The Journal of Entrepreneurial Finance

Volume 1
Issue 1 *Spring 1991*

Article 4

December 1991

Size, Liquidity, and the Cost of Equity

William L. Beedles
University of Kansas

Size, Liquidity, and the Cost of Equity

William L. Beedles

The inverse association of capitalization and performance is found to hold over a broader range of firms than has been previously studied. This result is found by merging data for listed United States firms with data for listed Australian companies, which are on average much smaller than their North American brethren. For the entire size spectrum and across listing locations, liquidity is found to be related to performance, adding support to the popular belief that it is (perhaps one of) the factor(s) missing from conventional tests of asset pricing. The results suggest that a lack of liquidity, rather than size *per se,* is a material contributor to the high cost of equity finance experienced by small companies. Some commentators attach much currency to proposals to subsidize small firms by enhancing the liquidity of their shares; the results reported here suggest that such subsidies may be effective.

INTRODUCTION

Political economists spent much of the 1980s trying to foster "economic development" by increasing the general level of investment. Some encouragement has come from direct subsidies, often in the form of venture capitalists organized under the auspices of state governments. A variety of indirect subsidy that might produce investment at levels beyond those deemed appropriate by usual marketplace discipline involves intervening in the microstructure of the capital market. For example, Emshwiller [6] has described ideas to reduce the trading illiquidity of small companies. The thinking seems to be that greater liquidity will reduce investors' required return from small companies. The firms' capital costs will hence go down, and so their levels of investment will go up, or so the logic goes. Little evidence exists as to whether such actions might be effective (the focus of this paper), let alone whether they might be cost effective (beyond the focus of this paper).

Also during the 1980s, financial economists devoted much energy to documentation and explanation of what has come to be called the "small firm anomaly." Small firms have been found to pay substantially more for equity capital than their equivalent risk but larger brethren.

William L. Beedles • School of Business Administration, The University of Kansas, Lawrence, KS 66045.

The Journal of Small Business Finance, 1(1): 29-44
ISSN: 1057-2287

The work reported here looks at two questions. (1) Does the well-known size effect, where capitalization and two-moment performance are found to be inversely related, obtain for enterprises smaller than those investigated by most students of the issue? (2) Does trading liquidity serve as a possible explanation of the size phenomenon for these smaller firms? Empirical evidence is provided indicating that the answers are a firm "yes" to the first and "probably" to the second.

Addressing these matters involved merging information about U.S. companies provided by the University of Chicago's Center for Research in Securities Prices (CRSP) with similar information on Australian shares maintained by the Center for Research in Finance (CRIF) at the Australian Graduate School of Management, University of New South Wales (Sydney).

We find that when attention is restricted to New York Stock Exchange (NYSE) securities, a weak size effect is evident that is consistent with a liquidity explanation. When shares listed on the American Exchange (AMEX) are examined, the size effect is stronger, and the liquidity argument is supported more clearly. For the smallest firms—those traded in Australia—the size/liquidity effect observed on the AMEX is confirmed. This paper concludes with a commentary.

EMPIRICAL RESULTS

The Size Effect—Updated

Banz [3] and Reinganum [11] were two of the pioneers of size effect research. Since Reinganum dealt with "small" AMEX firms, the first step here was to conduct an updated (he covered 1963 to 1977) replication of his work. Using NYSE and AMEX data from CRSP, a firm was categorized into one of 20 portfolios depending upon its equity market value at the end of December 1973.[1] If a firm's value was among the 5% of the smallest, its 1974 returns were included in portfolio one; if its December 1973 size fell within percentiles six to ten, its 1974 returns were included in portfolio two; ... ; if it was in the largest 5%, its returns were put in portfolio 20. All listed firms were reclassified on the basis of December 1974 value and 1975 returns retained in the same way. The process continued until classification was based on December 1986 value. After employing this procedure for every security, the result is a return matrix with 20 rows, the first of which simulates the experience of an investor who specialized in the 5% of all NYSE and AMEX stocks that were smallest, the last row representing a mutual fund of the largest capitalization firms, with portfolio revision occurring yearly.

As reported in Table 1, the average size of the firms included in the smallest portfolio (computed simply as the mean size struck over the 168 study

Table 1
Update of Reinganum
Performance of 20 Market Value Portfolios Composed of NYSE and AMEX Firms, 1974-1987, Using Equal-Weighted NYSE—AMEX Index

Portfolio	*Average Value*[a]	*Mean Monthly Return*[b]	*Slope*[c]	*Pct intercept*[c]	*t(a)*[c]	*Percent AMEX*[d]
Smallest	7.01	1.73	1.33	0.70	1.94#	95.8
2	8.15	1.08	1.25	0.10	0.44	91.4
3	12.12	0.89	1.18	−0.03	−0.14	87.5
4	18.60	0.96	1.16	0.05	0.33	81.6
5	24.59	0.97	1.13	0.09	0.66	71.8
6	32.87	0.76	1.08	−0.08	−0.73	59.0
7	41.62	0.97	1.08	0.13	1.25	49.9
8	52.55	0.95	1.06	0.13	1.40	40.9
9	69.21	0.78	1.07	−0.05	−0.56	30.8
10	84.99	0.71	1.07	−0.12	−1.36	27.4
11	108.22	0.66	1.01	−0.12	−1.41	20.5
12	144.63	0.81	0.97	0.06	0.64	16.7
13	208.14	0.70	0.96	−0.05	−0.51	14.4
14	251.47	0.72	0.91	0.01	0.08	10.7
15	342.92	0.65	0.88	−0.03	−0.31	7.4
16	463.25	0.56	0.86	−0.10	−0.73	6.7
17	660.28	0.57	0.84	−0.08	−0.60	4.7
18	987.53	0.51	0.79	−0.11	−0.67	3.4
19	1594.14	0.44	0.72	−0.13	−0.73	2.1
Largest	5509.55	0.19	0.65	−0.32	−1.46	3.4
AVERAGE	531.09	0.78	1.00	0.00	−0.12	36.3

Notes: * Exceeds .05 significance criterion of 1.960.
Exceeds .10 significance criterion of 1.645.
[a] Millions of U.S. dollars. Computed as average of end-of-month portfolio value over 168 months, January 1974 to December 1987.
[b] Continuously compounded. Stated in excess of the monthly return on 90-day U.S. Treasury securities.
[c] Estimates of the market model, equation (1). Portfolio and index returns are in excess of returns on U.S. Treasury instruments.
[d] Percentage of returns computed using prices from American Stock Exchange quotes, averaged across 168 months.

months, January 1974 to December 1987) was $7 million. The largest was over $5 billion.

On a "raw" basis, the size effect is observed. The correlation of market value and return is −.60, virtually identical to Reinganum's finding. The small firm effect is also in evidence. The portfolio of the smallest firms is

the only one with a return more than twice the cross sectional standard deviation relative to the cross sectional mean.

To judge performance on a risk-adjusted basis, the market model, stated in excess return form using continuously compounded returns, was estimated:

$$R_{pt} - R_{ft} = a_p + b_p(R_{mt} - R_{ft}) + e_{pt} \quad (1)$$

where R_t denotes continuous return during month $t(= 1, \ldots, 168)$; p, f, and m denote portfolio $(= 1, \ldots, 20)$, riskfree, and index, respectively; a and b are estimated parameters; and e is a residual term assumed to satisfy standard assumptions.

Risk adjustment turns out to be appropriate. The high-return small firm portfolios had the largest slopes, i.e., largest OLS estimated betas, i.e., the highest estimated systematic risks. Thus the intercept—Jensen's [8] index—is a useful performance measure.

This risk adjustment does not negate the size effect. The correlation of size and the intercept is −.48, although much of this is caused by the negative performance of the large firm portfolios. The small firm effect also seems to hold. Note that the portfolio of smallest firms provided abnormal returns that were noteworthy at a comparatively high level of statistical significance and that were almost certainly economically material (8.7% per year).

The data of Table 1 also serve to confirm an "exchange effect." The correlation between size and the proportion of the portfolio made up of AMEX companies is a highly significant −.41. In other words, we cannot tell from Table 1 whether a size effect is at work, or if we are observing some sort of exchange effect.

In an attempt to unravel the size and exchange effects, the next step involved conducting exactly the same analysis reported above, but on exchange-specific stocks. The procedure involved forming portfolios by classifying each NYSE and each AMEX stock on the basis of size at the end of December 1973, December 1974, December 1975, and so forth. The result was two data matrices, one with NYSE firms, one with AMEX, each with 20 rows for the portfolios and 168 columns for the months. Various parameters were estimated, and the resulting data reported in Tables 2 and 3.

First consider the big board (Table 2). The size effect is documented with a correlation between market value and risk-adjusted performance (market model intercept) of −.68. The half dozen or so portfolios of extreme size had the most dramatic performance.

The same patterns existed for AMEX firms (Table 3). Performance and size were significantly negatively correlated (−.39), and the portfolio of smallest firms had a market model intercept substantially larger than the others.

Table 2
Performance of 20 Market Value Portfolios Composed of NYSE Firms, 1974-1987, Using Equal-Weighted NYSE—AMEX Index

Portfolio	*Average Value*[a]	*Mean Monthly Return*[b]	*Slope*[c]	*Pct intercept*[c]	*t(a)*[c]
Smallest	20.84	1.17	1.31	0.15	0.48
2	33.39	0.98	1.15	0.09	0.53
3	43.94	1.20	1.08	0.36	2.76*
4	57.49	0.90	1.07	0.07	0.64
5	75.07	0.84	1.05	0.02	0.19
6	88.60	0.82	1.04	0.02	0.17
7	108.66	0.78	0.99	0.02	0.15
8	135.72	0.78	0.96	0.03	0.36
9	172.17	0.67	0.96	−0.08	−0.75
10	228.78	0.77	0.92	0.06	0.54
11	251.39	0.75	0.89	0.07	0.63
12	318.85	0.57	0.89	−0.12	−1.00
13	392.15	0.72	0.86	0.06	0.42
14	489.98	0.56	0.85	−0.11	−0.72
15	622.99	0.54	0.83	−0.11	−0.70
16	814.86	0.55	0.81	−0.08	−0.51
17	1048.67	0.47	0.76	−0.12	−0.67
18	1428.60	0.43	0.74	−0.15	−0.84
19	2221.22	0.34	0.69	−0.19	−0.96
Largest	7164.22	0.14	0.62	−0.34	−1.43
AVERAGE	785.88	0.70	0.92	−0.02	−0.04

Notes: * Exceeds .05 significance criterion of 1.960.
Exceeds .10 significance criterion of 1.645.
[a] Millions of U.S. dollars. Computed as average of end-of-month portfolio value over 168 months, January 1974 to December 1987.
[b] Continuously compounded. Stated in excess of the monthly return on 90-day U.S. Treasury securities.
[c] Estimates of the market model, equation (1). Portfolio and index returns are in excess of returns on U.S. Treasury instruments.

Of special interest is a comparison of the results for NYSE and AMEX shares, i.e., a comparison of the *magnitudes* of the data reported in Tables 2 and 3. While a size effect existed for both, the performance of the smallest AMEX firms was much more dramatic than for the NYSE firms—12.4% on an annualized basis, versus 4.4% for the third NYSE portfolio. Similarly, the AMEX portfolios were all substantially smaller in market value terms than their NYSE parallels. Indeed, the median AMEX portfolio would have been in the smallest 10% of NYSE firms.

Table 3
Performance of 20 Market Value Portfolios Composed of AMEX Firms, 1974-1987, Using Equal-Weighted NYSE—AMEX Index

Portfolio	*Average Value*[a]	*Mean Monthly Return*[b]	*Slope*[c]	*Pct intercept*[c]	*t(a)*[c]
Smallest	3.26	2.04	1.37	0.98	1.98*
2	4.15	1.24	1.32	0.22	0.54
3	5.82	1.20	1.26	0.22	0.71
4	7.21	0.84	1.23	−0.11	−0.41
5	9.19	1.34	1.24	0.38	1.57
6	10.60	0.77	1.15	−0.13	−0.60
7	12.30	0.95	1.17	0.05	0.24
8	14.43	0.80	1.09	−0.05	−0.26
9	17.52	1.12	1.17	0.21	1.12
10	19.48	0.76	1.12	−0.11	−0.64
11	23.56	1.07	1.11	0.21	1.16
12	26.47	0.62	1.07	−0.21	−1.35
13	30.63	0.60	1.02	−0.20	−1.18
14	37.45	0.72	1.05	−0.09	−0.58
15	43.85	0.68	1.04	−0.12	−0.81
16	53.51	0.48	1.03	−0.32	−1.88
17	68.68	0.32	1.08	−0.52	−3.11*
18	98.36	0.65	1.05	−0.16	−0.86
19	174.56	0.54	1.02	−0.25	−1.17
Largest	804.19	0.30	0.94	−0.43	−1.83#
AVERAGE	73.26	0.85	1.13	−0.02	−0.37

Notes: * Exceeds .05 significance criterion of 1.960.
Exceeds .10 significance criterion of 1.645.
[a] Millions of U.S. dollars. Computed as average of end-of-month portfolio value over 168 months, January 1974 to December 1987.
[b] Continuously compounded. Stated in excess of the monthly return on 90-day U.S. Treasury securities.
[c] Estimates of the market model, equation (1). Portfolio and index returns are in excess of returns on U.S. Treasury instruments.

The data of Tables 1-3 support these generalizations:

- The size effect has been pervasive, being in evidence for the combination of NYSE and AMEX firms studied by Reinganum as well as NYSE and AMEX firms studied separately here. The phenomenon has been found here for a sample period mostly outside of Reinganum's.

- Much of the size effect has been due to a small firm effect. The most dramatic above-average performance has come from the smallest firms, which for the most part have been AMEX companies.
- By many standards, the smallest of CRSP firms—AMEX portfolio number one—are large on an absolute basis, with an average market value of over $3 million during 1974 to 1987.

To summarize, this subsection has been designed to confirm the size/small firm anomaly found by Reinganum, but over a sample period different from his. The intent also has been to extend previous work so as to investigate the effects separately for AMEX firms. During 1974 to 1987, the smallest 5% of AMEX firms paid about 12% more per annum for equity finance than did the typical firm.

Size is not thought to be a causal factor in return generation, but is instead an instrument for a (set of) factor(s) omitted from the test methodology. Liquidity is one of the most promising factors.

The Liquidity Story

Lakonishok and Smidt [9] have provided evidence that shares' lack of liquidity may be (one of) the missing variable(s) in size effect studies. Among other important findings, they show that the frequency with which shares trade is a useful reflection of their liquidity [9, especially pp. 438-441]. The intuition is this: If an investor holds a share that typically trades on five days of the (five-trading-day) week, s/he will have comparatively few concerns regarding immediacy. If a sale is desired, willing buyers are usually available. In contrast, a share that trades typically only two days per week may pose greater immediacy problems. As Grossman and Miller [7] point out, the more that trades are separated by time, the greater is the risk exposure.

To operationalize this notion, the following illiquidity measure is used. Consider a portfolio containing 100 shares during January, a month that has, say, 22 trading days. If on average 10 shares do not trade on a given day, the portfolio's illiquidity measure would be $.1 = 220/2200 = (10 \times 22)/(100 \times 22)$. If during February, a month with 19 trading days, the portfolio contains 110 shares, 100 of which trade on a typical day, the illiquidity measure would be $.0909 = 190/2090 = (10 \times 19)/(110 \times 19)$. For the two-month period, the illiquidity would be $.0956 = (220 + 190)/(2200 + 2090)$. The interpretation is that on the typical day during the two-month study period, 9.56% of the portfolio's constituent securities did not trade. This statistic has been computed for the NYSE and AMEX portfolios.

Over the sample period, the typical AMEX stock did not trade on about 15% of the days the market was open. This is nearly 12 times more illiquidity than the typical NYSE share. The smallest AMEX shares traded, on average, only about two days out of three.

Table 4
Illiquidity of 20 NYSE Market Value Portfolios and 20 AMEX Market Value Portfolios, 1974-1987

	Illiquidity[a]	
Portfolio	*NYSE*	*AMEX*
Smallest	6.20	36.94
2	3.11	29.78
3	2.34	25.70
4	2.18	22.42
5	1.88	20.15
6	1.54	18.59
7	1.26	16.99
8	1.13	17.04
9	1.13	14.75
10	0.64	13.93
11	0.69	12.15
12	0.48	11.75
13	0.53	11.68
14	0.68	10.09
15	0.47	9.50
16	0.23	7.92
17	0.11	6.61
18	0.27	6.13
19	0.17	6.14
Largest	0.17	9.18
AVERAGE	1.29	15.37

Note: [a] Illiquidity is defined as the number of days constituent securities did not trade divided by the number of days when they were listed. More precisely, if month t has T_t trading days, if portfolio p contains $j = 1, \ldots, J_t$ shares, and if M_{jt} denotes the number of days that share j did not trade during the month, the portfolio's illiquidity measure is simply the summation across constituent secruties of all the "non-trading days" divided by the summation of the "available for trade" days in month t. The liquidity measure of portfolio p for month t is

$$M_{pt} = \sum_{j=1}^{J} M_{jt}/(J_t \times T_t)$$

For the NYSE portfolios the illiquidity/performance relationship is similar to that found for size and performance, with a correlation of +.61. The smallest NYSE shares are nearly five times as illiquid as the typical NYSE shares. The association between illiquidity and performance for AMEX shares is remarkable; the correlation is +.82.

To summarize:

- When it comes to the conventional size and small firm effects, "most of the action" comes from the smallest firms, which for the most part are traded on the AMEX.
- Size itself does not have normative backing as a factor in the pricing of assets. But size perhaps serves as an instrument for liquidity, a notion that others have advanced as a factor in the pricing process.
- Empirically, illiquidity is a powerful correlate with performance, especially for those firms with dramatic performance—AMEX companies.
- By many standards "small" AMEX firms are large.

The Australia Story

The results presented thus far serve to support—and extend to the AMEX—the size/performance/illiquidity findings of others. An important extension would be an "outside of sample" test. Do the associations found here apply to a different class of shares? The natural way to address this is to look at OTC stocks. Unfortunately, data on NASDAQ shares are not easily compared to the NYSE and AMEX information, although some progress is being made [10]. Similarly, transactions prices on "pink sheet" shares are not commercially available in computer readable form.

Fortunately, data on firms listed in Australia are available. The markets there and in the U.S. are essentially the same in terms of microstructure. A major difference is that small Australian companies are extremely small by U.S. standards.

That extremely small firms are listed in Australia is rooted in historic provincialism. Australia's land mass is approximately equal to that of the U.S. but with vast stretches of desert. The country's population is only 16 million. Therefore, Australia's citizens are highly concentrated in the arable areas, for the most part around the capital cities of its six states. Adelaide, Brisbane, Hobart, Melbourne, Perth, and Sydney have historically been the centers of regional commerce and trade. A separate stock market has developed in each of the cities. (The Melbourne and Sydney exchanges are by far the largest.)

Table 5
Performance of 20 Market Value Portfolios Composed of Australian Firms, 1974-1987, Using Equal-Weighted NYSE—AMEX Index

Portfolio	*Average Value*[a]	*Mean Monthly Return*[b]	*Slope*[c]	*Pct intercept*[c]	*t(a)*[c]	*illiquidity*[d]
Smallest	0.81	8.29	0.67	7.77	7.74*	30.69
2	1.67	5.04	0.57	4.60	6.49*	28.80
3	2.18	3.22	0.40	2.90	4.21*	28.84
4	2.24	3.10	0.44	2.76	4.72*	25.30
5	2.82	2.71	0.41	2.39	4.25*	23.85
6	3.61	2.11	0.42	1.78	3.51*	21.39
7	4.44	1.29	0.43	0.96	2.01*	21.86
8	5.35	1.93	0.38	1.64	3.52*	21.76
9	6.55	1.10	0.45	0.75	1.67#	19.88
10	7.94	0.99	0.42	0.66	1.51	19.80
11	9.87	1.28	0.46	0.92	2.19*	19.31
12	12.26	1.11	0.37	0.82	2.17*	17.88
13	15.10	1.14	0.39	0.84	2.50*	16.61
14	18.49	0.74	0.42	0.41	1.10	14.96
15	24.18	1.18	0.38	0.89	2.56*	14.61
16	33.33	0.88	0.46	0.53	1.40	13.30
17	50.25	0.93	0.54	0.51	1.26	9.79
18	78.83	0.85	0.48	0.47	1.25	7.80
19	154.11	0.90	0.58	0.45	1.03	3.69
Largest	638.73	0.59	0.70	0.04	0.09	3.83
AVERAGE	53.64	1.97	0.47	1.61	2.76	18.20

Notes: * Exceeds .05 significance criterion of 1.960.
Exceeds .10 significance criterion of 1.645.
[a] Millions of U.S. dollars. Computed as average of end-of-month portfolio value over 168 months, January 1974 to December 1987, using monthly exchange rates.
[b] Continuously compounded. Stated in excess of the monthly return on 90-day U.S. Treasury securities.
[c] Estimates of the market model, equation (1). Portfolio and index returns are in excess of returns on U.S. Treasury instruments.
[d] Number of days constituent securities did not trade divided by number of days they were listed, cf. fn. [a], Table 5.

Until the advent of reliable real time data transmission, the six exchanges had little interaction. Thus, as elsewhere in the world, equity needs of the smallest of firms have been met by existing owners through retentions and direct investment. When external equity has been desired, owners have had available a small, regional stock exchange. As a result, firms

Table 6
Performance of 20 Market Value Portfolios Composed of Australian Firms, 1974-1987, Using Equal-Weighted Australian Index

Portfolio	*Slope*[a]	*Pct intercept*[a]	*t(a)*[a]
Smallest	1.55	5.18	6.45*
2	1.29	2.45	4.87*
3	1.25	0.71	1.55
4	1.14	0.82	2.24*
5	1.09	0.52	1.49
6	1.03	0.04	0.12
7	1.03	−0.78	−3.10*
8	0.98	−0.03	−0.12
9	0.98	−0.85	−3.32*
10	0.96	−0.93	−3.94*
11	0.97	−0.67	−3.26*
12	0.83	−0.56	−2.82*
13	0.76	−0.38	−1.97*
14	0.87	−1.00	−5.49*
15	0.75	−0.33	−1.61
16	0.86	−0.84	−3.87*
17	0.97	−1.01	−4.46*
18	0.88	−0.92	−4.22*
19	0.99	−1.09	−3.88*
Largest	1.09	−1.59	−5.13*
AVERAGE	1.01	−0.06	−1.52

Notes: * Exceeds .05 significance criterion of 1.960.
Exceeds .10 significance criterion of 1.645.
[a] Estimates of the market model, equation (1). Using portfolio and index returns in excess of returns on U.S. Treasury instruments.

have gone (and still go) from private ownership to listing, without the "intermediate" step of OTC trading witnessed in the U.S.

With the advent of effective communication, the six regional markets are now computer-linked and operate in concert in real time. The Australian share market today is akin to the oft-discussed "national" exchange in the United States.

CRIF maintains monthly size, return and other data on transactions executed at all six locations, beginning in 1973. (This explains why the analysis of U.S. firms was started at that time, rather than using all information available from CRSP.) These data are compatible with the CRSP information, except with respect to the illiquidity measure. Daily data are not available from CRIF. However, the date of the last monthly trade

is provided for each share. With this datum, an illiquidity measure can be estimated that is an exact parallel to the one developed for U.S. firms.

If an Australian share changes hands on the last trading day of the month, the presumption is made that it traded every day, i.e., its illiquidity is set to 0.0. If it traded on the next to last day, but not on the last day, the pattern of its trading on half the days was presumed to hold throughout the month, i.e., its illiquidity is set to .5. If the last trade occurred three days from month end (that is, no trades occurred during the last two trading days), the share was assumed to trade just one of three days for the entire month, so illiquidity is set at .67; illiquidity is set to .75 if three days were missed; and so forth.[2] Table 5 has the data for the Australian firms.

In terms of average size and illiquidity, Australia is similar to the AMEX: $53 million versus $73 million; 18% missing trading versus 15%. However, the smallest Australian companies are about a fourth the size of the smallest AMEX firms, $810 thousand versus $3.26 million. The performance of the smallest Australian firms is dramatically greater than the smallest AMEX: 7.77% per month versus .98%.

This striking performance of the smallest Australian shares is in keeping with the findings of Brown, Keim, Kleidon, and Marsh [5] and Beedles, Dodd, and Officer [4].[3] However, interpreting the Australian performance in the present context is difficult because the Australian portfolios are not highly correlated with the U.S. index. Table 6 contains Australian performance statistics when an Australian index is used.

These data support three generalizations.

- The size effect exists in Australia. The correlation of value and performance using a U.S. (Australian) index is −.29 (−.32).
- The small firm effect is dramatic. Australian enterprises with a market value of less than one million dollars (U.S.) paid perhaps 60% more per year for equity than the standard mean and variance-based testing regime would lead us to expect.
- Illiquidity is highly collinear with the small firm/size effects. The most illiquid portfolio is the smallest. The correlation of illiquidity and performance using a U.S. (Australian) index is .90 (.87).

CONCLUSIONS AND COMMENTARY

The lack of ambiguity in the results reported here is surprising; the size/performance/liquidity relationship comes through clearly even in the face of several potentially onerous methodological problems. (1) Due to Australian data availability, a relatively short time period (14 years) had to

Table 7
Performance of 20 Market Value Portfolios Composed of NYSE, AMEX, and Australian Firms, 1974-1987, Using Equal-Weighted NYSE—AMEX-Austrailian Index

Portfolio	Average Value[a]	Mean Monthly Return[b]	Slope[c]	Pct intercept[c]	t(a)[c]	Percent AMEX[d]	Percent Ausralian[d]	Illiquidity[e]
Smallest	1.90	5.22	1.06	4.09	7.63*	11.6	88.2	31.05
2	4.91	2.59	1.04	1.40	4.48*	34.8	64.5	27.72
3	5.32	1.57	1.08	0.34	1.46	45.8	51.6	23.44
4	7.27	1.30	1.06	0.09	0.53	52.1	42.6	20.31
5	10.50	1.19	1.09	−0.06	−0.39	55.0	38.0	17.68
6	14.26	1.20	1.07	−0.02	−0.11	54.3	33.0	14.89
7	18.86	0.98	1.06	−0.23	−1.99*	53.3	29.4	12.28
8	26.16	0.89	1.03	−0.28	−3.41*	48.8	25.4	9.94
9	35.50	0.97	1.07	−0.26	−2.33*	41.9	21.4	8.04
10	44.88	0.86	1.07	−0.36	−3.62*	35.9	16.9	6.04
11	59.84	0.87	1.09	−0.37	−3.76*	29.4	14.6	4.41
12	79.94	0.68	1.06	−0.53	−4.83*	22.4	14.9	3.79
13	106.09	0.75	1.05	−0.45	−4.09*	17.0	13.1	2.62
14	145.84	0.73	1.01	−0.42	−3.92*	14.6	11.4	2.08
15	218.28	0.72	0.99	−0.40	−3.28*	11.5	9.2	1.80
16	299.21	0.68	0.95	−0.41	−3.32*	6.6	10.7	1.30
17	438.69	0.58	0.95	−0.51	−3.38*	6.6	6.6	1.20
18	698.34	0.55	0.92	−0.49	−3.05*	4.5	4.6	0.73
19	1204.97	0.44	0.83	−0.51	−2.78*	2.4	2.6	0.60
Largest	4549.97	0.24	0.73	−0.59	−2.75*	3.0	1.7	1.06
AVERAGE	398.54	1.15	1.01	0.00	−1.65	27.6	25.0	9.55

Notes: * Exceeds .05 significance criterion of 1.960.
Exceeds .10 significance criterion of 1.645.
[a] Millions of U.S. dollars. Computed as average of end-of-month portfolio value over 168 months, January 1974 to December 1987. Month-end and exchange rates used for Australian firms.
[b] Continuously compounded. Stated in excess of the monthly return on 90-day U.S. Treasury securities.
[c] Estimates of the market model, equation (1). Using portfolio and index returns in excess of returns on U.S. Treasury instruments.
[d] Percentage of returns computed using prices from American Stock Exchange or Australian quotes, averaged across 168 months.
[e] Number of days constituent securities did not trade divided by number of days they were available for trading.

be studied. (2) A rather crude measure of liquidity—average frequency of trading divided by average "availability for trading"—was used. (3) An unambiguous specification of the appropriate "market index" is not available, so the characterization of the return generating process was not as accurate as one would like.

Even with these problems, the size, performance, and liquidity associations came through clearly. A final summary in Table 7 thus combines data from all three trading locations.

Several conclusions emerge irrespective of how the data are arranged. The size effect holds over a broader range of company sizes than has been studied before in an integrative fashion. Investors in high performing small firms are exposed to greater liquidity risks than are investors in large firms, adding further support to liquidity's being (one of) the missing factor(s) in studies of asset pricing. Importantly for present purposes, from a manager's standpoint a clear incentive exists to see that the firm's investors face as little market illiquidity as is cost effective [1; 2]. Operationally, this suggests that encouraging broker/dealers to "make a market" in your shares may be a worthwhile undertaking. From the standpoint of public policy, considerable debate and discussion currently centers on methods for governmental bodies to intervene in the marketplace to affect the cost of financing for small firms. Some units of government have provided subsidies under the auspice of "economic development," e.g., venture capital funds that are not subject to the typical discipline of the marketplace.

Another method is to intervene in the structure of the market [6]. The notion seems to be to the effect that enhancing the liquidity of investments will make them more attractive, and thereby make the raising of funds easier and less costly for inherently illiquid, i.e., small, firms. The results here suggest that such intervention can be effective. The evidence indicates that illiquidity is closely associated with the cost of equity capital, especially for extremely small firms.

The previous paragraph is dramatically different than an advocacy position for such market intervention. While effective, whether such intervention is an efficient use of the resources of a governmental body is beyond the purview of this—and perhaps any other—scientific investigation. Judgments regarding such intervention are best left to political economists rather than financial economists. However, the results presented here are more powerful than any to have gone before regarding documentation of the potential effectiveness of programs to affect market illiquidity.

Acknowledgments: The research assistance of Dana Goldblatt, Brian Hattaway, and Karl Smith is gratefully acknowledged, as are comments by participants at the Small Firm Financial Research Symposium, where an earlier version of this paper was presented in April 1990. This work was in part supported by contract SBA-3050-AER-88; Charles Ou of the SBA has made numerous helpful suggestions on previous drafts. The opinions expressed here are those of the author and are not necessarily embraced by the Small Business Administration or its employees.

NOTES

1. Reinganum [11] used deciles. Since the most dramatic abnormal returns are displayed by the smallest firms—see [11], Table 8—the small firm effect can be seen more clearly with more groups, hence the use of 20 here.
2. Of course, a share might only trade once during the entire month, in which case it should have an illiquidity measure of about .95 = 19/20. If that single trade occurred on the last day of the month, estimated illiquidity would be 0.0. However, no evidence of systematic intra-month trading variation exists in Australia across firms of various sizes, so no reason exists to expect that a bias is introduced to the illiquidity measure.
3. "Striking" may be an understatement; the average annual return on the smallest decile of Australian firms was over 100%.

REFERENCES

[1] Amihud, Yakov and Haim Mendelson, "Trading Mechanisms and Stock Returns: An Empirical Investigation," *Journal of Finance*, Volume 42, July 1987, pp. 533-553.

[2] Amihud, Yakov and Haim Mendelson, "Liquidity and Cost of Capital: Implications for Corporate Management," *Journal of Applied Corporate Finance*, Volume 2, Fall 1989, pp. 65-73.

[3] Banz, Rolf W., "The Relationship Between Return and Market Value of Common Stocks," *Journal of Financial Economics*, Volume 9, March 1981, pp. 3-18.

[4] Beedles, William L., Peter Dodd, and Robert R. Officer, "Regularities in Australian Share Returns," *Australian Journal of Management*, Volume 13, June 1988, pp. 1-29.

[5] Brown, Phillip, Donald B. Keim, Allen W. Kleidon and Terry A. Marsh, "Stock Return Seasonalities and the Tax-Loss Selling Hypothesis," *Journal of Financial Economics*, Volume 12, March 1983, pp. 105-127.

[6] Emshwiller, J. R., "Small Stockmarkets May Be Right Size," *The Wall Street Journal*, Dow Jones and Co., New York, January 18, 1989, p. B2.

[7] Grossman, Sanford J. and Merton H. Miller, "Liquidity and Market Structure," *Journal of Finance*, Volume 43, July 1988, pp. 617-633.

[8] Jensen, Michael C., "The Performance of Mutual Funds in the Period 1945-1964," *Journal of Finance*, Volume 23, May 1968, pp. 389-416.

[9] Lakonishok, Joseph and Seymour Smidt, "Volume and Turn-of-the-Year Behavior," *Journal of Financial Economics*, Volume 13, December 1984, pp. 435-455.

[10] Lamoureux, Christopher G. and Gary C. Sanger, "Firm Size and the Turn-of-the-Year Effects in the OTC/NASDAQ Market," *Journal of Finance*, Volume 44, December 1989, pp. 1219-1245.

[11] Reinganum, Marc R., "Misspecification of Capital Asset Pricing," *Journal of Financial Economics*, Volume 9, March 1981, pp. 19-46.

[12] Schwert, G. William, "Size and Stock Returns and Other Empirical Regularities, *Journal of Financial Economics*, Volume 12, June 1983, pp. 3-12.