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The January Effect and the Relationships between Stock Returns, Market Beta, Firm Size, and Book-to-Market

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ABSTRACT

Using Taiwan's equity data, we test whether stock return seasonality affects the explanatory powers of market beta, firm size, and book-to-market on the cross-section of stock returns. We find that market beta, firm size, and book-to-market equity ratio fail to explain cross-sectional stock returns for the all-months sample. Further, while stock returns are positively related to beta and negatively related to firm size in the January month, they are still unrelated to beta, size, and book-to-market in the non-January month. Overall, we find that the beta-risk premium and the negative size-return relation exist a January effect, whereas the value premium is nonexistent.

Keywords: *Market beta; Firm size; Market-to-book equity; The January effect*

JEL Classification: *G12, G14*

INTRODUCTION

The objective of this paper is twofold using a sample of firms listed in the Taiwan stock market. The first is to test whether market beta, firm size (ME), and market-to-book equity (B/M) have ability to explain the cross-section of stock returns. The second is to further test whether there is a January effect on the explanatory powers of market beta, size, and B/M on stock returns.

We perform the test in two steps. In the first, we conduct a sorting-based portfolio analysis by sorting firms into five portfolios based on betas, size, and B/M, and then track their subsequent monthly returns. The main results of the portfolio analysis are as follows. First, average returns are higher in the January month than in the remaining eleven months for the full sample, a January effect of stock returns. Second, average return spreads between high and low beta groups are insignificantly different from zero in the all-months sample, whereas they are significantly positive in the January month. Third, small firms have higher average returns than big ones in all months and the January month, but not in the non-January months. Finally, high-B/M firms outperform low-B/M ones in all months and the January month, but do not in the rest of the year.

In the second, we follow the approach of Fama and Macbeth (1973) to conduct a month-by-month, cross-sectional regression analysis, which allows us to compare the explanatory power of betas, size and B/M. The main results can be summarized as follows. First, while beta cannot explain average stock returns for the all-months sample, the positive beta-return tradeoff shows up in the January month; that is, there is a January effect on beta risk premium as shown by Tinic and West (1984). Second, while the size-return relation is negative but insignificant in all months, it is significantly negative in the January month.

The January effect of the size-return relation is consistent with Chen and Chien's (2011) conjecture, which predicts that under Chinese tradition, employees of companies are rewarded with a generous bonus at the Lunar year-end, frequently in January, and the employee bonus will make individual investors less risk averse in January to buy more high risky stocks, mostly small stocks. Finally, our results are robust to Kandel and Stambaugh (1995) and Shanken and Zhou (2007), who argue that the generalized

lease square estimator is often much more precise than the ordinary lease square estimator.

Taiwan's equity data is a good case to perform the test for two reasons. First, the investor sentiment effect is expected to be more prominent in the Taiwan stock market, a high-growth and high-turnover emerging stock market with high-proportion individual investors. Second, Chen and Zhang (1998) argue that Taiwan-listed firms are almost highgrowthin the early time period, and hence making distinguishing their relative risks difficult. Huang (2011) further provide evidence confirming Chen and Zhang's (1998) conjecture. Therefore, the size and B/M effects in stock returns should be observed for the all-month sample, if they represent mispricing as argued by Lakonishok et al. (1994) and Daniel and Titman (1997, 2006). Conversely, if the risk-based explanation suggested by Fama and French (1992, 1995) and Cohen et al. (2003) holds, there are no size and B/M effects in Taiwan.

The motivations of the paper are as follows. While Rozeff and Kinney (1976) show a January effect on stock returns, Tinic and West (1984) document a January seasonal in the beta-risk premium in U.S.[1]Corhay et al. (1987) address these two related puzzles and argue that any potential cause of return seasonality could also be a possible explanation of the beta risk-premium seasonality. That is, the beta risk-premium seasonality coincides with return seasonality. However, we know little about whether Corhay et al.'s (1987) conjecture is consistent with Taiwan's equity data. Davis (1994) also shows a January seasonal in the positive B/M-return relation for U.S. market, seeming to be consistent with Corhay et al.'s (1987) conjecture. Despite its important in asset pricing, whether there exists a January seasonal in the size-return and B/M-return relations for Asian emerging stock markets remains inconclusive.[2]

Our paper adds to the literature on the link between beta risk-premium seasonality and return seasonality. In particular, we contribute to the debate on whether or not beta is dead[3]and why and whether there exists size and B/M effect in stock returns (Lakonishok et al., 1994; Kothari et al., 1995; Loughran, 1997; Rouwenhorst, 1999)[4]. Our paper also enhances our knowledge about the explanatory power of beta,size, and B/M on the cross-sectional stock returns in Taiwan. Despite a large theoretical and empirical literature on the asset-pricing models, based mainly on the U.S. markets, there is limited empirical work in this area from Taiwan.[5]In particular, previous studies for the

[1]See Hawawani and Keim (1995) for a review of return seasonality, which is indeed a puzzle until now. The empirical studies on return seasonality include Rozeff and Kinney (1976), Brown, Keim, Kleidon, and Marsh (1983), Gultekin and Gultekin (1983), Keim (1983), Reinhanum (1983), Roll (1983), Berges, McConnell, and Schlarbaum (1984), Kato and Schallheim (1985), Schultz (1985), Reinganum and Shapiro (1987), Tinic, Barone-Adesi, and West (1987), Jones, Lee, and Apenbrink (1991), Lee (1992), Agrawal and Tandon (1994) and others.

[2]While Chui and Wei (1998) show less evidence that there exists a January seasonal in the B/M-return relation for five Pacific-Basin emerging stock markets, Ding et al. (2005) and Brown et al. (2008) argue that the value premium is sensitive to the sample selection, liquidity, and growth potentials.

[3]An incomplete literature is listed as follows. Prior to the publication of Fama and French (1992), there are some studies that may contradict the CAPM, such as Banz (1981), Reinganum (1981), Basu (1983), Hawawiniet al. (1983), Rosenberg et al. (1985) and others. However, most studies indeed support the market betas, such as Black, Jensen, and Scholes (1972), Fama and MacBath (1973), Hawawini and Michel (1982), Chan and Chen (1988) and others. The post-Fama and French (1992) CAPM evidence is mixed. The beta advocators include Chan and Lakonishok (1993),Chou and Liu (2000), Clare et al. (1998), Downs and Ingram (2000), Heston et al. (1999), Huang et al. (2003), Kim (1995), Kothari et al. (1995), Rouwenhorst (1999), Ang and Chen (2007), Shanken and Zhou (2007), Bali et al. (2009), Huang (2009), and Ray et al. (2009). Evidence against the beta includes Huang (1997), Asgharian and Hansson (2000), Chui and Wei (1998), Hu (1998), Liu et al. (1996), Sheu et al. (1998), Daniel et al. (2001),and others. See Frankfurter (1995) and Levy (2012) for a review.

[4] One view believes that the value premium represents compensation for risk, such as Fama and French (1992, 1993, 1995, 1996, 1998, 2006), Chen and Zhang (1998), and Huang (2011). A second argues that the value premium is due to mispricing, such as Lakonishok et al. (1994), Daniel and Titman (1997, 2006), Loughran (1997). A third is that the value premium is the result of data snooping, selection, or survivorship bias, such as Black (1993), Kothari et al. (1995) and others.

[5]In the Taiwan stock market, the advocators of betas include Chou and Liu (2000), Huang, Wang, Ho, and Hsu (2003), and Huang (2009), whereas Liu, Hwang,

Taiwan stock market do not examine whether there is a January effect on the relationships between returns, beta, size, and B/M. Therefore, our out-of-sample evidence from Taiwan seems unlikely to suffer from the data snooping biases (Lo and Mackinlay, 1990), and help shield some light on both the beta debate and the value debate initially arose in the U.S. market.

The rest of the paper is organized as follows. Section 2 describes the two-pass methodology. Section 3describes our data. Section 4 presents the empirical results. Section 5 concludes.

THE TWO-PASS TESTS OF CROSS-SECTION OF STOCK RETURNS

In the Fama and Macbeth (1973) second-pass cross-sectional regression (CSR), the relationship between excess returns and betas for estimating the market risk premiums at a specific time t is

$$R_t = \gamma_{0t} + \gamma_{1t}\beta_t + \varepsilon_t, \quad t=1,\ldots,T, \tag{1}$$

where R_t is a N-vector excess return over risk-free rates, β_t isa N-vector market beta for N stocks, ε_t is a N-vector idiosyncratic error with mean zero and variance (σ_ε^2). Hence, the ordinary least squares (OLS) CSR of R_t on β_t can be run for each month. By letting $X=[1_N,\beta]$ and $\gamma=[\gamma_0,\gamma_1]'$, the OLS estimate of γ at time t is

$$\hat{\gamma}_t^{OLS}=[\hat{\gamma}_{0t}^{OLS},\hat{\gamma}_{1t}^{OLS}]'=(X_t'X_t)^{-1}(X_t'R_t), \tag{2}$$

where 1_N denote the N-vector of ones. The statistic of testing whether the beta risk premium is indifferent from zero is

$$t^{OLS}=\frac{\bar{\hat{\gamma}}_1^{OLS}}{s(\hat{\gamma}_{1t}^{OLS})/\sqrt{T}}. \tag{3}$$

$\bar{\hat{\gamma}}_1^{OLS}$ and $s\left(\hat{\gamma}_{1t}^{OLS}\right)$are the sample mean and standard deviation of $\hat{\gamma}_{1t}^{OLS}$,respectively. As argued by Kandel and Stambaugh (1995) and Shanken and Zhou (2007), because the variance of individual stock return may be different, the generalized least squares (GLS) estimate of γ will be more efficient than the OLS estimate. Thus, the month-by-month CSR coefficient estimated from GLS at time t is

$$\hat{\gamma}_t^{GLS}=[\hat{\gamma}_{0t}^{GLS},\hat{\gamma}_{1t}^{GLS}]'=(X_t'\Omega_t^{-1}X_t)^{-1}(X_t'\Omega_t^{-1}R_t), \tag{4}$$

where Ω_t is the N×N variance matrix of all firms at time t. Assume that the error terms are serially independent and uncorrelated across stocks. Similarly, the test statistic of testing whether the market beta risk premium is indifferent from zero is

$$t^{GLS}=\frac{\bar{\hat{\gamma}}_1^{GLS}}{s(\hat{\gamma}_{1t}^{GLS})/\sqrt{T}}. \tag{5}$$

$\bar{\hat{\gamma}}_1^{GLS}$ and $s\left(\hat{\gamma}_{1t}^{GLS}\right)$ are the sample mean and standard deviation of $\hat{\gamma}_{1t}^{GLS}$.

DATA

This paper uses monthly data of firms listed on Taiwan Stock Exchange (TSE) and GreTai Securities Market (abbreviated GTSM in 1994) for the period from July 1982 to June 2002. The reasons we use the sample period are to compare our results with prior related literature in Taiwan, and to avoid the potential contaminations of financial crisis in recent years. For comparison, using this sample period allows us to provide more clear-up results. We have two data selection criteria as suggested by Fama and French (1992). First, all firms must have monthly stock returns for at least 24 months before entering the sample. Second, firms must have a non-negative book value at the end of December each year to compute their B/M. Book value of equity is defined as total shareholders' equity minus book value of preferred stock. Our final sample consists of 63 firms in the first month and 584 firms in the final month. There are totally 51,684 monthly returns observations in this study. We us a combined series of rediscount rates (before October 1984 and after July 1999) with the 91-day T-bills rate (October 1984-July 1999) as a proxy for risk-free rate. Excess stock returns are stock raw returns in excess of this risk-free rate. The sample contains all firms listed on the Taiwan stock market for the period from July 1982 to June 2002. The firm size (ME) used to form portfolios is the market value of equity as of the end of the second to last month. B/M is equal to book value of equity divided by the market value of equity as of December of year t-1. Panel A, B, and C show the results for portfolios formed on beta, ME, and B/M, respectively.

and Liu (1996), Chui and Wei (1998), Fang and Yau (1998), Sheu et al. (1998) show evidence that beta is unable to explain average stock returns. Interestingly, Hu (1998) show that the beta risk premiums are -8.35 (t-statistic=-2.524) and 0.792 (t-statistic=2.924) in the period of 1978-1985 and 1985-1994, respectively.

Table1. *Summary statistics*

	Panel A: Portfolios formed on β			Panel B: Portfolios formed on firm size (NT $ 10 million)			Panel C: Portfolios formed on B/M		
	β	**ME**	**B/M**	**β**	**ME**	**B/M**	**β**	**ME**	**B/M**
All	0.798	1895	0.754						
Low	0.214	1306	0.740	0.756	189	0.967	0.904	4519	0.299
2	0.549	1524	0.743	0.776	389	0.856	0.794	1759	0.499
3	0.767	1337	0.750	0.804	664	0.768	0.756	1258	0.669
4	1.004	1856	0.794	0.794	1229	0.682	0.736	1057	0.882
High	1.454	3449	0.744	0.859	6996	0.499	0.800	888	1.421

The explanatory variables are constructed as follows. Fama and French (1992) use the market value of equity of the firm in June of year t to explain the monthly returns from July of year t to June of year t+1. However, as argued by Huang (2009), the firm size in June of year t is expected to containless valuable information about monthly returns subsequent to August of year t. Thus, we use the lagged 2-month size to explain current monthly returns. This also can preclude the possibility of bias estimation because of bid-ask effects and thin trading. B/M is equal to book value of equity divided by the market value of equity as of December of year t-1. Conditional market betas for all firms are estimated on 24 to 60 months as available in the five years prior to each monthly CSR. Specifically, we follow the method of Dimson (1979) to estimate beta, which are the sum of the regression coefficients from a regression of monthly returns of the firms on the current and prior month's returns on the value-weighted portfolio of TSE and GTSM stocks. Market beta is estimated monthly.

Table 1 reports mean value of market betas, firm size (in NT $ 10 million), and B/M. In order to delineate the preliminary relationship among these variable, five portfolios are formed monthly.The first row of Table 1 present the full sample result. Mean beta is 0.798. Moreover, mean market value of equity for the full sample is NT $ 18,950 million. Panel A reports that mean beta ranges from 0.214 for lowest beta portfolio to 1.454 for highest beta portfolio and beta spreads between highest and lowest beta portfoliosis 1.24. Besides, there is no systematical relationship between beta and B/M. Moreover, highest beta portfolio is associated with the largest firm, while the lowest beta portfolio is associated with the smallest firm. Panel B presents the results that firm sizeranges from NT $ 1,890 million for the smallest firms to NT $ 69,960 million for the largest ones. The book-to-market ratio ranges from 0.299 for the lowest group to 1.421 for the highest group.

Empirical Results

Portfolio Returns and Seasonality

Table 2 shows the portfolio results. As shown in the first column in Panel A of Table 2, mean excess returns for all months is 1.083 and, indeed, display pronounced seasonality. First, mean excess returns for the full sample are 1.083%. However, mean excess returns are 9.648% and 0.305% for the January and non-January months, relatively. As shown in Panel A, mean excess return for all months ranges from 1.012 for the lowest beta portfolio to 1.201 for the highest beta portfolio while mean excess return spreads between the highest and lowest portfolio is 0.189 with a t-statistic of 0.72. However, there is a January seasonal in beta risk-return relation. Mean excess return spread between low and high beta portfolios is 6.217% (t-statistic=5.16) in January month, whereas it is -0.35% in non-January months. While we find a January seasonal in return spreads between high and low beta portfolios, Chui and Wei (1998) don't find this pattern. Panel B and C present that size and B/M may be priced in all months and the January month. For example, mean excess return spread between large and small firm portfolios in January month is -7.672% (t-statistic=-6.45), whereas it is -0.75% in the non-January months.

The sample contains firms listed on the Taiwan stock market for the period from July 1982 to June 2002. Excess returns are raw returns in excess of this risk-free rate. Portfolios are formed monthly. Panel A, B, and C report the results for portfolios formed on beta (β),ME and B/M, respectively. The F-values are computed under the null hypothesis that the mean excess returns on portfolios lowest through highest are jointly equal. Significance indicators: 1 % (***), 2.5 % (**), and5 % (*).

Table2. *Average excess monthly returns for beta, size, and B/M quintiles*

	All	Low	2	3	4	High	High-Low Spread	t-value (Spread)	F Value
Panel A: Portfolios sorted on β									
All months	1.083	1.012	1.046	1.018	1.138	1.201	0.189	0.72	0.124
January only	9.648	7.147	7.104	9.105	11.506	13.364	6.217	5.16***	6.131
Non-January months	0.305	0.445	0.493	0.289	0.201	0.095	-0.350	-1.35	0.528
Panel B: Portfolios sorted on firm size									
All months		2.167	0.997	0.896	0.533	0.830	-1.337	-5.11***	10.249
January only		14.267	10.408	8.921	8.063	6.595	-7.672	-6.45***	12.056
Non-January months		1.055	0.139	0.166	-0.141	0.305	-0.750	-2.88***	5.152
Panel C: Portfolios sorted on B/M									
All months		0.968	0.842	1.064	1.020	1.522	0.554	2.08**	1.211
January only		8.841	8.500	8.338	9.113	13.444	4.602	3.64***	3.409
Non-January months		0.254	0.137	0.412	0.281	0.439	0.185	0.70	0.305

Cross-Sectional Regression Results

Table 3 reports the cross-sectional regression results. The results show that beta, size, and B/M cannot explain cross-section of stock returns either alone or jointly. For example, as panel A displays, the mean ordinary least squares (OLS) regression coefficient of beta is 0.202 (t-statistic=0.47).

In addition, as shown in rows 2 and 3 of panel A, the regression coefficients are -0.207 (t-statistic =-1.11) and -0.073 (t-statistic=-0.18) for ln(ME) and ln(B/M), respectively. The results remain unchanged when we conduct the test using generalized least squares (GLS).

Excess returns are regressed month-by-month on beta (β), size (ME), and B/M. Excess returns are stock raw returns in excess of risk-free rate. Firm size (ME) is measured as of the end of the second to last month. B/M is equal to book value of equity divided by the market value of equity as of December of year t-1. There are totally 240 months for full samples. OLS and GLS denote that coefficients are estimated from OLS and GLS regression, respectively. Ln(.) denotes natural log operator.

The t-statistics are in parentheses and is equal to the average regression coefficient divided by its time-series standard error. Panel A and B show the results for the OLS and GLS estimates. The numbers of positive regression coefficients are in bracket. One-tail significance indicators: 1% (***), 2.5% (**), and 5% (*).

Table3. *Average slopes of monthly cross-sectional regressions of excess stock returns on beta, ME, and B/M*

Panel A: OLS estimates of average parameter values					**Panel B: GLS estimates of average parameter values**				
Intercept	β	**ln(ME)**	**ln(B/M)**	$\overline{\text{Adj}R^2}$	**Intercept**	β	**ln(ME)**	**ln(B/M)**	$\overline{\text{Adj}R^2}$
1.410 (1.83)	0.202 (0.47) [113]			0.0143	1.390 (1.79)	0.197 (0.46) [109]			0.0121
0.912 (1.44)				0.0172	0.840 (1.33)				0.0154
3.566 (1.71)		-0.207 (-1.11) [117]		0.0472	3.509 (1.68)		-0.202 (-1.08) [117]		0.0468
1.242 (1.43)			-0.073 (-0.18) [118]	0.0394	1.223 (1.41)			-0.029 (-0.07) [118]	0.0393
2.770 (1.50)	0.655 (1.57) [115]	-0.228 (-1.28) [116]	-0.232 (-0.67) [114]	0.0850	2.619 (1.42)	0.657 (1.58) [115]	-0.214 (-1.20) [114]	-0.229 (-0.66) [114]	0.0845

Table 4 presents the results for the January and non-January months. We do find that there is a strong January seasonal in the explanatory power of beta and size, but not for B/M. For example, while rows 1 and 2 in panel A show that the mean OLS (GLS) regression coefficients of beta are 4.113 with a t-statistic of 2.09 (4.159 with a t-statistic of 2.13) in the January month, rows 1 and 2 in panel B show that the mean OLS (GLS) regression

coefficients of beta are -0.153 with a t-statistic of -0.36 (-0.163 with a t-statistic of -0.38) in the non-January months.

Row 3 and 4 of panel A show that in January, the mean OLS (GLS) regression coefficients are -1.443 with a t-statistics of -2.15 (-1.396 with a t-statistics of -2.04) and 1.643 with a t-statistics of 1.12 (1.687 with a t-statistics of 1.14) for ln(ME) and ln(B/M), respectively.

Excess returns are regressed month-by-month on beta (β), size (ME), and B/M. Excess returns are stock raw returns in excess of risk-free rate. There are totally 240 months for full samples. OLS and GLS denote that coefficients are estimated from OLS and GLS regression, respectively. Ln(.) denotes natural log operator. Panel A shows the results for the January month only, while Panel B shows the results for the non-January months. The numbers of positive regression coefficients are in bracket. One-tail significance indicators: 1% (***), 2.5% (**), and 5% (*).

Table4. *Average slopes of monthly cross-sectional regressions of excess returns on beta, size, and B/M: January versus non-January months*

OLS estimates of average parameter values						GLS estimates of average parameter values				
Intercept	β	**ln(ME)**	**ln(B/M)**	$\overline{Adj}R^2$		**Intercept**	β	**ln(ME)**	**ln(B/M)**	$\overline{Adj}R^2$
Panel A: January only										
3.186 (1.43)	4.113 (2.09)** [12]			0.0289		3.112 (1.40)	4.159 (2.13)** [11]			0.0288
2.033 (1.11)				00372		2.023 (1.11)				0.0372
19.130 (2.59)		-1.443 (-2.15)** [4]		0.0590		18.722 (2.50)		-1.396 (-2.04)** [4]		0.0588
6.971 (2.42)			1.643 (1.12) [12]	0.0407		6.959 (2.41)			1.687 (1.14) [12]	0.0406
13.770 (2.06)	4.102 (1.83)* [12]	-1.345 (-1.92)* [5]	0.810 (0.63) [12]	0.1156		13.853 (2.08)	3.997 (1.77)* [12]	-1.350 (1.94)* [6]	0.788 (0.60) [11]	0.1152
Panel B: non-January months										
1.249 (1.53)	-0.153 (-0.36) [114]			0.0130		1.233 (1.50)	-0.163 (-0.38) [98]			0.0127
0.810 (1.20)				0.0153		0.732 (1.09)				0.0152
2.151 (1.00)		-0.095 (-0.49) [113]		0.0461		2.126 (0.99)		-0.094 (-0.49) [113]		0.0459
0.721 (0.79)			-0.224 (0.56) [106]	0.0392		0.701 (0.77)			-0.185 (-0.46) [106]	0.0391
1.770 (0.93)	0.342 (0.85) [103]	-0.126 (-0.69) [111]	-0.327 (0.90) [102]	0.0822		1.598 (0.84)	0.354 (0.88) [103]	-0.110 (-0.60) [108]	0.322 (-0.89) [103]	0.0817

CONCLUSION

Using a sample of firms listed in the Taiwan stock market, a high-grow emerging market with high-proportion individuals that is highly likely to observe the effect of investor sentiments on stock prices, this paper tests whether market beta, firm size, and B/M can explain the cross-section of sock returns and whether the explanatory powers will exhibit a January effect. We use both the portfolio analysis and the two-pass test of Fama and Macbeth (1973) to perform the test. We find that there is a January seasonal in the beta-risk premium and in the negative size-return relation, consistent with Corhay et al.'s (1987) hypothesis that return seasonality may coincide with the seasonality in the explanatory power of beta, size, and B/M on stock returns. Our study adds to the literature on the link between beta risk-premium seasonality and return seasonality

and enhances our knowledge about what factors determining the cross-sectional stock returns in Taiwan.

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