Scientific Research Publishing

Theoretical Economics Letters, 2023, 13, 351-359
https://www.scirp.org/journal/tel
ISSN Online: 2162-2086
ISSN Print: 2162-2078

Size, Value, and Beta in Japan—A Panoramic View

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How to cite this paper: Tsuji, C. (2023). Size, Value, and Beta in Japan—A Panoramic View. *Theoretical Economics Letters, 13,* 351-359.
https://doi.org/10.4236/tel.2023.132022

Received: February 23, 2023
Accepted: April 27, 2023
Published: April 30, 2023

Abstract

Considering finance theory, this study investigates the relations between portfolio returns and betas in Japan, and derives the following interesting findings. First, we observe that for January 1992 to December 2021, there was little nexus between the returns and their betas in six size- and book equity to market equity (BE/ME)-sorted portfolios in Japan. Second, we also observe that for our six five-year sub periods, there was little linkage between the returns and their betas in Japanese six size- and BE/ME-sorted portfolios. Third, our regression analysis confirms that statistically, there was almost no relation between the returns and their betas in Japanese six size- and BE/ME-sorted portfolios for January 1992 to December 2021.

Keywords

Asset Pricing, Beta, Book-to-Market Ratio, CAPM, Size Premia, Value Premia

1. Introduction

According to finance theory, beta risk should be rewarded with higher return. Typically, such a relationship is theoretically suggested by the capital asset pricing model (CAPM); however, is this empirically supported? Moreover, size and value premia have been observed in international stock markets (Banz, 1981; Schwert, 1983; Barber & Lyon, 1997; Fama & French, 1993, 1995, 1996, 2012; Tsuji, 2012), but how are the relations between size, value, and beta?

Hence, motivated to empirically clarify these questions, this paper investigates the relations between portfolio returns and their betas in Japan. More concretely, considering the standard finance theory, this paper empirically examines the relations between the returns and their betas in six size- and book equity to market equity (BE/ME)-sorted portfolios in Japan. As a result, we derive the following interesting findings. First, 1) our full-sample return and beta analysis shows that

for January 1992 to December 2021, there was little linkage between the returns and their betas in Japanese six size- and BE/ME-sorted portfolios.

Second, 2) our sub-sample return and beta analysis also clarifies that for our six five-year sub periods, there was either little nexus between the returns and their betas in Japanese six size- and BE/ME-sorted portfolios. Third, 3) our regression analysis also evidences that statistically, there was almost no relation between the returns and their betas in Japanese six size- and BE/ME-sorted portfolios.

Regarding the rest of this paper, Section 2 provides a theoretical discussion, and Section 3 documents our data and methodology. Section 4 presents the results, and Section 5 provides our conclusions.

2. Theory

This section briefly reviews the related finance theory. The CAPM—a very well-known theoretical asset pricing model in financial economics—suggests that returns of a certain asset or portfolio have some relations with their betas (Sharpe, 1964; Lintner, 1965a, 1965b; Mossin, 1966). This theoretical relationship between asset returns and their betas is presented by the so-called security market line.

That is, in accordance with the CAPM, beta risk should be rewarded with higher return. This means that theoretically, investing highly co-varying assets or portfolios with the market—moving sensitively in the same direction as the market, showing high betas—should be rewarded with higher return. On the other hand, although empirically, size and value premia are observed in stock markets. Then, how are these size and value premia associated with beta risk? More specifically, how are the relations between size, value, and beta?

To inspect these relations derived theoretically and empirically, we below examine the beta-return relation in Japanese size and BE/ME-sorted portfolios. We consider this will add a valuable contribution to the body of research in economics and finance.

3. Data and Methodology

This section explains our data and methodology. Our data analyzed in this paper are returns of six size- and BE/ME-sorted portfolios and the market portfolio in Japan. Specifically, our six size- and BE/ME-sorted portfolios are 1) small-size and low-B/M ratio; 2) small-size and middle-B/M ratio; 3) small-size and high-B/M ratio; 4) big-size and low-B/M ratio; 5) big-size and middle-B/M ratio; 6) big-size and high-B/M ratio portfolios in Japan.

Our samples are monthly time-series data and our full sample period is from January 1992 to December 2021. We also analyze six five-year sub periods, and these are 1) January 1992 to December 1996, 2) January 1997 to December 2001, 3) January 2002 to December 2006, 4) January 2007 to December 2011, 5) January 2012 to December 2016, and 6) January 2017 to December 2021. **Table 1**

Table 1. Descriptive statistics for monthly returns of six Japanese size and BE/ME-sorted portfolios: Full sample period of January 1992 to December 2021.

	Market portfolio	Small-Low B/M	Small-Middle B/M
Mean	0.358	0.316	0.427
SD	5.255	7.156	5.929
Skewness	0.258	0.363	0.271
Kurtosis	3.744	3.975	4.384
JB	12.299	22.176	33.132
p-value	0.002	0.000	0.000
ADF	−16.228	−15.898	−16.157
p-value	0.000	0.000	0.000

	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Mean	0.562	0.280	0.372	0.528
SD	6.002	5.667	5.109	5.743
Skewness	0.384	0.120	0.341	0.466
Kurtosis	4.400	3.935	4.032	4.011
JB	38.234	13.985	22.943	28.323
p-value	0.000	0.001	0.000	0.000
ADF	−15.851	−16.356	−16.568	−17.178
p-value	0.000	0.000	0.000	0.000

Statistics are for monthly percentage returns. SD: standard deviation value; JB: Jarque-Bera statistic; ADF: augmented Dickey-Fuller test statistic.

displays the descriptive statistics for our full sample period. Table 1 shows that the mean values of these portfolio returns are all positive, and the skewness values of the portfolio returns are also all positive. It is noted that all the tables and figures in this paper are created by the author. Raw data were provided by Eugene Fama and Kenneth French.

Regarding our methodology, we first examine the relations between the betas and returns in the six size- and BE/ME-sorted portfolios in Japan for both our full and six sub periods. After that, we also conduct a pooled regression to inspect the relations statistically.

4. Results

4.1. Beta-Return Analysis

We first provide the result of beta-return analysis for our full period in Table 2. As this table shows, for our full period, we cannot recognize the clear relationship between the betas and returns in the six size- and BE/ME-sorted portfolios in Japan. To view the relations graphically, in Figure 1, we exhibit the beta-return relations that were shown in Table 2. From this figure, we understand that

Table 2. Annualized returns and betas for six Japanese size and BE/ME-sorted portfolios: Full period of January 1992 to December 2021.

	Market portfolio	Small-Low B/M	Small-Middle B/M
Beta	1.000	1.157	0.992
Return	4.292	3.790	5.127
	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	0.987	1.027	0.945	0.998
Return	6.744	3.365	4.469	6.332

All returns are annualized and in percent figures.

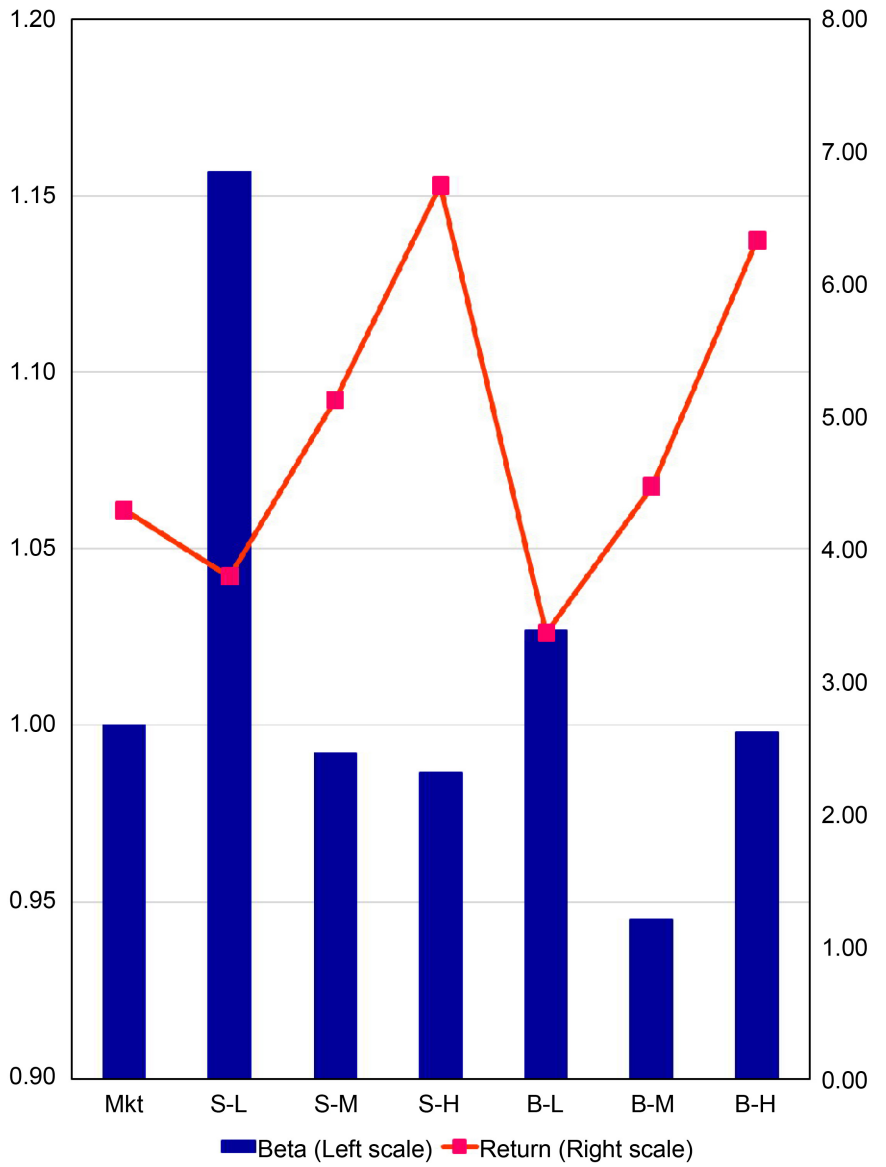

Figure 1. Relations between returns and betas of Japanese size and BE/ME-sorted portfolios: Full period of January 1992 to December 2021.

Table 3. Annualized returns and betas for Japanese six size- and BE/ME-sorted portfolios: Six five-yaer sub periods.

Panel A. Sub period of Jan. 1992 to Dec. 1996				
	Market portfolio	Small-Low B/M		Small-Middle B/M
Beta	1.000	1.060		1.010
Return	1.724	−3.216		−0.226
	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	1.074	0.985	0.981	0.977
Return	2.112	0.094	1.264	6.572
Panel B. Sub period of Jan. 1997 to Dec. 2001				
	Market portfolio	Small-Low B/M		Small-Middle B/M
Beta	1.000	1.227		0.997
Return	−5.358	−9.940		−10.336
	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	0.981	1.083	0.847	0.946
Return	−7.578	−6.138	−3.802	−0.638
Panel C. Sub period of Jan. 2002 to Dec. 2006				
	Market portfolio	Small-Low B/M		Small-Middle B/M
Beta	1.000	1.181		0.977
Return	14.682	14.748		19.798
	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	0.955	0.977	0.952	0.953
Return	22.792	8.548	16.744	19.202
Panel D. Sub period of Jan. 2007 to Dec. 2011				
	Market portfolio	Small-Low B/M		Small-Middle B/M
Beta	1.000	1.020		0.872
Return	−3.720	−5.482		−1.258
	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	0.814	1.011	0.995	0.967
Return	3.860	−3.982	−4.822	−2.086
Panel E. Sub period of Jan. 2012 to Dec. 2016				
	Market portfolio	Small-Low B/M		Small-Middle B/M
Beta	1.000	1.021		0.885
Return	9.620	16.022		13.354

Continued

	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	0.890	0.952	0.925	1.179
Return	12.544	8.048	9.254	11.066
Panel F. Sub period of Jan. 2017 to Dec. 2021				
	Market portfolio	Small-Low B/M		Small-Middle B/M
Beta	1.000	1.351		1.039
Return	8.806	10.608		9.428
	Small-High B/M	Big-Low B/M	Big-Middle B/M	Big-High B/M
Beta	0.966	1.003	0.918	1.039
Return	6.732	13.620	8.174	3.878

All returns are annualized and in percent figures.

Table 4. Result of pooled regression of portfolio returns on betas.

	Intercept	Slope coefficient	Adjusted R-squared
Estimate	10.041	−5.057	−0.021
SE	13.283	13.301	
p-value	0.454	0.706	

Regression is implemented by using pooled data of betas and returns of Japanese six size- and BE/ME-sorted portfolios. SE: standard error.

there is little linkage between the betas and returns in the Japanese six size- and BE/ME-sorted portfolios for our full period.

Second, we further provide the result of our beta-return analysis for our six five-year sub periods in Table 3. As this table shows, it is again difficult to recognize the clear relationship between the betas and returns in the Japanese six size- and BE/ME-sorted portfolios for our six sub periods.

4.2. Regression Analysis

We next provide the result of a pooled regression in Table 4, which regresses all the portfolio returns on their corresponding betas. As Table 4 shows, the statistically insignificant negative slope coefficient and the almost zero adjusted R-squared value indicate that statistically, there is little linkage between the portfolio betas and returns in Japan.

To more easily see the relations of the betas and returns, we plot the realized pairs of betas and returns in Figure 2. As this figure shows, we again understand that there is little nexus between the betas and returns in the six size- and BE/ME-sorted portfolios in Japan from January 1992 to December 2021. We note that this is the evidence against the standard finance theory.

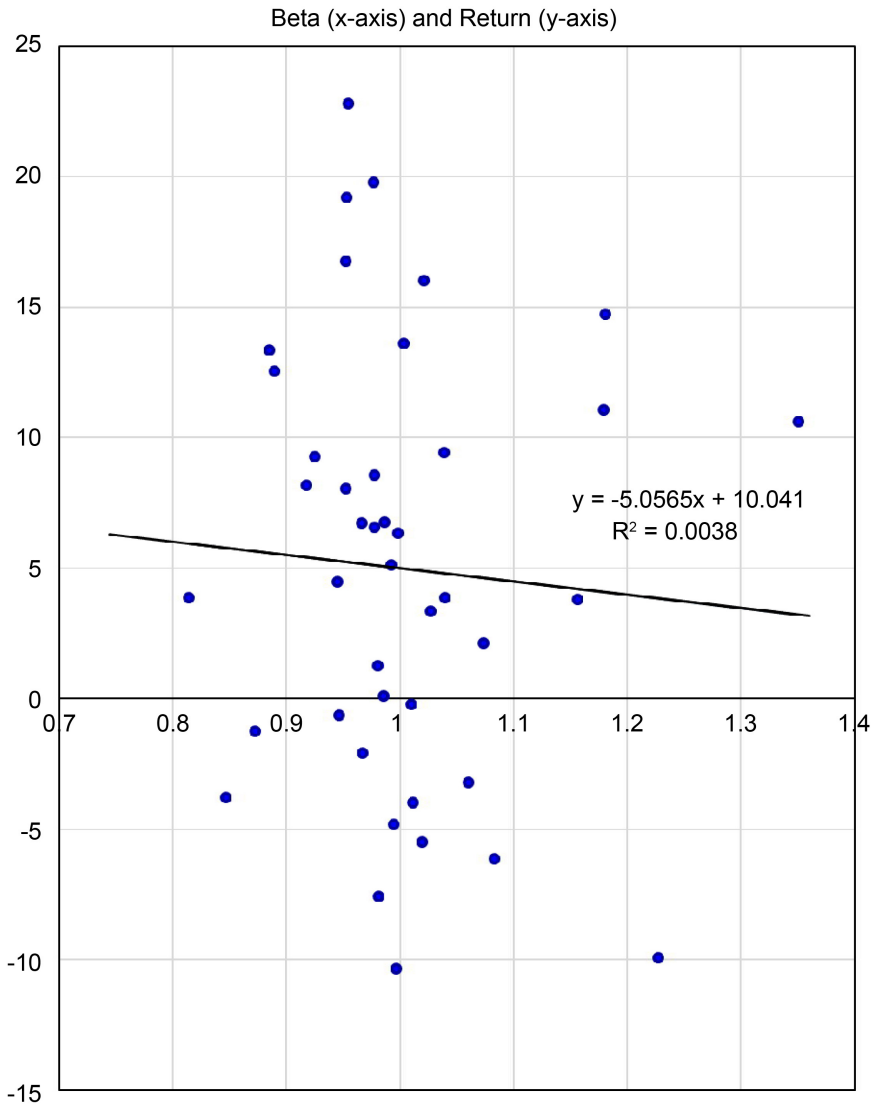

Figure 2. Relations between returns and betas of Japanese size and BE/ME-sorted portfolios: From pooled data.

5. Conclusion

This paper investigated the relations between returns and betas in six size- and BE/ME-sorted portfolios in Japan. As a result of our empirical analysis, we derived the following interesting findings.

1) First, our full sample return and beta analysis evidenced that for January 1992 to December 2021, there was little nexus between the returns and their betas in the six size- and BE/ME-sorted portfolios in Japan.

2) Second, our sub-sample return and beta analysis also clarified that for our six five-year sub periods, there was either little linkage between the returns and their betas in the Japanese six size- and BE/ME-sorted portfolios.

3) Third, our regression analysis also confirmed that statistically, there was almost no relation between the returns and their betas in the six size- and

BE/ME-sorted portfolios in Japan.

As above, our empirical examinations performed in this study showed that as far as for the six Japanese size and BE/ME-sorted portfolios and for our sample period of January 1992 to December 2021, there was little linkage between returns and betas in Japan. This is important because the evidence is against the standard finance theory. However, because these results might be limited to the Japanese portfolios and sample period analyzed in our current study, further research shall be needed, and it is one of our future works.

Acknowledgements

The author is grateful to the repeated cordial article invitations from this journal. The author also thanks anonymous reviewers for their supportive comments on this paper. Furthermore, the author appreciates the financial support of the grant program of the Chuo University Promoting Research Period. Finally, I deeply thank all the editors of this journal for their kind attention to this paper.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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