 |
| *Duration (Hours)* | 0.352 | 0.180 | 0.126 | 0.170 | 3.02 | 3.60 | 4.96 | 5.06 |
| *Average no. of Trades* | 3.72 | 3.63 | 4.92 | 5.47 | 6.22 | 7.14 | 13.52 | 13.66 |
| *Number of observations* | 505 | 503 | 600 | 617 | 595 | 592 | 548 | 492 |
| *Panel C: Change from pre-period to post-period* | | | | | | | | |
| *Price Impact* | -0.0250 | 0.0250 | 0.0031 | -0.0106 | -0.1263* | 0.0004 | -0.1337** | 0.0060 |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

## Table 4
## Pre-Post Price Impact Regressions

The table presents the results of the following regression model:

$$PriceImpact_i = \alpha_0 + \alpha_1 Change + \alpha_2 PackageLength_i + \alpha_3 Size_2 + \alpha_4 Size_3 + \alpha_5 Size_4$$

Where $PriceImpact_i$ is calculated as the difference between the VWAP of a package and the open price on the first day of the package. To account for the impact of a move to half basis point trading, the dummy variable *Change* takes the value of 1 after the reduction in tick size and 0 otherwise. Consistent with previous literature, the variable $PackageLength_i$ controls for the time taken to fully execute a package. Further, each of the size dummy variables, $Size_2$, $Size_3$ and $Size_4$ correspond to the package size quartiles. The sample consists of the December 2006 and March 2007 contracts.

| | $PriceImpact_{Buy}$ | $PriceImpact_{Sell}$ |
|---|---|---|
| *Intercept* | -0.0909 | 0.1526* |
| *Change* | -0.4066** | 0.0357 |
| $PackageLength_i$ | 0.0196** | -0.0176** |
| $Size_2$ | 0.2094* | -0.1257 |
| $Size_3$ | 0.8702** | -0.1493* |
| $Size_4$ | 0.7392** | -0.2837** |
| $R^2$ | 0.0235 | 0.0115 |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

**Table 5**
**Year-On-Year Market Quality Indicators**

The table presents results for various market quality indicators around the move to half-basis point trading in the 3 year bond futures contract. The variable *Bid-Ask Spread* is the time-weighted bid-ask spread in each contract, while *BAS* standardises the spread, dividing by the minimum tick in each contract. *Best Depth* presents the average quoted volume at the prevailing quotes, while *Total Depth* represents the total depth in the visible limit order book. *Volatility* is calculated as the log difference between daily high and low prices. The average daily volume traded in each contract is represented by the *Volume* variable. The sample consists of the March 2006 and March 2007 contracts. Night trading results are presented in parentheses.

| | *Bid- Ask Spread* | *BAS* | *Best Depth* | *Total Depth* | *Volatility* | *Volume* |
|---|---|---|---|---|---|---|
| *Panel A – Pre-period (16 December 2005- 10 March 2006)* | | | | | | |
| 3 Year | 0.0100 | 1.000 | 7,269 | 24,147 | 0.0403 | 45,656 |
| | (0.0104) | (1.027) | (3,297) | (12,930) | (0.0454) | (16,887) |
| 10 Year | 0.0051 | 1.024 | 729 | 4,368 | 0.0385 | 19,537 |
| | (0.0060) | (1.195) | (271) | (1,769) | (0.0467) | (8,021) |
| 90 Day BAB | 0.0101 | 1.007 | 10,162 | 27,995 | 0.0199 | 25,747 |
| | (0.0105) | (1.044) | (6,246) | (23,088) | (0.0274) | (7,371) |
| *Panel B – Post- period (16 December 2006- 10 March 2007)* | | | | | | |
| 3 Year | 0.0051 | 1.021 | 2,647 | 14,048 | 0.0390 | 50,331 |
| | (0.0057) | (1.147) | (1,121) | (7,225) | (0.0444) | (18,052) |
| 10 Year | 0.0051 | 1.013 | 1,010 | 5,489 | 0.0413 | 27,273 |
| | (0.0058) | (1.156) | (342) | (2,419) | (0.0512) | (11,998) |
| 90 Day BAB | 0.0101 | 1.012 | 12,326 | 31,473 | 0.0256 | 32,742 |
| | (0.0107) | (1.057) | (7,498) | (26,427) | (0.0246) | (9,429) |
| *Panel C – Change from pre-period to post-period* | | | | | | |
| 3 Year | -0.0049** | 0.0210 | -4,622** | -10,099** | -0.0013 | 4,675 |
| | (-0.0047**) | (0.1260) | (-2,176**) | (-5,705**) | (-0.0010) | (1,165) |
| 10 Year | 0.0000 | -0.0110 | 282** | 1,121** | 0.0028 | 7,736** |
| | -(0.0002) | (-0.0390) | (71**) | (650**) | (0.0045) | (3,978**) |
| 90 Day BAB | 0.0000 | 0.0050 | 2,164** | 3,478** | 0.0057 | 6,995 |
| | (0.0002**) | (0.0123*) | (1,253**) | (3,339**) | (0.0039) | (2,057) |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

**Table 6**
**Year-on-Year Regressions**

The table presents results from the following regression models:

$$BAS_i = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility$$

$$Ln(BestDepth_i) = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility$$

$$Ln(TotalDepth_i) = \alpha_0 + \alpha_1 Change + \alpha_2 Ln(ControlVolume_i) + \alpha_3 ControlVolatility_i + \alpha_4 Ln(ThreeVolume) + \alpha_5 ThreeVolatility$$

Where $BAS_i$ represents the bid-ask spread in each futures contract, $Ln(BestDepth_i)$ represents the depth at the best prevailing quotes and $Ln(TotalDepth_i)$ represents the total visible depth. The binary variable, *Change,* takes the value of 1 after the reduction in tick size and 0 otherwise. $Ln(ControlVolume_i)$ represents daily traded volume in each control contract and $ControlVolatility_i$ represents daily volatility, calculated as the natural logarithm of the difference between daily high and low prices. *Ln(ThreeVolume)* and *ThreeVolatility* represent daily traded volume and volatility in the 3 year bond futures contract, respectively. The sample consists of the March 2006 and March 2007 contracts. Night trading results are presented in parentheses.

| | *Intercept* | *Change* | *Ln(Control Volume$_{10}$)* | *Ln(Control Volume$_{BAB}$)* | *Control Volatility$_{10}$* | *Control Volatility$_{BAB}$* | *Ln(Three Volume)* | *Three Volatility* | $R^2$ |
|---|---|---|---|---|---|---|---|---|---|
| *Panel A: Bid-Ask Spreads* | | | | | | | | | |
| $BAS_3$ | 0.0106** | -0.0050** | -0.0001* | - | 0.0056 | - | 0.0000 | 0.0099 | 0.8987 |
| | (0.0140**) | (-0.0046**) | (-0.0002) | - | (0.1788**) | - | (-0.0006**) | (-0.0023) | (0.8662) |
| $BAS_3$ | 0.0105** | -0.0049** | - | 0.0000 | - | -0.0082 | -0.0001* | 0.0151* | 0.8986 |
| | (0.0136**) | (-0.0046**) | - | (0.0001) | - | (0.0057) | (-0.0006**) | (0.0993**) | (0.8627) |
| $BAS_{10}$ | 0.0056** | 0.0000 | -0.0001** | - | 0.0145** | - | 0.0000 | -0.0020 | 0.3020 |
| | (0.0098**) | (0.0000) | (-0.0005**) | - | (0.2331**) | - | (-0.0003) | (-0.1020) | (0.2649) |
| $BAS_{BAB}$ | 0.0108** | 0.0001* | - | 0.0000 | - | -0.0132 | -0.0002** | 0.0259* | 0.1515 |
| | (0.0153**) | (0.0001) | - | (0.0001) | - | (0.0761) | (-0.0007**) | (-0.0003) | (0.3207) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Panel B: Best Depth* | | | | | | | | | |
| Ln(BestDepth$_3$) | 3.228** | -1.089** | 0.5117** | - | -157.7** | - | 0.4508** | -7.829** | 0.7766 |
| | (4.116**) | (-1.125**) | (0.2123) | - | (-157.4**) | - | (0.5252**) | (66.92*) | (0.7021) |
| Ln(BestDepth$_3$) | 3.875** | -1.281** | - | 0.0274 | - | 8.383 | 0.7706** | -100.8** | 0.7185 |
| | (4.449**) | (-1.097**) | - | (0.0941) | - | (-21.69) | (0.5206**) | (-12.65**) | (0.6778) |
| Ln(BestDepth$_{10}$) | 0.969* | 0.1397 | 1.013** | - | -144.2** | - | -0.0450 | 28.24 | 0.6223 |
| | (2.215**) | (-0.0867) | (0.6804**) | - | (-159.5**) | - | (0.0731) | (26.07) | (0.4257) |
| Ln(BestDepth$_{BAB}$) | 2.548* | -0.2951 | - | 0.0317 | - | 59.76 | 1.010** | 128.5** | 0.3795 |
| | (3.583**) | (0.1082) | - | (0.1205) | - | (-126.8*) | (0.7383**) | (11.17**) | (0.3013) |
| *Panel C: Total Depth* | | | | | | | | | |
| Ln(TotalDepth$_3$) | 4.428** | -0.6138** | 0.5367** | - | -135.2** | - | 0.4002** | -2.050 | 0.6836 |
| | (6.045**) | (-0.6487**) | (0.2039) | - | (-129.4**) | - | (0.4035**) | (51.83) | (0.5212) |
| Ln(TotalDepth$_3$) | 5.221** | -0.7505** | - | -0.0243 | - | 13.84 | 0.7632** | -76.54** | 0.5980 |
| | (6.405**) | (-0.6167**) | - | (0.0453) | - | (-15.60) | (0.4719**) | (-35.22*) | (0.4874) |
| Ln(TotalDepth$_{10}$) | 2.565** | -0.0239 | 1.015** | - | -121.9** | - | -0.0162 | 9.596 | 0.6151 |
| | (4.234**) | (0.0282) | (0.5950**) | - | (-132.0**) | - | (0.0884) | (41.75) | (0.3635) |
| Ln(TotalDepth$_{BAB}$) | 3.576** | -0.2622 | - | 0.0272 | - | 55.62 | 0.9706** | -91.96* | 0.4142 |
| | (5.596*) | (0.0288) | - | (-0.0020) | - | (-153.1**) | (0.7489**) | (4.694) | (0.3037) |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

**Table 7**
**Year-on-Year Price Impact**

The table presents the mean total price impact for the 3 year Commonwealth Treasury Bond Futures around the move to half basis point trading. Packages are divided into four quartiles based on total volume. In addition to price impact, the average number of contracts in each quartile, the time taken to execute each package and average number of trades per package are presented. The sample used is a proprietary SFE data set containing trade-by-trade information including volume and price of execution, as well as client codes, allowing for a construction of packages. The sample consists of the March 2006 and March 2007 contracts. Price impact is reported in basis points.

| | 2-55 | | 56-250 | | 251-680 | | 681-9000 | |
|---|---|---|---|---|---|---|---|---|
| | Buys | Sells | Buys | Sells | Buys | Sells | Buys | Sells |
| *Panel A – Pre-period (16 December 2005- 10 March 2006)* | | | | | | | | |
| *Price Impact* | 0.0597 | -0.0220 | 0.2133* | 0.0315 | 0.4184** | -0.1108* | 0.6679** | -0.2607** |
| *Average Package (Contracts)* | 18.30 | 12.98 | 164.1 | 166.5 | 424.8 | 458.6 | 1,856 | 1,750 |
| *Duration (Hours)* | 0.416 | 0.220 | 0.132 | 0.160 | 2.83 | 3.72 | 4.99 | 5.33 |
| *Average no. of Trades* | 3.64 | 3.82 | 6.47 | 4.42 | 7.82 | 6.69 | 13.43 | 10.07 |
| *Number of observations* | 493 | 562 | 562 | 601 | 508 | 583 | 570 | 497 |
| *Panel B – Post-period (16 December 2006- 10 March 2007)* | | | | | | | | |
| *Price Impact* | 0.0725 | 0.0690 | 0.0691 | -0.0521 | 0.1461* | -0.0457 | 0.2784** | -0.2116* |
| *Average Package (Contracts)* | 15.30 | 13.06 | 133.9 | 116.3 | 433.7 | 416.3 | 1,881 | 1,886 |
| *Duration (Hours)* | 0.352 | 0.180 | 0.126 | 0.170 | 3.02 | 3.60 | 4.96 | 5.06 |
| *Average no. of Trades* | 3.72 | 3.63 | 4.92 | 5.47 | 6.22 | 7.14 | 13.52 | 13.66 |
| *Number of observations* | 505 | 503 | 600 | 617 | 595 | 592 | 548 | 492 |
| *Panel C: Change from pre-period to post-period* | | | | | | | | |
| *Price Impact* | 0.0128 | -0.0910 | -0.1443* | 0.0836 | -0.2723** | -0.0651 | -0.3895** | -0.0491 |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.

**Table 8**
**Year-on-Year Price Impact Regressions**

The table presents the results of the following regression model:

$$PriceImpact_i = \alpha_0 + \alpha_1 Change + \alpha_2 PackageLength_i + \alpha_3 Size_2 + \alpha_4 Size_3 + \alpha_5 Size_4$$

Where $PriceImpact_i$ is calculated as the difference between the VWAP of a package and the open price on the first day of the package. To account for the impact of a move to half basis point trading, the dummy variable *Change* takes the value of 1 after the reduction in tick size and 0 otherwise. Consistent with previous literature, the variable $PackageLength_i$ controls for the time taken to fully execute a package. Further, each of the size dummy variables, $Size_2$, $Size_3$ and $Size_4$ correspond to the package size quartiles. The sample consists of the March 2006 and March 2007 contracts.

| | $PriceImpact_{Buy}$ | $PriceImpact_{Sell}$ |
|---|---|---|
| *Intercept* | -0.3243** | 0.1016 |
| *Change* | -0.1606** | -0.0169 |
| $PackageLength_i$ | 0.0239** | -0.0055 |
| $Size_2$ | 0.3412** | -0.0810 |
| $Size_3$ | 0.6204** | -0.0839* |
| $Size_4$ | 0.7413** | -0.2551** |
| $R^2$ | 0.0245 | 0.0028 |

* Significantly different from zero at the 5 percent level.
** Significantly different from zero at the 1 percent level.