Proceedings of Joint Conference of Korean Data And Information Science Society and Korean Data Analysis Society, June 21-22, 2002, pp. 75-84

Measuring the Long-run Stock Returns to Investors

Seung-Doo Choi[1]

Abstract

This paper compares long-run returns of privatization initial public offerings to those of domestic stock markets of respective countries using a sample of 196 privatization initial public offerings from 39 countries. The evidence indicates that the privatization initial public offerings (IPOs) significantly outperform their domestic stock markets. There are substantial differences in the long-run performance of privatization IPOs depending on the return estimation techniques, however. Evidence indicates that the inference based either on conventional t or on skewness-adjusted t statistics may yield misspecified test statistics. The quality of estimation tends to be improved by simply eliminating the outliers from the sample, especially for the buy-and-hold abnormal return technique.

I. Introduction

Privatization has recently become the policy of choice in both industrialized and developing countries. Over the past two decades, 40 governments around the world have obtained 37 trillion dollars in proceeds from the divestiture of state-owned enterprises (SOEs) through 166,300 deals of privatization programs. It has been promoted based on the evidence that privatizations serve to improve the efficiency and profitability of a firm. Galal, Jones, Tandon, and Vogelsang (1992), Megginson, Nash and van Randenborgh (1994), and Dewenter and Malatesta (1999) all alike, report that there are significant improvements in firm output, efficiency and profitability following privatization.

The above evidences indicate that the ownership matters to the value of the firm. Then, how the capital markets react to privatization of an SOE. Recently, Megginson, Nash, Netter, and Schwartz (1999) document that average market-adjusted (cumulative) abnormal returns of privatization are significantly positive over one-, three-, and five-year holding periods. Their findings are in sharp contrast with those of Ritter (1991) who reports that there is long-run under-performance phenomena in the U.S. IPO market. However, Fama (1998) and Lyon, Barber, Tsai (1999) argue that commonly used methods for long-run abnormal returns tend to

[1]Professor, Department of Finance, Dongeui University, Busan 614-714, Korea.

yield misspecified test statistics. Barber and Lyon (1997) indicate that cumulative abnormal returns (CARs) are a biased predictor of buy-and-hold abnormal returns (BHARs). Moreover, CARs do not reflect investor experience. Thus, it appears that the assertion, "privatization IPOs (PIPOs) outperform the market,""is unwarranted.

This paper investigates the long-run returns to investors using a sample of 196 PIPOs from 39 countries during the 1981-1997 period. The long-run stock performances are estimated by CAR technique and BHAR technique. Tests are based on conventional t statistics as well as outlier detection technique suggested by Belsley, Kuh, and Welsch (1980) and bootstrap methods and skewness-adjusted t-statistics recommended by Lyon et al. (1999).

The remainder of the paper is organized as follows. Section **II** summarizes the literatures on the financial performance of privatization. Section **III** addresses the statistical issues concerning estimation on long-run abnormal returns of event firms. Sample and methodology are described in section **IV**. Section **V** presents the findings on the long-run abnormal returns. Section **VI** concludes.

II. Operating and Financial Performance of Privatization

The U.K. based database Privatisation International summarizes that 40 governments have raised 37 trillion dollars through share offerings and direct sales over the period 1977-1997. It is believed that the impact of equity issuance by governments on liquidity and total capitalization of respective domestic and international stock markets has been profound. Megginson et al. (1994) report that privatization IPOs are almost always the largest equity offerings in the history of most domestic capital markets and usually cause a significant increase in the number of shareholders.

One of the empirical question rests on the long-run performance of privatized firms. Ritter (1991) reports that there is long-run under-performance phenomena in the U.S. IPO market. Voluminous follow-up studies confirm that the long-run underperformance of IPOs is a global phenomenon. In contrast, Megginson et al. (1999) document statistically significant positive long-run CARs for the sample of 158 PIPOs from 33 countries.

These results are consistent with the economic success of privatization, empirically supported by Galal et al. (1992), Megginson et al. (1994) and Dewenter and Malatesta (1999), among others. Megginson et al. (1994) document that privatized firms increase real sales, become more profitable, increase their capital investment spending, and improve their operating efficiencies. Other studies also report that there are significant improvements in firm output, efficiency and profitability following privatization. In contrast Jain and Kini (1994) show that

the post-issue operating performance of IPOs falls short of matching firms, while they outperformed the matching firms in the pre-issue period. Therefore it is natural for us to expect long-run out-performance of PIPOs unless the initial trading prices perfectly reflect a future increase in the performance of the firm.

III. Test of Long-run Returns

One of the most intensively discussed issues in financial economics in recent years has been the long-run return earned by investors who purchase the share of event firms. It appears that an analysis of long-run abnormal return is treacherous. Lyon et al. (1999) show in their random sample simulation that commonly used methods for long-run abnormal returns tend to yield misspecified test statistics. Barber and Lyon (1997) document that long-horizon returns are positively skewed and that this positive skewness in the distribution, from which observations are drawn, results in the sample distribution being negatively skewed. This leads to an inflated significance level for lower tailed tests and a loss of power for upper tailed tests. Moreover, Fama (1998) indicates that a spurious abnormal return of x percent per month eventually becomes statistically reliable in long-horizon abnormal returns, unless expected differences between the return on event firms and on benchmarks are close to zero. The statistical problems will be worsened if the abnormal returns are obtained by compounding (BHARs) rather than summing (CARs).

However, CARs are also subject to other problems. Barber and Lyon (1997) argue that CARs are a biased predictor of BHARs. They show that empirical rejection levels of CARs fall short of theoretical level in their random sample, while those of BHARs do not. Moreover, it is believed that CARs may not reflect investor experiences. For example, a mean annual BHAR of 10 percent can be interpreted as the additional return of 10 percent earned from investing in a sample relative to a benchmark portfolio, while one year CAR of 10 percent might not be translated into a measure of annual return.

Thus, Barber and Lyon (1997) advocate the use of BHARs over CARs in detecting long-run abnormal stock returns. In the follow up study, Lyon et al. (1999) recommend the use of bootstrapped skewness adjusted t-statistics, to control the skewness bias when long-horizon returns are calculated using the BHAR method (pp. 174-175). Their method is based on the normal approximation technique. Efron (1979) suggests that standard deviation of the bootstrap sampling distribution can be used to estimate the standard deviation of the hypothesis sampling distribution. He assumes that the shape of the hypothesis sampling distribution is normal and the bootstrap sampling distribution is only used to estimate the variance of the normal

distribution. The hypothesis test takes the following form:

$$\text{Reject if } \Phi(\xi \geq \xi 0) \leq \alpha \qquad (1)$$

$$\text{where } \xi = \frac{t - \tau}{stddev(t_b[x])}$$

Note that the denominator of equation (1) is a bootstrapped version of the estimator, in lieu of stddev(t[x]) used in the conventional t test. Adding the skewness adjustment factor to equation (1) is reduced to the test statistic recommended by Lyon et al. (1999). Specifically, their bootstrapped skewness-adjusted t-statistic is calculated as follows:

$$t_{sa} = \sqrt{n}\left[S + \frac{1}{3}\hat{\gamma}S^2 + \frac{1}{6n}\hat{\gamma}\right] \qquad (2)$$

where,

$$S = \frac{\overline{AR}}{\sigma(AR_\tau)}, \quad \text{and} \quad \hat{\gamma} = \frac{\sum_{i=1}^{n}(AR_{i\tau} - \overline{AR_\tau})}{n\sigma(AR_\tau)^3}$$

Note that $\hat{\gamma}$ is an estimate of the coefficient of skewness and $\sqrt{n}S$ is the conventional t-statistic. The skewness adjustment procedure is supposed to cure the statistical problems arising from the asymmetry of the sample distribution.

In sum, there is no conclusion on the estimation technique of estimating the level of long-run stock returns. Therefore, the problems arising from the estimation techniques should be decided by the real data.

Ⅳ. Data and Methodology

1. Data and Descriptive Statistics

The sample includes 196 candidate PIPOs from 39 countries that took place between 1977 and 1997. The main sources of data are the privatization database, Privatization International and Jones et al. (1999). For those transactions representing IPOs, stock market data are collected from Datastream International.

The final sample of PIPOs, described in table 1, consists of 196 initial equity issues, which collectively raised 189 billion dollars for 39 countries. Interestingly enough, table 1 shows that frequency of PIPOs and mean of stake sold are closely related to the income level (GNP per capita) of the country. The World Bank classifies 49 countries as low-income, 60 countries as middle-income and 24 countries as high-income economies. Table 1 shows that

only 4 low-income countries have conducted 13 PIPOs worth 5 billion dollars while 17 countries in high-income economy have conducted 108 PIPOs worth 160 billion dollars. Mean stake sold at initial offer equals 30.5 percent for low-income, 36.1 percent for middle-income, and 57.6 percent for high-income economies.

Table 1 Sample Description

Country	Sample Period	Sample Size	Stake Sold (%)	Mean proceeds in Million of Dollar	Total Proceeds in Million of Dollar
Egypt	1994-96	5	34.8	25	124
India	1991-97	3	30.5	517	1,034
Indonesia	1994-96	3	26.3	1,017	3,050
Kenya	1994-96	2	35.5	29	58
Low income	1991-97	13	30.5	402	5,222
Argentina	1991-94	5	26.1	958	4,7895
Greece	1996	2	7.6	216	431
Hungary	1992-96	9	32.3	61.9	557
Korea, R.	1988-94	3	22.5	1,921	5,764
Malaysia	1985-95	11	29.1	383	4,208
Morocco	1993-96	4	32.3	69	278
the Philippines	1991-94	3	13.3	195	584
Poland	1991-97	22	51.7	33	689
Portugal	1990-97	5	29.9	791	3,955
Thailand	1989-97	6	31.3	107	643
Middle income	1985-97	73	36.1	329	23,991
Australia	1991-97	8	69.5	1,735	1,920
Austria	1987-95	10	37.8	184	1,843
Canada	1988-96	8	68.0	490	3,917
Finland	1994-95	2	22.7	235	469
France	1986-97	9	65.7	2,978	26,805
Germany	1988-96	4	36.4	3,729	14,915
Japan	1986-96	4	45.6	7,552	30,209
Israel	1992-93	3	28.4	140	420
Italy	1994-97	5	39.0	1,793	8,965
the Netherlands	1989-94	2	32.2	2,244	4,487
New Zealand	1991-92	3	355.8	312	936
Norway	1990-95	3	54.8	198	595
Singapore	1990-94	7	29.8	361	2,524
Spain	1987-97	5	46.7	517	2,585
Sweden	1993-95	3	42.2	666	1,999
Taiwan	1991-96	4	13.1	100	399
U.K.	1981-97	26	89.2	1,493	38,813
High income	1981-97	108	57.6	1,480	159,799
Other countriesa	1989-1996	7	43.87	1,200	8.399
Full Sample	1981-97	196	47.6	974	189,012

a Belgium (1996), Denmark, Greece (1996), Pakistan (1994), South Africa (1989), Turkey (1988), U.S (1989), and Venezuela (1996),

2. Methodology

I estimate privatization returns one-year to five-year holding periods following the offer. The long-horizon returns, are based on monthly returns. They are calculated using the closing price of the first trading date. I adjust the stock return by subtracting the contemporaneous return on a domestic market index from the return on each privatized firm. Specifically, long-horizon buy-and-hold abnormal returns are calculated as follows:

$$BHAR_{it} = \prod_{t=0}^{\tau}(1+R_{it}) - \prod_{t=0}^{\tau}(1+R_{MCt}) \qquad (3)$$

where, BHAR is buy-and-hold abnormal return,; t is the number of months from the first trading day; τ is the period of investment in months (τ = 12, 24, 36, 48, 60); Rit is the return on security i in month t, and RMCt is the market return of the country in month t.

Cumulative abnormal returns are calculated as follows:

$$CAR_{i\tau} = \sum_{t=1}^{\tau} R_{it} - \sum_{t=1}^{\tau} R_{MCt} \qquad (4)$$

I select the most comprehensive, value-weighted market indices of the sample countries with as many listed firms as possible in the respective country, to catch the general movement of the market. Details on the market indices are available from the author.

V. Results

This section presents the long-horizon return results for our samples of PIPOs. Table 2 reports summary statistics on the long-horizon CARs and BHARs for the 196 PIPOs in the sample. Results in table 2 reject the null hypothesis of no difference between holding period returns of PIPOs and market returns of their home countries. Results indicate that abnormal returns measured both by CARs and BHARs are significantly and consistently positive over each holding period. Over five years, PIPO firms have outperformed their respective markets by 31.54 percent in the CAR technique and by 59.14 percent in the BHAR technique.

The results in panel 1 indicate that the estimated CARs tend to follow normal distribution. The estimates of skewness and kurtosis show that the underlying distribution is normal, although mean returns tend to be greater than the median return. In contrast, the results in panel 2 indicate the underlying distribution of BHARs are not normal. The median returns are much smaller than mean returns, but nevertheless positive over each holding period.

Table 2 Summary Statistics: Long-run Abnormal Stock Returns

Holding period	One year	Two year	Three Year	Four year	Five year
(Panel 1) Cumulative abnormal return:					
Mean	0.1456	0.2019	0.2227	0.2945	0.3154
Median	0.1112	0.1689	0.2100	0.2936	0.2890
Skewness	0.245	0.137	-0.218	-0.706	-0.299
Kurtosis	0.616	0.323	0.593	3.163	1.682
t	5.615a	5.735a	5.281a	5.796a	5.419a
(Panel 2) Buy-and-hold abnormal return:					
Mean	0.1716	0.4139	0.4734	0.6846	0.5914
Median	0.1094	0.1580	0.1319	0.958	0.1700
Skewness	0.650	8.985	3.037	5.377	5.910
Kurtosis	3.376	110.950	18.134	46.672	65.040
t	5.055a	2.618a	3.789a	3.349a	1.888c
[p-value, conventional]	0.000	0.010	0.000	0.001	0.061
[p-value, bootstrapped]	0.000	0.000	0.000	0.000	0.031
skewness-adjusted t	5.109a	3.361a	4.321a	3.845a	6.720a
[p-value, bootstrapped]	0.000	0.000	0.000	0.000	0.000
N	196	195	188	183	172

* The superscript a and c indicate significant at 1%, and 10% level, respectively.

Skewness estimates of holding-periods seem to be at an acceptable level while kurtosis estimates indicate significant departure from normal distribution. Results of normal probability plot (do not reported) also indicate that the sample distribution is not normal. The descriptive statistics reported in table 2 clearly show that the sample distribution of BHARs do not follow normal but asymmetric, heavy-tailed distribution.

Therefore I draw 1,000 bootstrapped resamples from the original sample of size nb = n/4 for each holding period, as Lyon et al. (1999) recommend, and calculate bootstrapped significance level for the conventional t-statistic. Bootstrapped results lend support for the assertions of Fama (1998) and Lyon et al. (1999) that conventional t test leads to an deflated significance level for the upper tailed tests. Test results based on the bootstrapped skewness-adjusted t-statistics, suggested by Lyon et al. (1999) confirm our conclusions of significant difference between privatization and market returns.

In sum, all of the methods: conventional t test, bootstrapped t test, and bootstrapped skewness-adjusted t test show that privatization shares do outperform the market. However, the estimates of skewness and kurtosis reported in panel 2 of table 2 indicate that the estimates do not properly describe the true value of returns to investors. Adjustment for the skewness may not be sufficient to cure the heavy-tailed problems of BHAR. Thus I employ outlier detection

technique to eliminate the contamination for the sample distribution.

Atypical observations may have somewhat large influence on the parameter estimation and inferences. Outliers can be defined as having different characteristics from underlying distribution. The samples with some outliers cannot explain the underlying distribution exactly at the statistical point of view. Outliers would exaggerate the estimated levels of skewness or kurtosis. The usual confidence interval cannot assure the significance level. Thus, a test or inference made without eliminating outlier effect tends to draw some false conclusions.

Two-year return vividly illustrates the influence of outliers on the test. Skewness and kurtosis of two-year return is estimated as 8.895 and 110.95, respectively. This indicates that the sample distribution is severely skewed and surprisingly heavy-tailed. The t statistic seems to be underestimated by some outliers. To decide the influence of outlier on our estimation, I adopt Belsley, Kuh, and Welsh (1980)'s R-student statistic. Any observation whose R-student value is greater than 4 is considered as an outlier, and is deleted from the data set. Specifically, I delete 6 observations from one-year return, 5 observations from the two-year BHAR, 5 observations from the three-year BHAR, 4 observations from the four BHAR, and 4 observations from the five-year BHAR sample. The results in table 3 indicate that the skewness (kurtosis) of two-year BHAR are decreased to 0.991 (2.137) from 8.985 (110.95) if we delete the outliers. Then we can say the distribution is symmetric, and thus a confidence interval of the estimate can be minimized to draw an informative conclusion. These results clearly show that long-horizon anomaly might be more sensitive to outliers than to methodology of estimating the long-horizon return.

Table 3 Summary Statistics for BHARs from the outlier detected sample

Holding period	One year	Two year	Three Year	Four year	Five year
Mean	0.1429	0.2411	0.3026	0.3967	0.4376
Median	0.0900	0.1436	0.1008	0.1455	0.1679
Skewness	0.619	0.991	0.628	0.887	0.768
Kurtosis	0.919	2.137	1.100	1.812	1.814
t	5.103a	4.353a	4.031a	4.489a	3.787c
N	190	190	184	179	168
Number of outlier	6	5	5	4	4

* The superscript a indicates significant at 1% level.

VI. Conclusion

There has been a general tendency that privatization IPO outperforms its domestic capital market, over a five-year holding period. These findings are in sharp contrast with those of

Ritter (1991) and others who report that there is long-run under-performance in the IPO market. However, these are consistent with recent empirical findings. Brav and Gompers (1997) indicate that private firms with small offers underperformance in the long-horizon while those with large offers do not.

Next, there are substantial differences in the long-run performance of privatization IPOs depending on the return estimation techniques. The empirical distribution of BHAR are substantially different from normal distribution while CAR offers relatively stable test results. I find that the inference based on a skewness-adjusted t statistics, which is recommended by Lyon et al. (1999) may also yield misspecified test statistics. It appears that the substantial departure from normal distribution can be attributed to the influence of outliers. Atypical observations seems to have somewhat large influence on the parameter estimation and inferences. An inference made without eliminating outlier tends to draw some false inference. The quality of estimation tends to be improved by simply eliminating the outliers from the sample, especially for the BHAR technique, since the procedure serves to solve the heavy tail problems which have serious contaminations in estimations and tests. This leads to improve the power of the test and robustness of the estimates.

REFERENCES

[1] Barber, B. M. and J. D. Lyon (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics*, 43, 341-372.

[2] Brav, A. and Gompers, P. A. (1997). Myth or reality? The long-run underperformance of initial public offerings: Evidence from venture and non-venture capital-backed companies. *Journal of Finance* 52, 1791-1821.

[3] Belsley, D. A., Kuh, E., and Welsch, R. E. (1980). *Regression Diagnostics*, Wiley & Sons, New York.

[4] Dewenter, K. and Malatesta, P. H. (1999). *State-owned and privately-owned firms: An empirical analysis of profitability, leverage, and labour intensity*. Working paper. University of Washington.

[5] Efron, B. (1979). Bootstrap methods: another look at the jackknife. *The Annals of Statistics*, 7, 1-26.

[6] Fama, E. (1998). Market efficiency, long-term returns and behavioral finance. *Journal of Financial Economics*, 49, 1579-1593.

[7] Galal, A., L. Jones, Tandon, P., and Vogelsang, I. (1992). *Welfare Consequences of Selling Public Enterprises*. Washington, D. C.: The World Bank.

[8] Jain, B. A. and Kini, O. (1994). The post-issue operating performance of IPO firms. *Journal of*

Finance, 49, 1699-1726.

[9] Jones, S. L., Megginson, W. L., Nash, R. C., and Netter, J. M. (1999). Share issue privatizations as financial means to political and economic ends. *Journal of Financial Economics*, 53, 217-253.

[10] Lyon, J. D., Barber, B. M., and Tsai, C.-L. (1999). Improved methods for tests of long-run abnormal stock returns. *Journal of Finance*, 54, 165-201.

[11] Megginson, W. L., Nash, R. C., and van Randenborgh, M. (1994). The financial and operating performance of newly privatized firms: An international empirical analysis. *Journal of Finance*, 49, 403-452.

[12] Megginson, W. L., Nash, R. C., Netter, J. M., and Schwartz, A. L. (1999). *The long-run return to investors in share issue privatizations*. working paper. University of Oklahoma and University of Miami.

[13] Ritter, J. R. (1991). The long-run performance of initial public offerings. *Journal of Finance*, 46, 3-27.

[14] World Bank, World Development Report, Various issues.