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A. Frino

University of Wollongong

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UNIVERSITY OF WOLLONGONG
DEPARTMENT OF ACCOUNTANCY



AN EMPIRICAL STUDY OF THE EFFECT OF
SHORT SELLING ON THE BID ASK SPREAD

by

Alex Frino
Department of Accountancy
University of Wollongong
Wollongong N.S.W. 2500, Australia

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AN EMPIRICAL STUDY OF THE EFFECT OF SHORT SELLING ON THE BID ASK SPREAD

Alex Frino*

Abstract

Short selling was legally and uniformly reintroduced in Australia in 1986. This presented the opportunity to study the effects of permitting short selling on stock market trading. The following study aims to determine the impact of short selling on the bid ask spread and thus transaction costs. The evidence presented in this paper supports the notion that short selling acts to reduce the size of the bid ask spread. The public policy implication is that short selling is desirable as it acts to reduce the size of transactions costs on the stock exchange.

1 Introduction

There have been many studies which have examined the effect of particular characteristics of trading design on the bid ask spread. The bid ask spread represents a major part of transactions costs for a round trip transaction on the stock exchange (the other component is stamp duty and brokerage fees) and thus has become the focal point for these studies which argue that spread or transaction cost minimisation is desirable because it promotes a more perfect capital market [????]. Table 1 over page provides a description of these studies and their broad findings. The studies suggest various trading design characteristics that promote low spreads and thus transaction costs. For example the Santomero (1974) and Hamilton (1978) studies advocate the introduction of automated quotation systems as they found that this leads to a decrease in the spreads of stocks *ceteris paribus*. Similarly Cohen and Conroy (1990) advocate 'back office' type matching as they found this lead to lower spreads on the main exchange, however, Hamilton (1976) suggests that the implied spreads on 'back office' transactions is higher. Tinic and West (1974) suggest that the use of a monopoly market maker leads to reduced spreads, however, Hamilton (1978) in a more rigorous study that controlled for more individual and general market forces that influenced spreads implied that there was no significant difference between the spreads caused by monopoly market makers and nonmonopoly market makers. Finally, both Branch and Freed (1977) and Hamilton (1979) found that allowing trading on other exchanges with a monopoly market maker on the main exchange tends to reduce spreads.

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Table 1 : Studies Examining the Effect on the Bid Ask Spread of Different Institutional Designs

Author (s)	Year	Institutional Characteristic Studied	Sample No of Stocks	Details Spread Data	Effect on Spread
Reilly and Slaughter	March 1973	Quotation of 30 NYSE Stocks on NASDAQ on 5 April, 1971	30	NYSE 1 March to 7 June 1971 NASDAQ 28 April to 7 June, 1971	no significant effect
Santomero	Jan 1974	Institution of NASDAQ on 1 Feb 1971 for OTC Stocks	56	1 July to 30 Dec 1971 1 April to 30 Sept 1971	fall in spreads
Tinic and West	June 1974	Monopoly NYSE Dealer Market Making Vs Toronto Stock Exchange Agent Market Making VS Nonmonopoly Dealership Market Making on OTC Market	177 TSE ??? NYSE	TSE 1 to 13 Dec 1971 NYSE ?? March 1969	Monopoly market making reduces spreads
Hamilton	Dec 1976	Monopoly market making and listing on NYSE Vs Nonmonopoly market making and trading on the OTC	199 NYSE 209 OTC	30 April, 30 June and 31 Aug 1970	- NYSE spreads smaller than OTC (and impliedly 'back office' trades) - fall in NYSE spreads = fall in OTC spreads as transactions increase
Hamilton	May 1978	Introduction of NASDAQ on OTC on 8 Feb, 1971	182 NYSE 174 OTC	30 April, 30 June, 31 Aug 1970 and 1971	fall in spreads
Branch and Freed	March 1977	Trading of NYSE stocks in third market	NYSE	24 Jan, 1974	reduces spreads
Hamilton	March 1979	trading of NYSE stocks in the OTC market	315	average for Dec 1974, Jan, Feb and March 1975	fall in spreads due to competition is greater than the rise due to fragmentation
Cohen and Conroy	April 1991	Rule 19c-3 introduced 18 July, 1980: allows brokers to act as dealers	145	29 sample dates from May 1981 to November 1983	fall in spreads

Short selling was introduced in Australia in 1986, thereby permitting its impact on spreads to be empirically and directly studied. The aim of this study was to determine whether short selling is desirable in so far as it reduces spreads, and thus transaction costs.

The rest of the paper is organised as follows. The next section discusses the history of short selling in Australia leading up to its general introduction in 1986. Section 3 presents some theoretical discussion as to the likely impact of short selling on spreads. Sections 4 and 5 outline the methodology and data respectively used to determine the impact of short selling on spreads. Finally section 6 is reserved for a discussion of the results, whilst section 7 contains the conclusion.

2 A Brief History of Short Selling in Australia

Short selling occurs when a stock market participant sells stocks without actually owning them at the time of sale. The Securities Industry Code (SIC) was the first form of uniform companies legislation in Australia, which outright prohibited short selling of stocks under section 68 (1) [which became section 846(1) of the Corporations Law in December 1990]. The effective date of commencement of the SIC in Australia was 1 July 1981 except in the Northern Territory, where commencement was 1 July 1986. Exceptions to this prohibition of short selling were contained within section 68 (3) [which became section 846 (3)] included:

- * Short selling by Brokers who specialised in odd lots, in odd lot transactions,
- * Short selling in an arbitrage transaction involving a simultaneous sale and purchase on two different exchanges,
- * Short selling by a seller who had entered into a contract to purchase the relevant stocks which had not yet been delivered, and
- * Short selling by a seller who makes arrangements to deliver the stocks in three days, provided the stock price is not falling.

Another exception to this prohibition was by Regulation 34 of the Securities Industry Regulations [which became Regulation 7.4.08 in July 1990] which originally became effective at the same time as the SIC. Regulation 34 permitted a short sale of stocks when they were covered by call options traded on the Australian Stock Exchange. Prompted by a recommendation by the Australian Financial System Inquiry (the Campbell Committee), A joint exposure draft was released on 29 April 1985 by the Australian Associated Stock Exchanges (ASX) and the National Companies and Securities Committee promulgating the general short selling of stocks subject to certain safeguards. The exposure draft eventually lead to the insertion of section 68(3)(e) [which became section 846(3)(e)] which became effective in March 1986. Section 68(3) (e) permitted short selling of stocks provided that at the time of the sale:

- (i) the stock was in a list of 'approved securities' in which short selling may be permitted,

- (ii) the sale was in accordance with the business rules of the ASX , and
- (iii) the seller was not an associate of the company that issued the securities.

A Business Rule detailing the operation of short selling was issued in April 1986 by the AASX which was introduced together with s68(3)(e). The original Business Rule subsequently became Business Rule 2.18 of the Australian Stock Exchange in 1987 when the state stock exchanges combined and was amended in September, 1989. The original rule, and the rule as it currently stands permitted short selling of 'approved securities' provided a short sale is not to be made at a price lower than the last transaction price[2.18 (8)].

Business Rule 2.18 (13) stipulates the criteria stocks must meet in order to be designated 'approved securities'. The most important of these are that a stocks:

- (i) Market capitalisation of the shares on issue is greater than \$100m, and
- (ii) In the opinion of the home exchange there is sufficient liquidity in the market for the security .

As at the date the original legislation became effective 57 ordinary stocks were 'approved securities' for the purposes of the short selling provisions of the act and the Business Rules. The list of 'approved securities' was contained within Business Rule 6.18 (1) which also became operative in April 1986. The introduction of short selling provisions meant that its impact on the stock market could be studied. In the following section the likely impact of the introduction of short selling is discussed.

3 The Effect of Short Selling on the Bid Ask Spread

In discussing a multidealer market setting Benston and Hagerman (1974), draw on the market structure and dealer inventory holding cost arguments in the seminal article by Demsetz (1968). Their analysis suggests that the greater the supply of immediacy to a stock market (ie., the supply of immediate transactions for those submitting market orders) the lower the spreads. Their argument implies that the number of dealers submitting limit buy and sell orders would cause the price on such orders to move closer together owing to competition. They explain 'A large number of dealers should keep the spread down to the competitive level' [p355].

Such an argument implicitly assumes that dealers are free to submit competitive buy and sell quotes without restriction at any point in time. However, in an environment where short selling is prohibited, dealers are required to have an inventory of stocks prior to submitting a sell quote. In such an environment, although a large number of dealers may exist, some of them may be prevented from competing for the supply of stocks by submitting sell quotes because they do not hold inventories of stocks. This lack of competition on the supply side of the market could lead to a wider spread.

Alternately, if dealers were to keep stocks of inventories in order to be able to compete in the supply side of the market. Then, they would incur higher holding costs which would also result in wider spreads as compensation to cover the higher inventory holding costs

Table 2 : Regression Studies of the Determinants of the Width of Spreads

Study	Exch.	Sample No of Stocks	Descript. Data	Dependant Variable(s)	Independent Variable(s)
Demsetz (1968)	NYSE	192	Average of 2 trading days in 1965	* \$ bid ask spread * $\frac{S \text{ Spread}}{\text{Stock Price}}$	*Price per Share ⁺ *No of trans/day ⁺ *No of markets on which listed *No of shareholders ⁺
Tinic (1972)	NYSE	80	Average 19 consecutive days trading in 1969	*\$ bid ask spread	* Price per Share ⁺ *No of Shares Traded/day ⁺ *Competition Index ⁺ *No of Institutional Investors ⁺ * Transactions/day ⁺ *Trading continuity ⁺ *No of Stocks handled by specialist ⁺ *Stock Price Volatility *Purchasing Capacity of Specialist
Barnes (1974)	NYSE	81	Average Month end spreads over 21 months from Jan 1968	* $\frac{(\text{Bid} - \text{Ask})}{(\text{Bid} + \text{Ask})/2}$	*\$Trading Volume/day ⁺ * Stock Price Volatility ⁺ * Insider holdings % ⁺ *Dealer Dummies
Benston & Hagerman (1974)	OTC	314	Average of 60 consecutive month end spreads from Jan 1963	$\frac{S \text{ Spread}}{\text{Share}}$	*Bid Price ⁺ *No of Shareholders ⁺ *No of Dealers ⁺ *Unsystematic Risk ⁺
Barnes & Logue (1975)	NYSE	76	Average over 19 trading days in 1969	* $\frac{S \text{ Spread}}{\text{Share Price}}$	*\$Volume ⁺ *Risk
Stoll (1978)	OTC	2000	Average of 6 trading days in 1973	* $\frac{(\text{Bid} - \text{Ask})}{(\text{Bid} + \text{Ask})/2}$	*\$Volume/day ⁺ *\$Volume/Trans ⁺ *Share Price ⁺ *No of Dealers ⁺ *Dealer Wealth ⁺ *Competition ⁺ *Systematic Risk ⁺ *Unsystematic Risk ⁺
Chiang & Venkatesh (1988)	NYSE	38	1 year of daily data in 1973	* $\frac{(\text{Bid} - \text{Ask})}{(\text{Bid} + \text{Ask})/2}$	*No of Shares traded/day ⁺ *Stock Price Volatility ⁺ *%Insider Holdings ⁺

* Designates variables reported as 'significant' in the relevant study

as a result of the compulsorily imposed inventory requirement.

Thus regardless of whether traders hold inventories of stocks in order to deal, the analysis above implies higher asking prices and thus wider spreads will exist in a market where short selling is prohibited. The implication is that a market which permits short selling would result in lower bid ask spreads *ceteris paribus*. Thus the removal of short selling restrictions on certain stocks in Australia in 1986 should have resulted in a reduction in the spreads of those stocks *ceteris paribus*.

4 Methodology

In order to determine whether the removal of restrictions on short selling reduced the size of the spreads on stocks, it becomes necessary to control for those individual and market factors which are contemporaneously and significantly associated with the size of the spread. The factors studied in cross sectional regression studies of the spread are presented in Table 2. The findings of these studies suggest the variables contained within the following regression model are the most reliable and relevant given the nonmonopoly dealer design of the Australian Stock Exchange:

$$S = a_0 + a_1 \ln P + a_2 \ln V + a_3 \ln \sigma + a_4 \ln \text{IND} + a_5 \ln \text{INT}$$

where:

S = Average Spread

V = Average Trading Volume

P = Average Stock Price

σ = the risk of a stock

INT = Degree of Institutional Holdings %

IND = Degree of Insider Holdings %

\ln = the natural logarithm

Unfortunately, a simple cross sectional regression using a dummy variable to capture the ability/inability to short sell a stock is inadequate. The correlation between trading volume and such a variable resulting from the criteria used by the exchange to determine whether short selling should be permitted for a stock, would introduce multicollinearity problems in estimation which would reduce the efficiency of the estimation of the coefficients by increasing the standard error of the estimate [Gujarati, 1988, p.290]. Hamilton (1978) devised a time series methodology for analysing the introduction of a trading design characteristic. The procedure involves estimating the equation above using data from stocks after short selling was introduced. Then data from the same stocks prior to the introduction of the short selling provisions could be used together with the estimated equation in order to estimate the implied spreads (S^{**}) of those stocks had short selling been permitted at the time. These implied spreads could be compared with the estimated spreads (S^*) of those stocks using a regression estimated from pre short selling data. The average of the differences between the two (D^*) represents the average change in the estimated spreads had short selling been permitted in the pre short selling period.

However, part of this difference may have been caused by other general market developments which would have influenced the data used to estimate the post short selling equation and thus the estimates of S^{**} . Hamilton (1978) suggests that the effect of other general market trends can be removed by using a control group of companies. In this case the control group would be comprised of a sample of corporations on which short selling restrictions were not removed. The series of regressions and estimates for the treatment group of companies can be replicated for the control group of companies to yield (D) representing the average change in spreads in the pre short selling period had market conditions been as in the post short selling period. A test of the impact of short selling on the spread excluding the effects of any individual and market influences reduces to a statistical test of the extent to which D^* is significantly different to D .

5 Data

Short selling was introduced on the 6th of April 1986. Data for the pre-short selling period to be collected is for the last week of trading which fell entirely in March, whilst the post-short selling period analysed is the last week of trading which fell entirely in May 1986. The periods selected allowed a gestation period for the short selling provisions of almost 3 months, whilst maintaining a reasonably close proximity to the pre-short selling period to be analysed. In addition, the period chosen avoids the seasonality in spreads associated with large stocks from September through to December [Lamoureux and Sanger, 1989]. Spread data was collected from the *Australian Financial Review (AFR)* for the periods Monday March 17 to Friday March 21 1986, and Monday May 26 to Friday May 30, 1986. The *AFR* reports the daily closing buy and sell quotes which represent the highest bid and lowest ask price respectively. Thus the spread representing the difference between the two is what has been termed the 'inside spread' [Stoll??].

The average trading volume, trading continuity and average stock price for the two periods for each stock was also calculated from daily data collected from the *AFR*. The proxy for degree of institutional holdings was the percentage of ordinary shares held by largest 20 shareholders, whilst the degree of insider holdings was proxied using the percentage of shares held by the directors of a corporation. Data for each of these variables was extracted from the Annual report of corporations. Finally, the risk associated with a stock was calculated to be the standard deviation of the stock price over the period in question.

When the short selling provisions were introduced in 1986, 57 stocks were designated 'approved securities' for the purposes of short selling on the Australian Stock Exchange. Of these, 12 had call options written on them which were being traded on the exchange. Since the regulations existing prior to 1986 implied that such stocks could be short sold provided traders held calls written on them, in order to avoid any potential confounding effects, they were excluded from both treatment and control samples. This resulted in 45 possible companies in the treatment sample. A further 12 of these had to be discarded for various data availability problems including non reporting of data in the *AFR*, non

reporting of directors holdings information in the annual report, values of variables of 0 existed which prevented its logarithmic transformation, and non availability of annual reports. The remaining sample of companies which will be referred to as the treatment sample are listed in Appendix A.

The control sample was made up of a random sample of 30 stocks in the top 150 group of companies by market capitalisation reported in the *Business Review Weekly* March 28, 1986. From this list, the corporations which were in the treatment sample and were traded on the Australian options market were deleted. This left 92 corporations as potential matches. From this, 30 stocks were selected at random for the control group of companies. This selection procedure was implemented in order to ensure that the characteristics of the control sample were as close as possible to the treatment sample. Those stocks in the control sample are also listed in Appendix A.

6 Results

Table 3 illustrates that the spreads of both samples of stocks increased from the pre short selling period to the post short selling period. However, whilst the treatment samples average dollar spread increased by about 25%, the control samples increased by 72%. This is consistent with the hypothesis that the introduction of short selling acts to reduce the size of spreads, since the control samples spread represents the increase in spreads which took place due to market conditions. Thus, the spreads of stocks which commenced to be short sold did not increase by as much as the market dictated suggesting the introduction of short selling acted to reduce spreads. The raw % spreads are also consistent with the hypothesis.

Table 3 : Raw Average Unadjusted Spreads before and After the Introduction of Short Selling

	Treatment sample		Control Sample	
	\$ Spread	% Spread	\$ Spread	% Spread
Pre short selling Period				
Mean	0.056	0.016	0.092	0.021
Standard Deviation	(0.042)	(0.010)	(0.076)	0.009
Post Short Selling Period				
Mean	0.070	0.019	0.158	0.033
Standard Deviation	(0.054)	(0.014)	(0.144)	(0.015)
Change from Pre to Post	25%	19%	72%	57%

In order to remove the effects of variables which have been found to influence spreads in earlier studies, and which may be driving the results in Table 3, as per the methodology, the spread regression model was estimated for each of the sample periods for both treatment and control samples. Table 4 contains the results of the OLS regressions. The

results of spread regressions using the percentage spread as an the dependant variable are not presented as the results were poor *vis-a-vis* the dollar spread regressions and were thus not used in the analysis. The results of the regression analysis are quite significant with the independent variables chosen explaining between 49 to 78 percent of variation in dollar spreads. The price, volume and insider holding variables were generally highly significant and in directions consistent with most previous studies. The results for the risk and institutional holdings variables on the other hand are generally poor. All models were significant at the 0.001 level.

Table 4 : The Estimated Parameters of the Spread Equation

	Const.	$\ln P$	$\ln V$	$\ln \sigma$	$\ln IND$	$\ln INT$	adj R ²
Treatment Sample							
Preshort Selling Period							
co-efficients	0.149	0.048	-0.021	0.012	-0.003	0.006	0.651
t / F value		6.003*	-	1.77**	-1.3***	0.300	12.934*
			4.928*				
Post Short Selling Period							
co-efficients	-0.139	0.063	-0.010	0.001	-0.008	0.044	0.489
t / F value		5.098*	-	0.139	-1.96**	1.4***	7.125*
			1.84**				
Control Sample							
Pre Short Selling Period							
co-efficients	-0.549	0.527	-0.006	-0.306	-0.004	0.001	.786
t / F value		5.428*	-	-4.366*	-1.3***	0.020	22.361*
			1.5***				
Post Short Selling Period							
co-efficients	0.074	0.233	-0.001	-0.026	-0.011	-0.058	0.540
t / F value		4.396*	-0.159	-0.840	-1.4***	-0.693	7.817*

* significance at the 0.001 level
 ** significance at the 0.05 level
 *** significance at the 0.10 level

Table 5 presents the average spreads of stocks after adjusting for individual differences in those stocks in the pre short selling and post short selling sample periods. S** represents the estimated adjusted spread of a pre short selling stock in the treatment sample if short selling had existed in the pre-short selling period. S* is the regression estimate of the treatment stocks spread in the pre short selling period. Thus D* [(S** - S*) / S*] represents the change in spreads of the treatment sample in the preshort selling period if short selling had been permitted in the pre-short selling period. The table indicates that spreads would have increased by approximately 37%, however, a t test implies the increase is insignificant. D* also includes the effects due to changes in general market conditions, which is measured by D' [(S'' - S') / S']. A t test indicates that D' is highly

significant and implies that if the market conditions in the post short selling period had existed in the pre-short selling period, spreads would have risen by 70%. Since this is lower than D^* , it can be concluded that if short selling had existed in the pre-short selling period for the treatment sample of stocks, and the market conditions in the post short selling period existed, then spreads would have fallen by some 33% ($D^* - D'$). This is consistent with the original hypothesis. Further, a t test indicates that this difference is significant at the 0.10 level.

Table 5 : The Estimated Adjusted Change in Bid Ask Spreads following the Introduction of Short Selling

	S^{**}	S^*	D^*
Mean	0.065	0.056	0.368
Standard Dev.	(0.037)	(0.035)	(1.118)
	S''	S'	D'
Mean	0.145	0.092	0.700 ⁺
Standard Dev.	(0.108)	(0.068)	(0.910)
		$D^* - D'$	0.332 ⁺⁺
		$\sigma_{D^* - D'}$	(0.262)

+ significant at the 0.05 level
 ++ significant at the 0.10 level

7 Conclusion

An analysis of the effects of short selling on the bid ask spread was carried out using data from the Australian Stock Exchange which permitted the short selling of certain listed stocks in April 1986 which could not previously be short sold. The analysis indicates that permitting short selling of a stock causes its bid ask spread to decrease and thus transactions costs on the stock exchange for such stocks to decrease. The implication is that short selling is desirable, and that it should be permitted.

APPENDIX A

Treatment Sample

Adelaide Steamship Company Limited
Ariadne Australia Limited
Arnotts Limited
Ashton Mining Limited
Australian Foundation Investment Company Limited
Australian National Industries Limited
Bell Group Limited
Bell Resources Limited
Boral Limited
Brambles Industries Limited
Bridge Oil Limited
Bundaberg Sugar Company Limited
Coles Myer Limited
Email Limited
FAI Insurances Limited
Humes Limited
ICI Australia Limited
Industrial Equities Limited
Kern Corporation Limited
Lend Lease Corporation
McPherson's Limited
Monier Limited
Moonie Oil Company Limited
News Corporation Limited
OPSM Industries Limited
Pacific Dunlop Limited
Pancontinental Mining Limited
Peko-Wallsend Limited
Petersville Sleigh Limited
TNT Limited
Woodside Petroleum Limited
Woolworths Limited
Wormald International Limited

Control Sample

Advertiser Newspapers Limited
Australian Guarantee Corporation Limited
Ampol Exploration Limited
Australian Paper Manufacturers Limited
Borg-Warner (Australia) Limited

BTR Nylex Limited
Burns, Philp & Company Limited
Commonwealth Industrial Gases Limited
Comalco Limited
Edwards Dunlop & Co Limited
Faulding (FH) & Co Limited
Hartogen Energy Limited
Herald & Weekly Times Limited
Keywest Investments Limited
Mayne Nickless Limited
National Consolidated Limited
Northern Star Holdings Limited
QBE Insurance Group Limited
Queensland Press Limited
Repcor Corporation Limited
Rheem Australia Limited
Rothmans Holdings Limited
South Australian Brewing Holdings Limited
Sons of Gwalia Limited
Sunshine Australia Limited
Tooth & Company Limited
Tubemakers of Australia Limited
Universal Telecasters Limited
Unity Corporation Limited
Westfield Holdings Limited

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