Small Firm Effect, Liquidity and Security Returns:

Australian Evidence

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Abstract

Standard asset pricing models ignore the costs of liquidity. In this study we advance the ongoing debate on empirical asset pricing and test if liquidity costs (as proxied by turnover rate, turnover ratio and bid-ask spread) affect stock returns for Australian stocks. Our tests use the factor portfolio mimicking approach of Fama and French (1993, 1996). We find small and less liquid firms generate positive risk premia after controlling for market returns and firm size. We find no evidence of any seasonal effects that can explain our multifactor asset pricing model findings. In summary, our study provides support for a broader asset-pricing model with multiple risk factors.

JEL Classification: G120, G150

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1. Introduction

The Capital Asset Pricing Model (hereafter CAPM) developed by Sharpe (1964), Lintner (1965) and Black (1972) states that the expected return on an asset is linearly related to its systematic risk or beta. However, recent evidence (for example, Fama and French, 1992, 1993, 1996 and Malkiel and Xu, 1997[1]) finds that beta alone does not adequately describe the cross-section of stock returns. Fama and French (1996, 2003) conclude that firm size and the book-to-market equity ratio are also pervasive risk factors besides the overall market factor.

The CAPM also assumes perfect or frictionless markets. In imperfect markets, however, investors bear transaction and liquidity costs. Liquidity costs reflect price concessions that investors must incur if they wish to be able to immediately buy or sell stock in the firm[2]. The focus of this paper is to investigate the role of liquidity in explaining asset returns for Australian stocks. To examine if a liquidity risk premium exists we adopt a multifactor asset pricing model that includes an overall market factor, firm size and proxies for liquidity.

Amihud and Mendelson [henceforth A&M] (1986) demonstrate the importance of liquidity as a market microstructure factor in the determinant of stock returns. A&M (1986) showed that expected returns are a decreasing function of liquidity since investors must be compensated for higher trading costs that they bear in less liquid markets. A&M find a significantly positive relation between expected returns and the

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[1] Malkiel and Xu (1997) find that portfolios of smaller stocks tend to have larger idiosyncratic volatility than portfolios of larger stocks. They also document a flat relationship between returns and beta; a fact that contradicts the positive linear relationship of the CAPM.

[2] Stoll (2003) argues that costs of illiquidity comprise adverse selection costs if dealers require compensation for providing transaction immediacy to investors, opportunity costs if there is a price shift away from the limit order price and direct broker or transactions costs.

bid-ask spread for NYSE / AMEX stocks during the period 1961-1980. The average portfolio risk-adjusted returns increase with an increase in the bid-ask spread and the effect persists even when firm size is added in the regression equation. Similarly Amihud (2002) argues that expected stock returns partly represent an illiquidity[3] premium. He also shows that small firms are more strongly affected by illiquidity and provides a potential explanation for the small firm effect (see Banz, 1981[4]). Amihud (2002) also shows that stock returns are an increasing function of illiquidity.

Datar, Naik and Radcliffe [henceforth DNR] (1998) provide further empirical evidence that liquidity or trading costs are important attributes of assets that influence investor's portfolio decisions. They report that the size-return relationship of Fama and French (1992) is a reflection of the liquidity-return relationship and suggest that the size factor could be one of the possible proxies for liquidity. Contrary to the findings of Eleswarapu and Reinganum (1993) DNR find the liquidity effect is observed throughout the year and not restricted to January alone.

Further studies by Brennan and Subrahmanyam (1996) and Brennan, Chordia and Subrahmanyam (1998) also conclude investors in US stocks require higher rates of return on those stocks that are more illiquid after controlling for the Fama-French three model risk factors. As noted by Bondarenko (2001) liquidity plays a fundamental role in the trading behavior of market makers. This affects securities

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[3] Amihud (2002) defines illiquidity as the daily ratio of absolute stock return to its dollar volume averaged over some period. It is interpreted as the daily price response associated with one dollar of trading volume. Other measures of liquidity are the bid-ask spread, transaction-by-transaction market impact or the probability of information based trading. For a discussion on measures of liquidity see, Amihud and Mendelson (1980, 1991), Glosten and Milgron (1985), Kyle (1985) and Keim and Madhavan (1996)

[4] Banz (1981) reports that for NYSE common stocks smaller firms on average have higher risk adjusted returns than larger firms

prices and thus the importance of stock liquidity is not only of interest to traders and regulators but also to academic researchers. Improving stock liquidity can lower a firm's cost of capital (Amihud and Mendelson, 1988). Research in markets other than the US also suggests that liquidity costs play an important role in explaining asset returns. In the Australian market Chan and Faff (2003) and Marshall and Young (2003) find evidence that a liquidity premium is important in explaining asset returns. These findings are robust to seasonality effects and persist throughout the year.

For stocks traded on the Tel Aviv Stock Exchange that changed from a call market to an (almost) continuous trading facility, Amihud, Mendelson, and Lauterbach (1997) present evidence that improvement in stock liquidity leads to increased stock prices. Similarly, Gardiol, Gibson-Asner and Tuchschmid (1997) find that liquidity effects are important in the price formation process of common stocks and the price differential between Swiss Bearer and Registered shares. Jun, Marathe and Shawky (2003) also report that stock returns using data for 27 emerging markets[5] are positively correlated with their proxies for market liquidity.

In this paper we contribute to the debate on the importance of liquidity in explaining asset returns for equities listed in the Australian Stock Exchange. Similar to Chan and Faff (2003) and Marshall and Young (2003) this study examines if a market microstructure factor is priced in the Australian market. Unlike Chan and Faff (2003) and Marshall and Young (2003), however, we adopt a different methodology in the sense that we use the constructed portfolio approach of Fama and French (1993, 1996) to test the presence of any liquidity premium. In addition to methodological contributions we also employ three different proxies for liquidity. We employ the turnover rate, defined as, the number of shares traded divided by the number of shares outstanding, turnover ratio, defined as, the value of shares traded divided by market capitalization and the quoted bid-ask spread as proxies for liquidity. In examining if liquidity is priced we seek to control for firm size. Controlling for firm size is important to disentangle any liquidity effect from a size effect. First, firms with a large market capitalization listed on an exchange may have a higher relative share turnover and a lower average bid-ask spread compared to small infrequently traded firms. Thus, size may be correlated to liquidity. Second, as already noted prior research by Fama and French (1992, 1993) suggests size is a pervasive risk factor in any asset pricing model.

In the Australian market Halliwell, Heaney and Sawicki (1999) find that size provides statistically significant incremental explanatory power in the Fama and French (1993) three factor asset pricing model. Halliwell et al, however, found little evidence of a statistically significant book-to–market effect. Similarly Drew and Veeraraghavan (2002) also report the importance of a statistically significant size risk factor (and to a lesser extent a book-to–market effect) in the Fama and French (1993) asset pricing model for Australian stocks over the 1985- 2000 period.

We conclude that liquidity plays an important role in explaining the cross-sectional variation of asset returns in the Australian market. Our results suggest that there is a positive risk premium for both size and liquidity in the Australian market and this is not a seasonal phenomenon. As such our study provides further support for a broader asset pricing model with multiple factors.

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[5] The study by Jun et al (2003) does not include Australia.

2. Data and Methods

Monthly stock and market returns, the number of shares outstanding and traded, the value of shares traded and the average monthly closing bid-ask spread are obtained from the database maintained by the Securities Industry Research Centre of Asia Pacific (SIRCA). The SIRCA database has trading history for each stock from 1996. Our study therefore examines asset returns over the period 1997 to the end of 2002 since we use the previous 12 months of data to form our size and liquidity portfolios. We obtain the monthly risk-free rate from the Reserve Bank of Australia. We use the 13-week Treasury note rate until May 2002 and thereafter the 2-year Treasury note rate from June 2002 as the proxy for the risk free rate. We use the 2-year Treasury note rate from June 2002 since the 13-week Treasury note rate is defunct.

We follow the constructed portfolio approach of Fama and French (1993, 1996) in forming portfolios on size and liquidity. We form six intersection and three zero investment portfolios. The six intersection portfolios formed are S/L, S/M, and S/H; B/L, B/M, and B/H. S/L is a portfolio of small firms with low liquidity. S/M is a portfolio of small firms with medium liquidity and S/H is a portfolio of small firms with high liquidity. Similarly, B/L, B/M, and B/H are portfolios of big firms with low, medium and high liquidity respectively.

The three zero investment portfolios are RMRFT, SMB and HLQMLLQ. We define the three zero investment portfolios as follows: RMRFT is the market excess return equal to R_{mt} - R_{ft}, where R_{mt} is the equally weighted return[6] on all stocks in the six intersection portfolios and R_{ft} is the risk-free rate observed at the end of each month. SMB (Small minus Big) is the monthly difference between the average of the return

[6] We also checked our results using a value weighted market index to determine market returns. Our results are identical to the equally weighted results reported in this paper.

of the portfolios of small stocks (S/L, S/M and S/H) and the portfolios of big stocks (B/L, B/M and B/H); HLQMLLQ (High liquidity minus Low liquidity) is the monthly difference between the average of the return on the portfolios of highly liquid stocks (S/H, B/H) and the portfolio of less liquid stocks (S/L, B/L). To investigate the relationship between expected returns, firm size and liquidity our model takes the following form:

$$R_{pt} - R_{ft} = a_p + b_p (R_{mt}-R_{ft}) + s_p SMB_t + l_p HLQMLLQ_t + \varepsilon_{pt}$$

2.1 Portfolio Aggregation Procedures

At the end of June of each year t all stocks are assigned to two portfolios of size (Small and Big) based on whether their June market equity (ME) [defined as the product of the closing share price times number of shares outstanding] is above or below the median ME. The same stocks are then allocated in an independent sort to three liquidity portfolios (Low, Medium, and High) based on the breakpoints for the bottom 33.33 percent and top 66.67 percent.

In this paper we employ three measures of liquidity. Following, DNR (1998), we use turnover rate of a stock as our first proxy for liquidity. DNR (1998) argue that this liquidity measure has strong theoretical appeal. This is because A&M (1986) show that in equilibrium liquidity is correlated with trading frequency. Thus, they suggest that if liquidity cannot be observed directly one can use the turnover rate as the proxy for liquidity.

As of June of each year t, we calculate the turnover rate for each stock by taking the average of the previous 12 months[7] turnover rate. Stocks with high turnover rate are deemed to have greater liquidity. Using the constructed portfolio approach we form

[7] Assume that we want to calculate the turnover rate as of June 95. We define the turnover rate as of June 95 as the average turnover rate for the period July 94 to June 95.

six intersection and three zero investment portfolios as described above. Our second measure of liquidity is the turnover ratio defined as trading value divided by market capitalization. Again to calculate the turnover ratio we take the average of the previous 12 months turnover ratio. We use this second measure of liquidity since A & M (1986) suggest that trading value of a security is an increasing function of its liquidity. Our third measure is the widely used bid-ask spread. We obtain the closing bid-ask spread data for each stock from the SIRCA database. As of June of each year t, we calculate the average quoted bid-ask spread for each stock by taking the average of the previous 12[8] months quoted bid-ask spread. More liquid stocks will have a lower average bid-ask spread. Once again we use the portfolio approach to form six size-liquidity portfolios and three zero investment portfolios formed at the intersection of the two size and three liquidity portfolios.

3. Findings

As already noted we use three measures as proxies for liquidity (turnover rate, turnover ratio and the average closing bid-ask spread). Tables 1, 2, 3 and 4 report the summary statistics and the regression coefficients for portfolios formed on size and turnover rate. Tables 5, 6, 7 and 8 report the summary statistics and regression coefficients for portfolios formed on size and turnover ratio while tables 9, 10, 11 and 12 report the summary statistics and regression coefficients for portfolios formed on size and bid-ask spread.

[8] We also estimate the turnover rate, turnover ratio and the bid-ask spread using the previous 3, 6 and 9 months data. Our results are not influenced by the choice of months used in the estimation period. For reasons of space we only report the results of the previous 12 months data.

3.1 Intersection and Zero Cost Portfolios with turnover rate as proxy for liquidity

Table 1

Number of companies in portfolios formed on size and turnover rate
06/97 to 06/02

YEAR	S/L	S/M	S/H	B/L	B/M	B/H	Total
1997	121	125	183	185	178	92	884
1998	116	126	193	203	181	92	911
1999	129	138	170	180	163	127	907
2000	141	142	156	172	147	133	891
2001	116	118	196	181	170	86	867
2002	150	148	184	180	172	140	974
AVERAGE	**129**	**133**	**180**	**183**	**170**	**112**	**906**

In Table 1 we detail the number of stocks in each of the six intersection portfolios (S/L, S/M, and S/H; B/L, B/M, and B/H) over the period 1997 to 2002 with turnover rate as the proxy for liquidity. The total number of firms in the sample varies between 867 (2001 year) and 974 (2002 year). Table 1 also shows that the B/L (183 firms) and S/H (180 firms) portfolios have the greatest average number of stocks per year followed by B/M, S/M, S/L and B/H portfolios.

Table 2

Average turnover rate
06/97 to 06/02

YEAR	S/L	S/M	S/H	B/L	B/M	B/H
1997	0.0067	0.0218	0.0676	0.0066	0.0210	0.0567
1998	0.0077	0.0239	0.0755	0.0077	0.0248	0.0600
1999	0.0072	0.0194	0.0509	0.0069	0.0194	0.0427
2000	0.0077	0.0195	0.0557	0.0068	0.0204	0.0509
2001	0.0077	0.0259	0.1328	0.0068	0.0265	0.1207
2002	0.0078	0.0226	0.0647	0.0068	0.0224	0.0706
AVERAGE	**0.0063**	**0.0221**	**0.0745**	**0.0069**	**0.0224**	**0.0669**

Table 2 presents the average share turnover for the stocks in the six intersection portfolios over the period 1997 to 2002. This table shows that S/H portfolio has the highest average turnover rate of 0.0745 followed by B/H, B/M, S/M, B/L and S/L portfolios.

3.2 Performance of portfolios formed on size and turnover rate

Table 3

Summary Statistics and Multifactor Regressions for Portfolios Formed on Size and Turnover Rate

Panel A

	Liquidity Portfolios					
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	Summary Statistics					
	Mean excess returns (over the risk free rate)			Standard Deviations		
S = Small	-0.004	-0.002	-0.020	0.060	0.086	0.106
B = Big	-0.001	-0.005	-0.028	0.030	0.039	0.070

Panel B

	Mean return	Standard deviation
RMRFT	-0.009	0.055
SMB	0.003	0.058
HLQMLLQ	-0.022	0.048

In Table 3, Panel A, we first report the mean monthly excess[9] returns and standard deviation of returns for portfolios formed on firm size and turnover rate. Our tests show that the mean monthly excess returns are negative for all six portfolios. We find that B/H portfolio has the highest mean excess negative return (-0.028), followed by S/H with a mean negative excess return of (-0.020). Table 3, Panel B, reports the mean returns on the zero investment portfolios. The mean monthly return on the equally weighted portfolio of all stocks (RMRFT) was -0.009 (standard deviation =

0.055 per cent). The mimic portfolio for size (SMB) generated a return of 0.003 per month (standard deviation = 0.058) suggesting that small firms are riskier than big firms. The mimic portfolio for liquidity (HLQMLLQ) generated a return of -0.022 per cent per month (standard deviation = 0.048) suggesting that investors required a higher risk premium for low liquidity firms compared to firms with greater liquidity.

3.3 Parameter Estimates for multifactor model with turnover rate as proxy for liquidity

Table 4

	Liquidity Portfolios					
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	$R_{pt} - R_{ft} = a_p + b_p (R_{mt}-R_{ft}) + s_p SMB_t + l_p HLQMLLQ_t + \varepsilon_{pt}$					
		a			t stat (a)	
S = Small	-0.007	0.006	-0.001	-4.06	2.42	-0.31
B = Big	0.002	0.002	-0.005	1.70	1.23	-2.39
		b			t stat (b)	
S = Small	1.079	1.080	0.884	18.11	12.62	15.19
B = Big	0.914	1.021	1.108	27.54	21.52	15.86
		s			t stat (s)	
S = Small	0.346	0.478	0.632	9.36	9.00	17.51
B = Big	-0.378	-0.503	-0.664	-18.37	-17.10	-15.32
		l			t stat (l)	
S = Small	-0.550	-0.009	0.613	-9.18	-0.10	10.47
B = Big	-0.304	-0.175	0.533	-9.12	-3.67	7.58
		Adjusted R^2				
S = Small	0.96	0.96	0.98			
B = Big	0.95	0.93	0.95			
		DW Statistic				
S = Small	1.92	2.09	2.05			
B = Big	1.95	1.89	1.84			

[9] The excess return is the return on the portfolio in excess of the risk free rate.

In Table 4 we report the parameter estimates for our multifactor model. Our results of show that the intercept, (a coefficient), is statistically indistinguishable from zero for the B/L, B/M and S/H portfolios. We also observe that the overall market factor, (b coefficient), is statistically significant for all six portfolios at the 1-percent level suggesting that an assets' beta plays an important explanatory role in determining expected returns. The size factor, (s coefficient), is positive and highly significant at the 1-per cent level for the three small portfolios (S/L, S/M and S/H). For the B/L, B/M and B/H portfolios the s coefficient is negative and statistically significant. The behavior of the coefficient for market and size is consistent with the findings of Fama and French (1996) who observe that small firms tend to have positive slopes on SMB while big firms tend to have diminishing positive or negative slopes on SMB.

The coefficient for liquidity (l coefficient) is significant for all portfolios with the exception of S/M portfolio. The coefficient is negative for the S/L and S/M portfolio but becomes positive and significant for the S/H portfolio. Similarly, the coefficient increases monotonically for the three big stock portfolios. In interpreting the sign of the coefficients for liquidity recall that the mimic portfolio for liquidity (HLQMLLQ) generates negative returns of 0.022 percent per month suggesting that "high" liquidity firms have lower returns (are less risky) than "low" liquidity firms.

Accordingly the significant negative (positive) coefficients on the S/L and B/L (S/H and B/H) portfolios are consistent with the finding that liquidity is priced and less liquid firms earn higher expected returns. The average adjusted R^2 for our model is 0.95 suggesting that the explanatory variables help explain at least 95% of the variation in the dependent variable. The DW test suggests no evidence of serial correlation in our sample. While not reported in Table 4 we also found no evidence of multicollinearity[10] or heteroscedasticity in our diagnostic tests of the regression results.

3.4 Seasonal effects

Prior research suggests stock returns exhibit a January seasonality effect with returns higher in this month compared to other months in the year (Branch, 1977, Keim and Stambaugh, 1986). The January effect is also particularly pronounced for small stocks (Fama, 1991). In Australia (in contrast to the US) the tax year-end for most listed firms is the end of June. Accordingly the January effect in the US may correspond to a July effect in the Australian market. To test for any seasonality effect we therefore add dummy variable parameters[11] for the months of January and July in our model. While the results are not reported here (to save space) the inclusion of dummy variables for the months of January and July do not alter our results reported in Table 4 above. Thus, we advance the argument that our findings cannot be explained by the turn of the year effect.

[10] We employ the Belsley, Kuh and Welsch (1980) approach to test for multicollinearity. We use the condition index and the variance inflation factors to detect multicollinearity. Condition index is defined as the square root of the ratio of the largest eigenvalue to each individual eigenvalue. It is suggested that if the condition index is between 10 and 30, then there is moderate to strong multicollinearity and if the index exceeds 30 then there is severe multicollinearity. If the condition index is below 10, multicollinearity is said to be absent.

[11] The dummy variable equals one for the months of January and July and zero otherwise.

3.5 Intersection and Zero Cost Portfolios with turnover ratio as proxy for liquidity

Table 5

Number of companies in portfolios formed on size and turnover ratio
06/97 to 06/02

YEAR	S/L	S/M	S/H	B/L	B/M	B/H	Total
1997	118	122	189	187	179	89	884
1998	117	125	193	203	180	93	911
1999	128	137	172	181	165	124	907
2000	143	139	157	170	150	132	891
2001	115	118	197	182	168	87	867
2002	147	150	185	183	170	139	974
AVERAGE	**128**	**132**	**182**	**184**	**169**	**111**	**906**

In Table 5 we detail the number of stocks in each of the six intersection portfolios formed over the period 1997 to 2002 with turnover ratio as the proxy for liquidity. The total number of firms in the sample varies between 867 (2001 year) and 974 (2002 year). The table also shows that B/L and S/H portfolios have the highest average number of firms followed by B/M, S/M, S/L and B/H portfolios.

Table 6

Average turnover ratio
06/97 to 06/02

YEAR	S/L	S/M	S/H	B/L	B/M	B/H
1997	0.0066	0.0211	0.0677	0.0066	0.0209	0.0558
1998	0.0078	0.0240	0.0745	0.0076	0.0245	0.0582
1999	0.0073	0.0198	0.0518	0.0069	0.0197	0.0436
2000	0.0079	0.0197	0.0561	0.0067	0.0202	0.0508
2001	0.0077	0.0260	0.1345	0.0069	0.0265	0.1177
2002	0.0078	0.0231	0.0707	0.0069	0.0226	0.0732
AVERAGE	**0.0075**	**0.0223**	**0.0759**	**0.0069**	**0.0224**	**0.0666**

Table 6 presents the average turnover ratio for the stocks in the six intersection portfolios over the period 1997 to 2002. This table shows that the S/H portfolio has the highest average turnover ratio of 0.0759 followed by the B/H, B/M, S/M, S/L and B/L portfolios.

Table 7

Summary Statistics and Multifactor Regressions for Portfolios Formed on Size and Turnover Ratio

Panel A

	Liquidity Portfolios					
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	Summary Statistics					
	Mean excess returns (over the risk free rate)			Standard Deviations		
S = Small	-0.005	-0.002	-0.020	0.059	0.084	0.107
B = Big	-0.001	-0.005	-0.029	0.031	0.038	0.069

Panel B

	Mean return	Standard deviation
RMRFT	-0.009	0.058
SMB	0.003	0.058
HLQMLLQ	-0.022	0.048

In this table we report the results of our second measure of liquidity – turnover ratio. In Table 7, Panel A, we first report the mean monthly excess returns and standard deviation of returns for portfolios formed on firm size and turnover ratio. Our tests show that the mean monthly excess returns are negative for all six portfolios. The portfolio B/H had the highest mean excess negative return (-0.029), followed by S/H with a mean negative excess return of (-0.020). It is to be noted that our findings for turnover ratio are consistent with that of turnover rate in the sense that all six intersection portfolios generate negative excess returns relative to the risk free rate.

Table 7, Panel B, reports the mean returns on the zero cost investment portfolios. The mean monthly return on the equally weighted portfolio of all stocks (RMRFT) was -0.009 (standard deviation = 0.058 per cent). The mimic portfolio for size (SMB) generated a return of 0.003 per month (standard deviation = 0.058) suggesting that small firms are riskier than big firms. The mimic portfolio for liquidity (HLQMLLQ) generated a return of -0.022 per cent per month (standard deviation = 0.048) suggesting that investors required a higher risk premium for low liquidity firms compared to firms with greater liquidity.

3.6 Parameter Estimates for multifactor model with turnover ratio as proxy for liquidity

Table 8

Regression Coefficients

	Liquidity Portfolios					
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	$R_{pt} - R_{ft} = a_p + b_p (R_{mt}-R_{ft}) + s_pSMB_t + l_pHLQMLLQ_t + \varepsilon_{pt}$					
		a			t stat (a)	
S = Small	-0.007	0.005	-0.001	-3.95	2.22	-0.02
B = Big	0.002	0.002	-0.005	1.88	1.38	-2.39
		b			t stat (b)	
S = Small	1.046	1.106	0.886	17.02	13.11	15.95
B = Big	0.932	1.014	1.092	28.97	21.92	15.82
		s			t stat (s)	
S = Small	0.350	0.470	0.635	9.25	9.03	18.55
B = Big	-0.380	-0.497	-0.665	-19.16	-17.42	-15.64
		l			t stat (l)	
S = Small	-0.504	-0.063	0.621	-8.21	-0.75	11.19
B = Big	-0.323	-0.173	0.550	-10.04	-3.75	7.98
		Adjusted R^2				
S = Small	0.95	0.96	0.98			
B = Big	0.95	0.93	0.95			
		DW Statistic				
S = Small	1.96	2.09	2.00			
B = Big	1.96	1.99	1.87			

In Table 8 we report the parameter estimates for our multifactor model with turnover as the proxy for illiquidity. Our results show that the overall market factor, (b coefficient), is statistically significant for all six portfolios at the 1-percent level, again suggesting that an assets' beta plays an important explanatory role in determining expected returns. We also report that the size factor, (s coefficient), is positive and highly significant at the 1-per cent level for the three small portfolios (S/L, S/M and

S/H). For the B/L, B/M and B/H portfolios the s coefficient is negative and statistically significant at the 1 percent level. Our findings are again consistent with the results of Fama and French (1996).

The coefficient for liquidity (l coefficient) is significant for five out of six portfolios. The coefficient is negative for the S/L and S/M portfolio but becomes positive and significant for the S/H portfolio. Similarly, the coefficient increases monotonically for the three big stock portfolios. As with our first measure of liquidity in interpreting the sign of the coefficients for liquidity recall that the mimic portfolio for liquidity (HLQMLLQ) generates negative returns of 0.022 percent per month suggesting that "high" liquidity firms have lower returns and are therefore less risky than "low" liquidity firms. Accordingly, the significant negative (positive) coefficients on the S/L and B/L (S/H and B/H) portfolios are consistent with the finding that liquidity is priced and less liquid firms earn higher expected returns.

The average adjusted R^2 for our model is 0.95. As far as diagnostics are concerned the DW tests suggest no evidence of autocorrelation in our sample. While not reported in Table 8 we found no evidence of multicollinearity or heteroscedasticity in diagnostic tests of the regression results. We also conducted seasonality tests to examine if the multifactor model findings can be explained by the turn of the year effect. While the results are not reported here (for reasons of space) the inclusion of dummy variables for the months of January and July do not alter our results reported in Table 8 above. Accordingly, our findings cannot be explained by the turn of the year effect.

3.7 Intersection and Zero Cost Portfolios with bid-ask spread as proxy for liquidity

Table 9

Number of companies in portfolios formed on size and bid-ask spread
06/97 to 06/02

YEAR	S/L	S/M	S/H	B/L	B/M	B/H	Total
1997	129	134	196	201	178	103	941
1998	114	140	202	216	179	99	950
1999	106	141	220	218	188	91	964
2000	108	139	227	221	179	94	968
2001	98	128	223	211	164	84	908
2002	132	141	239	219	201	110	1042
AVERAGE	**114**	**137**	**218**	**214**	**181**	**97**	**961**

We now proceed to discuss the robustness of our model under the third proxy for liquidity – average closing bid-ask spread. In Table 9 we detail the number of stocks in each of the six intersection portfolios formed over the period 1997 to 2002 with the average bid-ask spread as the proxy for liquidity. Using this proxy for liquidity costs the greatest average number of stocks under the two-way independent sort is concentrated in the S/H (218 firms) and B/L (214 firms) portfolios, followed by B/M, S/M, S/L and B/H portfolios.

Table 10

Average bid-ask spread
06/97 to 06/02

YEAR	S/L	S/M	S/H	B/L	B/M	B/H
1997	0.0954	0.0272	0.0094	0.1751	0.0263	0.0123
1998	0.1446	0.0247	0.0085	0.1793	0.0256	0.0118
1999	0.1325	0.0278	0.0093	0.2221	0.0283	0.0129
2000	0.1255	0.0260	0.0086	0.2174	0.0254	0.0120
2001	0.1283	0.0250	0.0079	0.1922	0.0249	0.0105
2002	0.0953	0.0216	0.0069	0.1483	0.0213	0.0093
AVERAGE	**0.1203**	**0.0254**	**0.0084**	**0.1891**	**0.0253**	**0.0115**

Table 10 presents the average bid-ask spread for the stocks in the six intersection portfolios over the period 1997 to 2002. This table shows that B/L portfolio has the highest average bid-ask spread of 0.1891 followed by the S/L, S/M, B/M, B/H and S/H portfolios.

3.8 Performance of portfolios formed on size and bid-ask spread

Table 11

Summary Statistics and Multifactor Regressions for Portfolios Formed on Size and Bid-Ask Spread

Panel A

			Liquidity Portfolios			
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
			Summary Statistics			
		Means			Standard Deviations	
S = Small	-0.008	-0.010	-0.009	0.050	0.074	0.110
B = Big	-0.006	-0.008	-0.015	0.034	0.042	0.054

Panel B

	Mean return	Standard deviation
RMRFT	-0.009	0.058
SMB	0.009	0.052
HLQMLLQ	-0.005	0.047

Table 11, Panel A, reports the performance of portfolios formed on firm size and the closing average bid-ask spread as the proxy for liquidity. Our results again show that the mean monthly excess returns are negative for all six portfolios. The highest mean excess monthly return was experienced by the B/H portfolio (-0.015). Table 11, Panel B, reports the returns on the zero cost investment portfolios. As with the previous two measures of liquidity (turnover rate and turnover ratio) we find that the returns on the zero cost portfolios for the overall market factor and liquidity are negative while the zero cost portfolios for size generates positive returns. The negative returns for HLQMLLQ again suggest that more liquid stocks earn lower returns than stocks with less liquidity.

3.9 Parameter Estimates for multifactor model with bid-ask spread as proxy for liquidity

Table 12

Regression Coefficients

	Liquidity Portfolios					
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	$R_{pt} - R_{ft} = a_p + b_p (R_{mt} - R_{ft}) + s_p SMB_t + l_p HLQMLLQ_t + \varepsilon_{pt}$					
		a			t stat (a)	
S = Small	-0.003	-0.001	0.002	-2.58	-0.92	1.93
B = Big	0.001	0.000	-0.004	1.30	0.75	-2.19
		b			t stat (b)	
S = Small	0.975	0.999	0.916	21.64	17.51	23.84
B = Big	0.920	0.992	0.979	33.79	29.98	20.19
		s			t stat (s)	
S = Small	0.494	0.469	0.659	14.04	10.51	21.93
B = Big	-0.337	-0.536	-0.502	-15.85	-20.73	-13.26
		l			t stat (l)	
S = Small	-0.755	-0.076	0.706	-3.75	-1.10	15.07
B = Big	-0.289	-0.083	0.248	-8.73	-2.07	4.20
		Adjusted R^2				
S = Small	0.95	0.96	0.99			
B = Big	0.96	0.96	0.95			
		DW Statistic				
S = Small	1.96	2.51	2.16			
B = Big	2.22	2.22	2.02			

In Table 12 we report the results of the regression analysis for bid-ask spread as our proxy for liquidity costs. The regression coefficients show that the intercept, (a coefficient), is statistically indistinguishable from zero for the majority of the portfolios. The overall market factor, (b coefficient), is statistically significant for all six portfolios at the 1-percent level. The size factor, (s coefficient), is positive and highly significant at the 1-per cent level for the three small portfolios (S/L, S/M and S/H) and negative and significant at the 1-per cent level for the three large portfolios (B/L, B/M and B/H). Our findings are again consistent with that of Fama and French (1993, 1996) and others who document a size effect. The liquidity factor (l coefficient) is significant for five out of six portfolios. The coefficient is negative for the S/L, S/M, B/L and B/M portfolios but becomes positive and significant for the S/H and B/H portfolios. Given that the mimic portfolio of HLQMLLQ experienced negative returns over the period 1997 to 2002, our results confirm our earlier findings that liquidity is priced by investors in the Australian market and that less liquid firms earn higher expected returns.

The average adjusted R^2 for our six portfolios is 0.96. The DW tests suggest no evidence of any serial correlation and we again found no evidence of multicollinearity in the multiple regression models. We also tested for a January and July effect by including dummy variables in our multifactor model with the bid-ask spread as a proxy for liquidity. The results (not reported here to save space) were very similar to those reported in Table 12 above. We conclude our multifactor model findings cannot be explained by any seasonality effect.

4. Conclusions

In this paper we advance the continuing debate in the area of empirical asset pricing and investigate the importance of firm size and liquidity in explaining stock returns for Australian stocks. Liquidity has important implications for transaction immediacy or the ability for investors to quickly buy or sell a firm's stock. To test if investors require higher expected returns for stocks that are less liquid we adopt the constructed portfolio approach of Fama and French (1993, 1996).

Our findings suggest that small and less liquid firms generate positive risk premia. The evidence is consistent with risk based explanations and investors requiring compensation for illiquidity costs. Improving a stock's liquidity may therefore lower the firm's cost of capital. Our results are robust to seasonality tests and thus we reject the claim that multifactor model findings can be explained by the turn of the year effect. In summary, we show that a multifactor asset pricing model that contains selected risk proxies may better explain the behaviour of stock returns than the standard CAPM model of Sharpe (1964) and Lintner (1965). This is an area deserving further research.

References

Amihud, Y., 2002, Illiquidity and stock returns: cross –section and time series affects, Journal of Financial Markets 5, 31-56.

Amihud, Y. and H. Mendelson, 1980, Dealership market: market making with inventory, Journal of Financial Economics 8, 311-353.

Amihud, Y. and H. Mendelson, 1986 Asset pricing and bid-ask spread Journal of Financial Economics 17, 223-249.

Amihud, Y. and H. Mendelson, 1988 Liquidity and asset prices: Financial management implications. Financial Management Vol 17, 5-15.

Amihud, Y. and Mendelson, H., 1991, Liquidity, maturity and the yields on US government securities, Journal of Finance 46, 1411-1426

Amihud, Y., Mendelson, H., and B. Lauterbach, 1997 Market microstructure and securities values: Evidence from Tel Aviv Stock Exchange. Journal of Financial Economics 45, 365-390.

Banz, R., 1981, The relation between return and market value of common stocks, Journal of Financial Economics 9, 3-18

Belsley, D.A., E.Kuh and R.E. Welsch, 1980, Regression Diagnostics, New York: John Wiley and Sons Inc.

Bondarenko, O. , 2001, Competing Market Makers, Liquidity Provision and bid-ask spreads, Journal of Financial Markets 4, 269-308.

Black, F., 1972, Capital market equilibrium with restricted borrowing, Journal of Business, July, 444-455

Branch, B., 1977, A tax loss trading rule, Journal of Business 50, 198-207

Brennan, M.J., Chordia, T., and Subrahmanyam, A., 1998 Alternative factor specifications, security characteristics, and the cross-section of expected stock returns Journal of Financial Economics 49, 345-373.

Brennan, M and M. Subrahmanyam, 1996, Market microstructure and asset pricing: on the compensation for illiquidity in stock returns, Journal of Financial Economics 41, 441-464.

Chan, H. and R. Faff, 2003, An investigation into the role of liquidity in asset pricing: Australian evidence, Pacific-Basin Finance Journal 11, 555-572

Datar, V.T., Naik, N.Y., and Radcliffe, R., 1998, Liquidity and stock returns: An alternative test. Journal of Financial Markets 1, 205-219.

Drew, M. and M. Veeraraghavan, 2002, A test of the Fama-French three factor model in the Australian equity market, Accounting, Accountability and Performance 8, (1), 77-92.

Eleswarapu and Reinganum, 1993, The seasonal behaviour of the liquidity premium in asset pricing, Journal of Financial Economics 34, 373-386

Fama, E., 1991, Efficient capital markets II, Journal of Finance 46, 1575-1617.

Fama, E., and K. French, 1992, The cross-section of expected stock returns. Journal of Finance 47(2), 427-466.

Fama, E., and K. French, 1993, Common risk factors in the returns on stocks and bonds, Journal of Financial Economics 33, 3-56

Fama, E., and K. French, 1996, Multifactor explanations of asset pricing anomalies, Journal of Finance 51, 55-84

Fama, E., and K. French, 2003, The CAPM: Theory and evidence, Working paper No 550, Center for Research in Security Prices, University of Chicago.

Gardiol, L., Gibson-Asner, R., and Tuchschmid, N., 1997 Are liquidity and corporate control priced by shareholders? Empirical evidence from Swiss dual class shares, Journal of Corporate Finance 3, 299-323.

Glosten, L. and P. Milgron, 1985, Bid, ask and transaction prices in a specialist market with heterogeneously informed traders, Journal of Financial Economics 14, 71-100.

Halliwell, J., Heaney, R. and J. Sawicki, 1999, Size and Book to Market Effects in Australian Share Markets: A Time Series Analysis, Accounting Research Journal 12 (2), 122-137.

Jun, S., Marathe, A. and H. Shawky, 2003, Liquidity and stock returns in emerging markets, Emerging Markets Review 4, 1-24.

Keim, D. and A. Madhavan, 1996, The upstairs market for large-block transactions: analysis and measurement of price effects, Review of Financial Studies 9, 1-36.

Keim, D. and R. Stambaugh, 1986, Predicting returns in the stock and bond markets, Journal of Financial Economics 17, 357-390.

Kyle, A., 1985. Continuous auctions and insider trading Econometrica 53, 1315-1335

Lintner, J., 1965, The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets, Review of Economics and Statistics 47, 13-37.

Malkiel, B. and Y. Xu, 1997, Risk and return revisited, Journal of Portfolio Management 23, 9-14.

Marshall B. and M. Young, 2003, Liquidity and stock returns in pure order-driven markets from the Australian stock market, International Review of Financial Analysis 12, 173-188.

Sharpe, W., 1964, Capital asset prices: A theory of market equilibrium under conditions of risk, Journal of Finance 19, 425-442.

Stoll, H., 2003. Market microstructure, forthcoming in *Handbook of the Economics of Finance*

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