Maker-taker exchange fees and market liquidity: evidence from a natural experiment*

Henk Berkman
University of Auckland
h.berkman@auckland.ac.nz

Glenn Boyle
University of Canterbury
glenn.boyle@canterbury.ac.nz

Alex Frino
University of Sydney
a.frino@econ.usyd.edu.au

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Abstract

Motivated by a desire to enhance market liquidity, exchanges around the world have recently shown increasing interest in so-called 'maker-taker' fee structures. However, little is currently known about the effectiveness of such schemes. We therefore make use of a natural experiment to empirically assess the impact of maker-taker fees on liquidity. For three months during 2008, the New Zealand Stock Exchange applied maker-taker exchange fees to *Australian* securities cross-listed on the New Zealand stock market, thereby allowing us to isolate the change in liquidity attributable to the introduction of maker-taker fees. We find some evidence suggesting that market depth and trading volume rose in response to the change in fee structure, but bid-ask spreads remained essentially unchanged. We conclude that the impact of maker-taker fees on market liquidity remains an open question.

JEL classification: G10, G12, G15

Keywords: maker-taker fees; liquidity; bid-ask; depth; volume

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1 Introduction

There are increasing differences in the structure of trading fees charged by stock exchanges around the world. While many retain the traditional structure that charges the same fee for both market orders and limit orders, others have recently introduced so-called 'maker-taker' fee arrangements in which limit order traders (market makers) are charged lower exchange fees than market order traders (market takers).[1] By offering rebates to liquidity providers (while continuing to charge liquidity users), exchanges hope to incentivize such traders and hence increase overall market liquidity.

Somewhat surprisingly however, there has been little formal analysis of the impact of maker-taker pricing on market liquidity. In the most directly relevant study, Foucault et al (2009) develop a theoretical model which implies that trading volume is greater under maker-taker pricing when tick sizes are small, the number of market makers is low, and market maker monitoring costs are high. Intuitively, this occurs because in these situations the gains from trade are skewed towards market takers, and so market makers need additional incentives to actively monitor and trade. Other studies indirectly suggest that maker-taker pricing should lower bid-ask spreads. For example, the models of Glosten (1994) and Ho and Stoll (1983) yield an inverse relationship between spreads and the number of liquidity providers, a hypothesis for which Huang and Masulis (1999) find some support. As the introduction of maker-taker pricing lowers the costs of providing liquidity, the number of liquidity providers should rise, thus implying a tightening of spreads.[2] Moreover, any increase

[1] Examples of the traditional group include the exchanges of Australia, Hong Kong and Singapore; those in the latter group include NYSE, Nasdaq, AMEX, Toronto and Switzerland. Some exchanges (e.g., NYSE, Nasdaq and the International Securities Exchange) have also begun making use of maker-taker pricing for options trading.

[2] Even in the absence of additional liquidity suppliers, maker-taker pricing may lower bid-ask spreads. Because almost 50% of spreads consists of compensation to liquidity providers for order processing costs – see Stoll (1989) and Brockman and Chung (1999) – any reduction in such costs should lower the spread.

in liquidity supply as the result of maker-taker pricing should also lead to a greater number of limit orders at each price level, and hence to an increase in market depth. Finally, of course, any lowering of trading costs should, other things unchanged, drive up trading volume.

There are thus strong theoretical reasons for believing that the adoption of maker-taker pricing should lead to an improvement in all three principal aspects of liquidity – volume, depth and bid-ask spreads. However, the only empirical test of this hypothesis yields mixed results: Lutat (2010) examines the 2008 introduction of maker-taker exchange fees by SWX Europe and, for 19 stocks in the Swiss blue-chip index, finds no evidence of any change in bid-ask spreads, but some limited evidence of increased depth at the best ask quote.

In some ways Lutat's (2010) findings are unsurprising, since empirically identifying the liquidity impact of a move to maker-taker pricing is potentially complicated by two factors. First, the change in pricing structure may be accompanied by other confounding events that also affect liquidity in the stocks of interest. Second, the decision to adopt maker-taker pricing may be an endogenous response to anticipated changes in trading conditions. Both phenomena make it difficult to isolate any liquidity effect that is due to the change in pricing structure. In this paper, we sidestep these problems by making use of a natural experiment helpfully conducted by the New Zealand stock exchange (henceforth NZX) during 2008. Between 1 August and 31 October of that year, NZX applied maker-taker pricing to the subset of Australian-domiciled companies that were listed on both the New Zealand and Australian exchanges.[3] Because there was no corresponding change in pricing structure during the same period on the Australian stock exchange (henceforth ASX), we are able to use liquidity in that market as a control for stock-specific changes in liquidity that are unrelated to the introduction of maker-taker fees. And because we compare liquidity in these stocks during the trial period with liquidity before *and* after that time, we also bypass the endogenous choice issue.

Our results are by no means unambiguous. Without controlling for ASX liquidity in the cross-listed stocks, NZX market liquidity is *lower* during the trial period, albeit insignificantly so for most liquidity measures. After controlling for ASX liquidity (and general market conditions), by contrast,

[3]In announcing the trial, NZX claimed that it was "...designed to encourage Market Participants to (trade cross-listed stocks) on NZX, thereby improving underlying market liquidity." See NZX Market Participant Pricing Update No. 11, 1 August 2008.

we find some evidence suggesting that market depth and trading volume rise in response to the change in fee structure, but that bid-ask spreads remain essentially unchanged. We conclude that the impact of maker-taker fees on market liquidity remains an open question.

In the next section, we describe the relevant institutional details for the ASX and NZX markets. Section 3 describes the data and research method, while Section 4 reports the results. Section 5 offers some concluding remarks.

2 Institutional detail

Both the ASX and NZX operate analogous open electronic limit order books with similar minimum tick sizes. The trading hours of NZX are 10am to 4:45pm NZ time, while ASX operates from 10am to 4pm Australian Eastern Standard Time (AEST). During our sample period, New Zealand time is two hours ahead of AEST, with the exception of the period between 28 September and 4 October, 2008 when the time difference was three hours. Therefore, trading hours on the ASX and NZX overlap from 10am to 2:45pm on the ASX and 12am to 4:45 pm on NZX (both in local time).

Between 1 August 2008 and 31 October 2008, NZX trialled maker-taker exchange fees for 17 ASX-listed firms that were cross-listed on NZX. As can be seen in Table 1, the quantity of NZX trading activity in these stocks during the six months centered around the trial period varies considerably: slightly more than half trade on all or most days, while the remainder trade infrequently or not at all.

Prior to the trial, the exchange fee charged to each side of a NZX transaction was $1 per trade plus 20 basis points of the value of the trade up to a maximum of $20. Following the introduction of maker-taker pricing on 1 August 2008, the exchange fee for limit order traders was eliminated and replaced by a rebate of five basis points. On 1 November, NZX reverted to the original fee structure. During the period in question, the ASX left its exchange fee structure unchanged.

As we shall see below in section 3, the average trade size for the stocks examined in this study is approximately $20,000 and 1,800 shares. Hence, in the absence of maker-taker pricing, the exchange fee for an average trade is $21, or approximately 1.2 cents per share, for each side of the trade. With maker-taker pricing, the market order trader (taker) was still charged $21 per trade, or 1.2 cents per share, while the limit order trader (maker) earned a

Table 1: Cross-listed Australian companies subject to maker-taker pricing on NZX

Australian-domiciled companies cross-listed on NZX that were subject to maker-taker pricing between 1 August 2008 and 31 October 2008. Days Traded reports the number of days the company's stock was traded on NZX during the six-month period (131 trading days) 15 June – 15 December 2008. Final Sample is 'Yes' if the company is ultimately included in our data sample, otherwise it is 'No'.

Company Name	NZX Code	Days Traded	Final Sample
AMP	AMP	129	Yes
Australian Foundation Investment Co.	AFI	119	Yes
APN News & Media	APN	45	No
Australia and New Zealand Banking Group	ANZ	130	Yes
Babcock & Brown Infrastructure	BBI	0	No
Downer EDI	DOW	0	No
Energy World Corporation	EWC	0	No
Goodman Fielder	GFF	125	Yes
L & M Petroleum	LMP	115	No
Lion Nathan	LNN	116	Yes
Pacific Brands	PBG	25	No
People Telecom	PEO	0	No
Pan Pacific Petroleum	PPP	124	No
Tag Pacific	TPC	15	No
Telstra Corporation	TLS	120	Yes
Transpacific Industries Group	TPI	0	No
Westpac Banking Corporation	WBC	128	Yes

rebate of $10, or 0.55 cents per share. Consequently, the difference in exchange fees during the maker-taker trial is 1.75 cents per share.

3 Data and summary statistics

The data used in this study is from the Reuters DataScope Tick History Database, provided by the Securities Industry Research Centre of Asia Pacific. For both NZX and the ASX, the database includes details of all transactions records, as well as the best bid and best ask every time there is an update. Each trade record contains fields with the date, security, price, and volume as well as a time-stamp which is accurate to the nearest 1/100th of a second. The bid and ask records contain fields with the date, security, best bid or ask

price, and the total depth at the best bid or ask price as well as a time-stamp accurate to the nearest 1/100th of a second.

To estimate the effects of the NZX maker-taker trial on liquidity, we use a control period that is chronologically close to the trial period and of similar duration, specifically the 1.5 months before the trial (from 15 June to 31 July, 2008) and the 1.5 months after the trial (from 1 November to 15 December). Hence, our data draws on observations for the six month period (131 trading days) extending from 15 June to 15 December 2008.

From the 17 cross-listed stocks subject to the maker-taker trial, we excluded those that were not traded on NZX during at least 100 of the 131 possible trading days during our sample period. This reduced the sample to nine stocks. In addition, we deleted two stocks (L&M Petroleum and Pan Pacific Petroleum) that changed minimum tick sizes during the sample period, leaving a final sample of seven stocks.

A brief summary of the trading activity for these stocks appears in Table 2. Unsurprisingly, trading is substantially lower in New Zealand — the average number of trades per day on NZX ranges from three to 14, compared to a minimum of 177 on ASX. Similarly, the daily number of shares traded is typically hundreds of times higher on ASX. By contrast, average trade size is approximately the same on the two exchanges, with NZX trading larger parcels on four of the seven stocks. Note that the discrepancy in the average price at which the stocks trade across the two markets reflects the New Zealand-Australia exchange rate which was approximately equal to 1.20 on average over the sample period.

To estimate the effect of maker-taker pricing on liquidity, we measure liquidity in three ways. First, we calculate the bid-ask spread as:

$$\text{bid-ask spread} = \frac{\text{ask - bid}}{(\text{ask + bid})/2} \tag{1}$$

where 'ask' and 'bid' are the best ask and bid quotes respectively. Second, market depth is defined to be the average dollar value of shares on offer at the best bid and ask price. To avoid any problems created by stale quotes, we record a stock's bid-ask spread and depth on both NZX and ASX at the end of the minute in which a trade occurs in that stock. We then average across observations within a given day to create a single observation for that day for both NZX and ASX. Third, trading volume equals the number of shares traded multiplied by the price per share during overlapping trading hours on

Table 2: Summary trading statistics for final sample of stocks

This table documents the average price, average number of shares traded, average trade size, and the average number of trades per day over the period 15 June to 15 December 2008 on both the New Zealand Stock Exchange (NZX) and Australian Securities Exchange (ASX) for each of the seven cross-listed stocks used in this paper. Average NZX and ASX prices are expressed in their respective currencies.

Company Name	Price ($)	Shares Traded	Trade Size	Trades /Day
Panel A: Trading on NZX				
AMP	7.66	7701	922	8
Australian Foundation Investment Co.	5.72	7984	2476	3
Australia and New Zealand Banking Group	20.6	20511	1315	14
Goodman Fielder	1.73	47448	7402	6
Lion Nathan	10.56	7375	1820	3
Telstra Corporation Ltd	5.19	14894	3570	5
Westpac Banking Corporation	25.39	19650	1377	12
Panel B: Trading on ASX				
AMP	6.32	5238518	1566	3359
Australian Foundation Investment Co.	4.70	299038	1704	177
Australia and New Zealand Banking Group	16.94	9340384	958	9641
Goodman Fielder	1.43	5392279	3824	1519
Lion Nathan	8.72	1240159	625	1974
Telstra Corporation	4.26	35808174	8369	4348
Westpac Banking Corporation	20.95	8392048	786	10532

NZX and ASX.

Table 3 reports some summary statistics for these three liquidity measures. Again, the greater trading activity on ASX is evident: average depth and volume for our sample of cross-listed stocks are many times higher than on NZX and the average bid-ask spread is 1/10 the size. More importantly, there is little difference between the experiment and control periods. In fact, all three measures of liquidity are *worse* on NZX during the experiment period, and in the case of the bid-ask spread this difference is statistically significant at the 1% level.[4]

[4]The test for significance is based on Christie (1990). A t-statistic of the difference in liquidity is estimated for each stock, followed by estimation of a Z-statistic testing whether the mean t-statistic is significantly different from zero. This two-step procedure eliminates potential domination by high volume/spread/depth stocks.

Table 3: Summary liquidity statistics for final sample of stocks

This table reports three measures of average daily liquidity in the sample of seven cross-listed stocks. The bid-ask spread is the difference between the best ask and bid quotes normalised by the average of the two quotes. Depth is the average dollar value of shares on offer at the best bid and ask quote. Volume equals the number of shares traded multiplied by the price per share during overlapping trading hours on NZX and ASX. For each stock, the first two measures are sampled on NZX and ASX at the end of each minute that there is a transaction on NZX in that stock, and then averaged across the day. The experiment period runs from from 1 August to 31 October 2008 while the control period includes 15 June to 31 July 2008 and 1 November to 15 December 2008. Terms in parentheses in the final column are absolute values of Z-statistics indicating whether or not the mean difference between the experiment and control periods is statistically significant – see Christie (1990).

	Experiment Period	Control Period	Difference
Panel A: Trading on NZX			
Bid-Ask Spread (%)	2.93	2.47	0.46 (3.7)
Depth ($000 NZ)	21.03	22.13	−1.10 (0.9)
Volume ($000 NZ)	112.57	166.80	−54.23 (0.5)
Panel B: Trading on ASX			
Bid-Ask Spread (%)	0.25	0.24	0.01 (0.6)
Depth ($000 AUS)	294.98	276.23	18.76 (0.1)
Volume ($000 AUS)	54353.98	57258.25	−2904.27 (0.7)

While not very suggestive of a maker-taker induced liquidity effect, the simple statistics appearing in Table 3 ignore some important factors that potentially obscure any impact of maker-taker pricing. For example, panel B of Table 3 shows that ASX spreads and volume also deteriorated during the experiment period, suggesting the possibility of stock-specific changes in liquidity that were unrelated to maker-taker pricing. Similarly, any offsetting changes to the cost of trading, or an overall downturn in NZX liquidity, during the experiment period would also make it difficult to identify any maker-taker effect on the cross-listed stocks. Clearly, liquidity is affected not only by trading

fees, but also by other variables that may themselves be correlated with the fee structure. This confirms the need for multiple regression models that are able to properly isolate the maker-taker effect.

4 Regression results

We estimate regression models of the general form

$$\text{Liquidity} = a + \boldsymbol{b}\mathbf{X} + c\text{Trial} + \varepsilon \tag{2}$$

where Liquidity is the natural logarithm of date t NZX liquidity (spread, depth or volume) for an equally-weighted portfolio of the seven cross-listed stocks subject to the maker-taker trial, Trial = 1 if day t is in the experiment period and zero otherwise, and $\mathbf{X}$ is a vector of control variables.

We include the following three variables in $\mathbf{X}$. First, to control for stock-specific shifts in liquidity, we use the natural logarithm of date t ASX liquidity for an equally-weighted portfolio of the seven cross-listed stocks. Second, to control for market-wide shifts in liquidity, we use the natural logarithm of date t liquidity for an equally-weighted portfolio of the largest 50 stocks listed on NZX. Third, to control for shifts in the relative cost of cross-country trading, we also include the natural logarithm of the Australia-New Zealand exchange rate (expressed as the number of New Zealand dollars needed to buy one Australian dollar). During the control period of our study, the average value of the exchange rate was 1.23, but this fell to 1.19 during the experiment period (a difference that is statistically significant at the 1% level), implying an increase in the costs of trading on NZX and hence a potentially powerful offset to the maker-taker inducement.

Estimation of equation (2) yields the results appearing in Table 4, with three principal findings. First, rather than lowering the bid-ask spread, the maker-taker trial period is associated with a *higher* average spread, although the difference is both economically and statistically close to zero. This may reflect the prediction of Foucault et al. (2009), who show that maker-taker pricing will have no effect on spreads if the net benefit to limit order traders is sufficiently low relative to the minimum tick size. Second, by contrast, the maker-taker trial period is associated with sizeable improvements in NZX depth and volume, these rising by approximately 11% and 17% respectively, although the latter difference is statistically significant at only the 10% level. Third, our natural experiment approach turns out, ex-post, to be relatively

Table 4: Regression results: the impact of maker-taker pricing on liquidity

The dependent variable is the natural logarithm of date t NZX liquidity (spread, depth or volume) for an equally-weighted portfolio of the seven cross-listed stocks subject to the maker-taker trial. ASXL is the natural logarithm of date t ASX liquidity for an equally-weighted portfolio of the seven cross-listed stocks. NZXL is the natural logarithm of date t liquidity for an equally-weighted portfolio of the largest xxx stocks listed on NZX. NZD is the natural logarithm of the Australia-New Zealand exchange rate (expressed as the number of New Zealand dollars needed to buy one Australian dollar). Trial = 1 if day t is in the experiment period and zero otherwise. Terms in parentheses are t-statistics. *, ** and *** denote statistical significant at the 10%, 5% and 1% levels respectively.

	Dependent Variable		
	Spread (%)	Depth ($)	Volume ($)
Constant	-1.51	9.09^{***}	3.11
	(1.5)	(16.8)	(1.1)
ASXL	0.20	-0.02	0.43^{***}
	(1.3)	(0.3)	(2.6)
NZD	-6.11^{***}	4.01^{***}	1.43
	(5.5)	(6.9)	(1.2)
Trial	0.07	0.11^{***}	0.17^{*}
	(0.7)	(2.4)	(1.7)
R^2	0.27	0.32	0.08

unimportant, as ASX liquidity in the seven cross-listed stocks has no impact on their NZX liquidity.[5] Fourth, a depreciating New Zealand dollar is associated with significantly lower bid-ask spreads and greater depth (elasticities of -6.11 and 4.01 respectively), while improved ASX liquidity in the seven cross-listed stocks has a positive effect on NZX volume.

Overall, our results can best be described as mixed. When stock-specific and market-wide liquidity influences are ignored, the maker-taker experiment period is associated with weaker NZX liquidity in the affected stocks. When we control for these external effects, the bid-ask spread is unaffected by maker-taker pricing, there is some weak evidence for enhanced trading volume, and there is somewhat stronger evidence for improved depth. One possible reason

[5]Of course, this does not imply that our natural experiment is of little value. Without being able to follow such an approach, we would have been unable to rule out the possibility of stock-specific liquidity shocks.

for the apparent lack of liquidity response is the relatively minor nature of the liquidity provider rebate relative to the costs of trading on NZX. Spreads on NZX are approximately 10 times those on ASX (see 3), so anybody willing to trade the cross-listed stocks on NZX despite such a large difference in costs is unlikely to notice much difference created by the maker-taker trial. One reading of these results, therefore, is that NZX may have been premature in abandoning the trial after three months, given its apparent beneficial impact on some aspects of liquidity. Another view, however, would be that any improvements in liquidity were insufficiently large to justify the costs involved. Although the third column of Table 4 suggests that maker-taker pricing did lead to a rise in trading activity, the resulting improvement in NZX revenues (17%) is small relative to the fall created by elimination of exchange fees for one side of each transaction (approximately 50%).

Issues remaining to be addressed and incorporated

- Check whether results are robust to alternative spread measures.
- Check whether results are robust to beginning-of-minute rather than end-of-minute quotes.
- The presence of fixed costs suggests that the experiment period response should differ according to size of limit orders, so check whether this occurs
- Does the experiment period response vary across firms?
- Quantify more precisely the relative ASX-NZX costs associated with both control and trial periods
- Separate trial-control comparison out by pre- and post-trial control periods

5 Concluding remarks

Does maker-taker pricing improve liquidity as intended? Despite considerable practitioner interest in this question, it has received little attention from researchers. In this paper, we attempt to shed some light on the issue by examining the 2008 three-month trial of maker-taker pricing by NZX on the

shares of cross-listed Australian companies. We find some evidence of an increase in market depth and trading activity, but bid-ask spreads appear to have been unaffected.

We suspect the ambiguous nature of our results is due, at least in part, to NZX selecting a sub-optimal form of maker-taker pricing. Currently, very little is known about optimal fee structures, suggesting an important role for further theoretical research in this area. Moreover, as more and more varied exchanges opt for maker-taker pricing (e.g., the South African and Bombay exchanges), the resulting increase in data availability should enable researchers to identify which features of maker-taker pricing are most important.

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