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Assessing the Impact of Risk Mismeasurement and Economic Cycle on the Seasonal-Size Anomaly in Hong Kong

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Abstract

This study investigates the seasonal-size effect in an emerging market by examining two alternative hypotheses over the period 1995 to the pre-2007 global financial crisis. Empirical results show some evidence. Small firms experience abnormally higher returns than large firms in non-January months, and the size effect in non-January months could be attributed to the consideration of risk compensation for small firms with high risk, especially when the market or firm performance is worse. Once the stock returns are adjusted appropriately for risk, the seasonal-size anomaly disappears, which tends to support the risk mismeasurement hypothesis rather than economic cycle hypothesis.

Keywords

Seasonl-Size Anomaly, The Risk-Mismeasurement Hypothesis, The Economic Cycle Hypothesis, Fama-MacBeth Regression

1. Introduction

Banz [1] indicated that small NYSE firms have significantly higher average returns than large NYSE firms, even after adjusting for returns on betas. Keim [2] and Reinganum [3] further showed that almost half of the magnitude of the small firm anomaly occurs in January, implying an anomaly within an anomaly. Although empirical studies asserted that the U.S. size effect has disappeared since the early 1980s [4]-[8], Van Dijk [9] and De Moor and Sercu [10] argued that it is premature to conclude that the size effect has gone away. Van Dijk [9] showed the substantial evidence on the U.S. equity size premium in recent years and argued that the international evidence is inconclusive, suggesting that the further empirical and theoretical research is needed to investigate

this anomaly. Thus, the small firm anomaly has been investigated not only in developed economy stock markets, but also in the Asian-Pacific emerging markets.

In the Asian-Pacific emerging markets, the Hong Kong market is relatively important, because its economy has grown dramatically from its position as an emerging market in the 1970s and 1980s, and its stock market ranks the second largest after Japan in terms of market capitalization. Researchers have also shown tremendous interest in exploring issues related to the size effect in this market, even though their findings are mixed [11]-[14]. Moreover, limited alternative explanations with regard to the causes of the seasonal-size effect in the literature were offered and examined in the literature, except for the tax-loss selling, risk mismeasurement, economic cycle, and culture bonus hypotheses.

Due to the inconclusive empirical results on the seasonal-size anomaly for Hong Kong, and the fact that little of these studies explore why the seasonal-size pattern may exist in this market, the Hong Kong stock market is still a good place to look for anomalies, and learn why they exist. Because the capital gains from security trading are not taxed in Hong Kong, the tax-loss selling hypothesis is unlikely to be associated with the seasonal-size effect in this market, and thus it does not need to be examined. On the other hand, the culture bonus hypothesis drawn from behavioral biases with regard to mental accounting and house money could also not explain the seasonal-size effect for Hong Kong since this market is composed of mainly institutional investors with fewer behavioral biases. The purpose of this paper is thus to explore the seasonal-size anomaly in the Hong Kong stock market using an out-of-sample period starting 1995 to the pre-2007 global financial crisis, along with examining two alternative hypotheses offered in previous research, namely, the risk mismeasurement hypothesis and the economic cycle hypothesis. This would also be useful to examine the external validity of the results of Chui and Wei [11], Lam [12], and Shum and Tang [13]. The major contribution of this study is to compare alternative hypotheses, and fill the gap in the literature with regard to why the seasonal-size anomaly exists for Hong Kong.

A review of the extant literature is provided in Section 2. Section 3 describes the data and methodology. Section 4 presents the empirical results and analyses, and the final section concludes this paper.

2. Literature Review

2.1. Evidence on the Seasonal-Size Effect in Hong Kong

For the existence of the size effect in Hong Kong, Ho *et al*. [15], Drew and Veeraraghavan [16], Ho *et al*. [17], and Chen and Fang [18] showed the small firm anomaly, but Lam and Spyrou [19] found the large firm effect. After taking into accounting the seasonality, Chui and Wei [11] found that the small firm anomaly existed significantly in non-January months, while the large firm anomaly is marginally significant at the ten percent level in January for Hong Kong for the period of 1984 to 1993. However, they focused on the existence of this market anomaly, but yet not empirically investigate why it occurs. Moreover, Lam [12] showed the large firm effect in January and non-January months, while Shum and Tang [13] indicated that the size effect is both insignificant in January and non-January months.

2.2. Explanations for the Seasonal-Size Effect

The tax-loss selling hypothesis is first frequently been advanced to explain the size effect. The tax-loss selling hypothesis suggests that individual investors tend to take advantage of tax benefits, and thus sell their losing stocks before the year ends, especially the stocks of smaller firms that institutions tend to avoid. The selling pressure in late December is then followed by buying pressure in January [20]. However, a series of international evidence that challenge this hypothesis has shown that the tax-loss selling hypothesis cannot completely explain the seasonal-size effect [3] [21]-[23].

The second explanation offered for the seasonal-size effect is the risk mismeasurement hypothesis that the size effect in January may be associated to the increased risk for small firms in January [24]. There exists some argument over whether the risk mismeasurement hypothesis can explain the seasonal-size effect. Carroll and Wei [25] suggest that there exist no linear relationship between return and risk even when firm size is taken into account. Rathinasamy and Mantripragada [26] found that the risk-adjusted returns are still higher for small firms in January by using Treynor and Sharpe risk measure.

Krueger and Johnson [27] proposed the economic cycle hypothesis for the seasonal-size effect. This hypothesis suggests that small firms usually outperform large firms in the expansion phase of the economic cycle, but

tend to underperform large firms in the contraction phase because of their higher financial leverage and lower productivity. However, this hypothesis also cannot completely explain the international evidence for the seasonal-size anomaly [28] [29].

The recent explanation for seasonal-size effect is the culture bonus hypothesis proposed by Chen and Chien [30], which suggests that the culture bonuses before Lunar New Year will enhance the propensity to bear risk for individual investors. Individual investors will become less risk averse and prefer small-cap stocks with higher risk, which in turn stimulate the seasonal-size effect.

3. Data and Methodology

This study uses a sample period of the pre-2007 global financial crisis, which ranges from January 1995 to December 2006, for the Hong Kong stock market. This sample period is different from the ten-year period of 1984 to 1993 in Chui and Wei [11], and thus is useful to examine the external validity of that paper for a small firm anomaly in non-January months. The monthly returns data are obtained to avoid the bias inherent in a daily rebalancing strategy from the TEJ database [31]-[33]. All listed and delisted firms are included to avoid the potential survivorship bias.

The Fama and MacBeth [33] cross-sectional regression is employed to explore the size effect under different conditions, such as whether the market is in January or in a bullish phase[1]. The first step is to perform the following cross-sectional regression model [30].

$$\left(R_{it} - R_{mt}\right) = \alpha_0 + \alpha_1 * Size_{it} + \varepsilon_t \tag{1}$$

where R_{it} is the monthly return of firm i at month t, and R_{mt} is the value-weighted market return at month t. $R_{it} - R_{mt}$ represents the excess returns. Size is defined as the logarithm of the ith firm's market value at the end of the preceding year. The next step is to calculate the time series means of the monthly regression slopes, and then provide standard tests of whether the size effect in January or non-January months exists. On the other hand, this paper uses the Sharpe ratio as the dependent variable to examine the risk mismeasurement hypothesis [26][2]. The Sharpe ratio of each firm is defined as the raw stock return minus the risk-free return and divided by the standard deviation of daily stock returns for a given month.

4. Empirical Results and Analyses

4.1. The Fama-MacBeth Cross-Sectional Regression

Table 1 reports the time series means of the slopes from the month-by-month Fama-MacBeth cross-sectional regressions of the excess returns on firm size. It presents that there exists a significant small firm anomaly in Hong Kong stock market, especially in non-January months. This result is basically consistent with that of Chui and Wei [11]. Nevertheless, earlier studies for Hong Kong did not present any evidence to explain why the seasonal-size anomaly exists. This study further investigates two alternative hypotheses proposed in prior research to explore whether they can explain the seasonal-size anomaly in the Hong Kong stock market. The tax-loss selling hypothesis does not be examined because there is no capital gains tax on security trading in Hong Kong. This study thus empirically examines the risk mismeasurement and the economic cycle hypotheses.

Table 2 shows the analyses of testing the risk mismeasurement hypothesis. If the hypothesis can explain the seasonal-size anomaly, the size effect in non-January months should become insignificant when the stock returns are adjusted for individual risk. This study uses the risk-adjusted return by the criteria of the Sharpe ratio as prior literature [26] [30], and shows that the coefficients of the firm-size variable are insignificant in both January and non-January months, which are different from the findings in Table 1 without controlling for any risk. Evidently, the small firm anomaly in non-January months for Hong Kong could be associated with the risk factor. After the appropriate risk-adjustment, such as the volatility defined as the standard deviation of daily stock returns, the seasonal-size anomaly disappears in Hong Kong.

On the other hand, Table 3 indicates the results of testing the economic cycle hypothesis. The bullish/bearish market is generally defined as the return is higher/lower than the preceding month in the literature [28] [30]. If the seasonal-size anomaly in Hong Kong is in support of the economic cycle, it should be apparent only in a

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[1]The Fama and MacBeth [34] cross-sectional regressions of stock returns on factor loadings were often used in prior literature [30] [35] [36].
[2]Chen *et al*. [37] suggested that an asset with higher Sharpe ratio is more attractive because of implying making more efficient use of the risks being taken.

Table 1. The regression analyses of testing the small firm anomaly. This table presents the results of the Fama-MacBeth cross-sectional regression of excess monthly returns on firm size. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The t-statistic is the average coefficient divided by its time-series standard error. N denotes the number of firm-month observations.

Parameters	Parameter estimate	N	R^2 $(Adj\ R^2)$
Panel A: January-December			
Intercept	4.1456[*]	98,436	0.0161
Size	−0.2770[*]		(0.0145)
Panel B: January			
Intercept	9.9340	8203	0.0269
Size	−0.6012		(0.0253)
Panel C: Non-January			
Intercept	3.6194	90,233	0.0151
Size	−0.2475[*]		(0.0135)

Note: [**] and [*] denote 1% and 5% significance level, respectively.

Table 2. The regression analyses of testing the risk mismeasurement hypothesis. This table presents the results of the Fama-MacBeth cross-sectional regression of the Sharpe ratio on firm size. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The t-statistic is the average coefficient divided by its time-series standard error. N denotes the number of firm-month observations.

Parameters	January			Non-January		
	Parameter estimate	N	R^2 $(Adj\ R^2)$	Parameter estimate	N	R^2 $(Adj\ R^2)$
Intercept	−3.2763	8110	0.0379	−2.4487[**]	89,238	0.0209
Size	0.1061		(0.0363)	0.0357		(0.0193)

Note: [**] and [*] denote 1% and 5% significance level, respectively.

Table 3. The regression analyses of testing the economic cycle hypothesis. This table presents the summary of the economic condition effect on the firm size anomaly in Hong Kong from the Fama-MacBeth cross-sectional regression. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The t-statistic is the average coefficient divided by its time-series standard error. N denotes the number of firm-month observations.

Parameters	January			Non-January		
	Parameter estimate	N	R^2 $(Adj\ R^2)$	Parameter estimate	N	R^2 $(Adj\ R^2)$
Panel A: A market is defined as bullish in the month if the index return was higher than the return of the preceding month						
Intercept	−1.1753	3169	0.0107	−3.5574	43,960	0.0136
Size	0.3181		(0.0093)	0.1386		(0.0120)
Panel B: A market is defined as bearish in the month if the index return was lower than the return of the preceding month						
Intercept	15.4886	5034	0.0350	10.5819[**]	46,273	0.0166
Size	−1.0609		(0.0334)	−0.6222[**]		(0.0150)

Note: [**] and [*] denote 1% and 5% significance level, respectively.

bullish rather than bearish market. Panel A shows that the coefficients on firm size are positive and insignificant in January and non-January months under the bullish market. However, Panel B shows that the coefficient of firm size is negative when the market is bearish, especially is significant at a 5% level in non-January months. This thus shows that the small firm anomaly in non-January months for Hong Kong should be not due to the expansion or bullish phase of the economic cycle. Specifically, this finding that the small firms tend to have higher stock performance only in a bearish market is more likely to imply the high risk-compensation for small firms that generally have higher risk than larger ones, especially when economic conditions are bad.

To explore whether the apparent seasonal-size anomaly in a bearish market is related to the risk factor, this study divides data into five sub-samples based on the stock risk defined as the standard deviation of daily stock

returns in the preceding year and reports the analyses for the five volatility portfolios in **Table 4**. The empirical results show that all coefficients of firm size are insignificantly negative in January, no matter what the economic conditions are. On the other hand, the estimated coefficients of firm size are all significantly negative in non-January months under a bearish market, and tend to be more negative and significant for firms with higher risk. In addition, when the market is bullish, the small firm anomaly in non-January months exists only in the highest risk portfolio. These results suggest that the small firm effect in non-January months for Hong Kong tends to be associated with the risk factor, consistent with the risk mismeasurement hypothesis.

Table 4. The regression analyses of testing the seasonal-size anomaly for the five volatility portfolios under different economic cycle phases. This table presents the summary of the economic condition effect on the firm size anomaly in Hong Kong from the Fama-MacBeth cross-sectional regression for five different risk portfolios. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The t-statistic is the average coefficient divided by its time-series standard error. N denotes the number of firm-month observations.

Parameters	January			Non-January		
	Parameter estimate	N	R^2 $(Adj\ R^2)$	Parameter estimate	N	R^2 $(Adj\ R^2)$
Panel A: A market is defined as bullish in the month if the index return was higher than the return of the preceding month						
Panel A1: The firms with the lowest volatility (RISK1)						
Intercept	−9.5985	644	0.0424	−9.0890**	8756	0.0283
Size	0.6629		(0.0357)	0.4591**		(0.0201)
Panel A2: The firms with RISK2						
Intercept	−9.5710	661	0.0195	−7.0915*	9011	0.0228
Size	0.9590		(0.0127)	0.3622		(0.0149)
Panel A3: The firms with RISK3						
Intercept	−19.5927	642	0.0323	−4.1338	8957	0.0238
Size	1.7932*		(0.0255)	0.2101		(0.0159)
Panel A4: The firms with RISK4						
Intercept	−12.1543	632	0.0090	−2.3566	8847	0.0178
Size	1.3587		(0.0020)	0.0558		(0.0099)
Panel A5: The firms with the highest volatility (RISK5)						
Intercept	11.0479	590	0.0092	6.1181	8389	0.0111
Size	−0.6765		(0.0017)	−0.5996*		(0.0028)
Panel B: A market is defined as bearish in the month if the index return was lower than the return of the preceding month						
Panel B1: The firms with the lowest volatility (RISK1)						
Intercept	12.7491	990	0.0346	7.8110**	9218	0.0239
Size	−0.7817		(0.0261)	−0.3438**		(0.0160)
Panel B2: The firms with RISK2						
Intercept	20.2523	1019	0.0534	10.3001**	9469	0.0293
Size	−1.2925		(0.0453)	−0.5657**		(0.0217)
Panel B3: The firms with RISK3						
Intercept	15.9281	1027	0.0321	13.2938**	9402	0.0275
Size	−1.1049		(0.0239)	−0.8656**		(0.0198)
Panel B4: The firms with RISK4						
Intercept	28.8828	1018	0.0401	13.1765**	9303	0.0213
Size	−2.1690		(0.0320)	−0.8661**		(0.0136)
Panel B5: The firms with the highest volatility (RISK5)						
Intercept	25.0918	980	0.0369	20.8609**	8881	0.0191
Size	−1.9707		(0.0285)	−1.4832**		(0.0111)

Note: ** and * denote 1% and 5% significance level, respectively.

4.2. Robustness Checks

A number of sensitivity tests confirm the robustness of the findings. First, this study employs different definitions of the bullish/bearish market, such as whether the index return was higher than the median return of the sample period or the same year, and whether the index return was positive. The results shown in **Table 5** are consistent with those in **Table 3**. Second, this study verifies the findings of the risk compensation explanation from the market growth based on the accounting performance index, namely earnings before tax. This study divides the sample into two sub-periods in which the sum of the earnings before tax per employee of all firms in the preceding year was higher and lower than the year before last, respectively. If the risk is an important factor for the seasonal-size anomaly in Hong Kong, the small firm anomaly in non-January months due to risk compensation should be apparent only for the sub-period in which the whole market has bad accounting performance, which is defined as the total earnings before tax of all firms has negative growth in the preceding year. **Table 6** indicates that the main result of this study holds consistently. Third, although the seasonal-size anomaly in the literature is a market phenomenon, this study switches the perspective from a macro view to a micro one, and thus explores whether the size effect in non-January months for Hong Kong is different between the firms with positive and negative growth. Generally, the negative growth firms are less attractive and more likely to require higher risk compensation to investors, and thus the size effect in non-January months should be more apparent for the sub-sample without positive earnings amount and growth in the preceding year. The findings in **Table 7** are qualitatively similar. Fourth, this study recalculates the t-statistics from the Newey-West [38] standard errors correction for heteroskedasticity and series correlation. Fifth, this study uses the sum of the log of daily returns to yield the log of monthly returns instead of using monthly return data. Finally, this study sets the top and bottom one percent of observations for returns at the 1st and 99th percentiles to reduce the influence of extreme outliers. The empirical results still tend to be consistent.

Table 5. The regression analyses of testing the economic cycle hypothesis based on different definitions of the bullish/bearish market for robustness. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The *t*-statistic is the average coefficient divided by its time-series standard error. *N* denotes the number of firm-month observations.

Parameters	January			Non-January		
	Parameter estimate	*N*	R^2 (*Adj R^2*)	Parameter estimate	*N*	R^2 (*Adj R^2*)
Panel A1: A market is defined as bullish in the month if the index return was higher than the median return of the sample period						
Intercept	−5.6075	3011	0.0150	−1.3072	52,744	0.0139
Size	0.4712		(0.0136)	0.0317		(0.0123)
Panel A2: A market is defined as bearish in the month if the index return was lower than the median return of the sample month						
Intercept	17.7047	5192	0.0328	10.1017**	37,489	0.0167
Size	−1.1374		(0.0312)	−0.6150**		(0.0151)
Panel B1: A market is defined as bullish in the month if the index return was higher than the median return in the same year						
Intercept	−5.6075	3011	0.0150	−0.7111	50,764	0.0137
Size	0.4712		(0.0136)	−0.0036		(0.0121)
Panel B2: A market is defined as bearish in the month if the index return was lower than the median return in the same year						
Intercept	17.7047	5192	0.0328	9.1445**	39,469	0.0169
Size	−1.1374		(0.0312)	−0.5587**		(0.0153)
Panel C1: A market is defined as bullish in the month if the index return was positive						
Intercept	−5.6075	3011	0.0150	−0.7795	55,970	0.0132
Size	0.4712		(0.0136)	0.0028		(0.0116)
Panel C2: A market is defined as bearish in the month if the index return was negative						
Intercept	17.7047	5192	0.0328	10.6058**	34,263	0.0182
Size	−1.1374		(0.0312)	−0.6451**		(0.0166)

Note: ** and * denote 1% and 5% significance level, respectively.

Table 6. The regression analyses of testing the risk compensation explanation from the market growth based on earnings before tax in the preceding year for robustness. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The *t*-statistic is the average coefficient divided by its time-series standard error. *N* denotes the number of firm-month observations.

Parameters	January			Non-January		
	Parameter estimate	*N*	R^2 (*Adj* R^2)	Parameter estimate	*N*	R^2 (*Adj* R^2)
Panel A: The sub-period in which the sum of earnings before tax per employee of all firms in the preceding year was higher than the year before last						
Intercept	22.0810	3483	0.0489	−0.7737	38,313	0.0157
Size	−1.4613		(0.0474)	−0.0067		(0.0142)
Panel B: The sub-period in which the sum of earnings before tax per employee of all firms in the preceding year was lower than the year before last						
Intercept	1.1352	4720	0.0112	6.6507[*]	51,920	0.0147
Size	0.0191		(0.0096)	−0.4133[*]		(0.0131)

Note: [**] and [*] denote 1% and 5% significance level, respectively.

Table 7. The regression analyses of testing the risk compensation explanation from the firm growth based on earnings before tax in the preceding year for robustness. A coefficient in the regression is the average of the coefficients in the monthly cross sections. The *t*-statistic is the average coefficient divided by its time-series standard error. *N* denotes the number of firm-month observations.

Parameters	January			Non-January		
	Parameter estimate	*N*	R^2 (*Adj* R^2)	Parameter estimate	*N*	R^2 (*Adj* R^2)
Panel A: The sub-sample in which the amount and growth rate of earnings before tax were both positive in the preceding year						
Intercept	12.2442	2940	0.1055	2.5808	32,340	0.0584
Size	−0.7680		(0.0709)	−0.1572		(0.0038)
Panel B: The sub-sample in which the amount and growth rate of earnings before tax were not both positive in the preceding year						
Intercept	8.3725	3475	0.0511	4.9335	38,225	0.0451
Size	−0.4587		(0.0256)	−0.3948[*]		(0.0217)

Note: [**] and [*] denote 1% and 5% significance level, respectively.

5. Conclusions

This is a comprehensive study using Hong Kong stock market to explore the seasonal-size anomaly in this emerging international market along with a comparison of alternative hypotheses. This study utilizes the Fama-MacBeth regression method and finds several results. First, the Hong Kong stock market does not exhibit an apparent size effect in January, but exhibits a significant small firm anomaly in non-January months. This supports the finding reported earlier by Chui and Wei [11]. Notably, we further find that the small firm anomaly in non-January months is more apparent when the whole market is bearish or has bad accounting performance, and individual firm performance was negative in the previous year.

The findings suggest that a relationship exists between the seasonal-size anomaly and the risk compensation explanation. Once the stock returns are adjusted appropriately for individual risk by using the Sharpe ratio, the seasonal-size anomaly disappears, which tends to support the risk mismeasurement hypothesis. In addition, the seasonal-size effect in Hong Kong should be not attributed to the economic cycle hypothesis or the tax-loss selling hypothesis offered in prior literature, because that the small firms do not significantly outperform large firms in the bullish market and there are no capital gain tax or loss offsets in Hong Kong, respectively. The culture bonus hypothesis seems to be also not associated with the anomaly in Hong Kong with mainly institutional investors since they are less likely to have behavioral biases drawn from culture bonus, and the non-January size effect could not be due to the Lunar New Year bonuses. The findings give important economic implications of capital market behavior, and should be helpful in financial decision making.

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