On the Alphas in Japan*

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Abstract

This paper empirically examines Jensen's (1968) alphas in Japan. Our investigations, which follow the methodology of Fama and French (1993, 1996) and Chan et al. (1998, 2001) using Japanese data, presents several new results. First, in contrast to the case of the USA, in Japan, the positive alphas remain after Fama and French's three factor model is applied to the excess stock returns. Furthermore, the positive alphas remain even if five factors, namely Fama–French's three factors and momentum and reversal factors, are applied to the excess stock returns in Japan.

JEL Classification Numbers: G12; G15.
Key Words: Asset pricing; BE/ME effect; Fama–French model; Jensen's Alpha; Momentum; Reversal; Size effect.

1 Introduction

The performance measure, alpha, developed by Jensen (1968), is the risk-adjusted return, and it is generally called Jensen's alpha. Regarding this alpha, most existing studies consider the alphas of mutual funds, like Baks et al. (2001), Berk and Green (2004), Bollen and Busse (2005), and Kosowski et al. (2006), among others.[1] Research on the alphas of the excess returns of common stocks or equity portfolios is limited, because the alphas of these assets are close to zero in the Unites States when the Fama–French model is applied to the excess return, as discussed in more detail below.

Internationally, the structure of the economy and financial markets, the characteristics of investors' preferences, the pertinent degree of education as to monetary and/or financial issues, and

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* This paper is presented in honor of the 60th year of the esteemed Professor of Finance at Osaka University, Doctor Kazuhiko NISHINA. I cordially celebrate his 60th birthday, and I wish him continuing happiness in both his academic and private life in the future.

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1 Other studies related to the alphas are mostly on the performance evaluations of mutual funds, and they include Brown et al. (1992), Grinblatt et al. (1995), Ferson and Schadt (1996), Gruber (1996), Carhart (1997), Chevalier and Ellison (1997), Daniel et al. (1997), Christopherson et al. (1998), Chen et al. (2000), Carhart et al. (2002), Pastor and Stambaugh (2002a, 2002b), Cohen et al. (2005), and Jones and Shanken (2005).

the strength or creditworthiness of the market systems are different in every country. Therefore, the factors that explain the excess stock returns shall be more or less different in every country.

Based on our above conjecture, we test the explanatory power of the well-known Fama and French (1993) three factors, and momentum and reversal factors, for excess returns in the Japanese stock market. Hence, our research in this paper conducts parallel tests with regard to the above factors' explanatory power, following the methodology of Fama and French (1993, 1996) and Chan et al. (2001). The tests are parallel procedures; however, the results are surprisingly different. Namely, our investigations reveal new evidence that there exists unexplained excess stock returns using the five factors: the positive alphas remain in Japan. This is our contribution in this paper.

The rest of this paper is organized as follows. Section 2 discusses the Fama–French (1993) model and the alpha. Section 3 describes the data we used. Empirical results and interpretations are explained in Section 4, and Section 5 concludes the paper.

2 The Fama–French Model and the Alpha

The Fama–French (1993) model suggests that the expected return of a portfolio in excess of the risk-free rate $[E(R_i) - R_f]$ is explained by the sensitivity of its return to three factors: (1) the excess return on a broad market portfolio $R_M - R_f$; (2) the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (small minus big, SMB); and (3) the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (high minus low, HML). Following Fama and French (1996, p.55), the expected excess return of portfolio i is written as follows:

$$E(R_i) - R_f = b_i[E(R_M) - R_f] + s_i E(SMB) + h_i E(HML), \tag{1}$$

where $E(R_M) - R_f$, $E(SMB)$, and $E(HML)$ are the expected premiums (expected factor returns), and the factor sensitivities or loadings, b_i, s_i, and h_i, are the slopes in the following time-series regression:

$$R_i - R_f = \alpha_i + b_i(R_M - R_f) + s_i SMB + h_i HML + \epsilon_i. \tag{2}$$

Fama and French (1995) argued that book-to-market equity and the slope of the HML factor act as a proxy for relative distress. They suggested that weak firms with persistently lower earnings tend to have higher BE/ME and positive slopes on HML, while stronger firms with persistently higher earnings have lower BE/ME and negative slopes on HML. They also explain that the motivation to use HML to explain returns is given by the evidence in Chan and Chen (1991) of a covariation in returns related to relative distress that is not captured by the market return and is compensated for in average returns. They also explain that the motivation to use SMB to explain returns is given by the evidence in Huberman and Kandel (1987) of a covariation in the returns on small stocks that is not captured by the market return and is compensated for in average returns.

Regarding the explanatory power of their model above, Fama and French (1996) insisted that the three-factor model captures much of the anomalous cross-sectional variation in average stock returns. As its rationale, Fama and French (1996) showed that when applied to the excess returns of 25 portfolios, which are formed by size and BE/ME ratio, the intercepts (alphas) of equation (2) were not statistically different from zero.

Thus, in this paper, we first investigate the explanatory power of the Fama–French model in Japan. In particular, focusing on the alpha of regression (2), we inspect whether their model, namely their three factors $R_M - R_f$, HML, and SMB, can reduce the alphas in Japan to zero as in the USA. Then based on these results, we conduct additional analyses. That is, we test whether the five factors $R_M - R_f$, HML, and SMB, as well as the momentum factor, UMD, and the reversal factor, WML, can reduce the alphas in Japan to zero.

3 Data and Factor Constructions

The data we constructed and used in this paper are as follows. The notations are risk-free percentage rate: R_f, market portfolio percentage return: R_M, Fama and French's (1993) small-minus-big factor percentage return: SMB, Fama and French's (1993) high-minus-low factor percentage return: HML, Chan et al.'s (1998) momentum factor percentage return: UMD, and Chan et al.'s (1998) reversal factor percentage return: WML.[2]

We also reexamined the case of the USA in this paper. The market excess return, SMB and HML factor returns for the US market, and the returns of 25 size-BE/ME portfolios for the US market were provided by Professor Kenneth French.[3] A complete explanation of the data source and variable construction are in Appendix A.

4 Empirical Results and Interpretation

4.1 The Fama–French factors' explanatory power: reexamining the case of the USA

As we mentioned earlier, with regard to the strong explanatory power of their three-factor model, Fama and French (1996) documented that when the three factors are applied to the excess returns of 25 portfolios formed by size and BE/ME ratio, the intercepts of the Fama–French (1993) model—more strictly, the alphas of the following time-series regression (3)—were not statistically different from zero.

$$R_{i,t} - R_{f,t} = \alpha_i + b_i(R_{M,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + \epsilon_{i,t} \tag{3}$$

[2] These UMD and WML factors were also used in Chan et al. (2001) for careful risk adjustment.

[3] We thank Professors Kenneth French and Eugene Fama for giving us the opportunity to use their valuable data.

Before testing the explanatory power of the Fama–French model in Japan, for comparison, using the same sample period for the test in Japan, we reexamined the case of the USA. The sample period is from October 1981 to April 2005, and the results are shown in Table 1.[4] The results are very similar to those in Fama and French (1996). Namely, the intercepts are very small, and the average absolute value of the 25 intercepts is 0.16 percent (16 basis points) per month, and the average of the 25 regressions' adjusted R-squared values is 0.87. Thus, as Fama and French (1996) insist, their three-factor model does capture most of the variation in the portfolio returns in the case of the USA.

4.2 The positive alphas in Japan

As Fama and French (1996) suggested, if their three-factor model (3) captures much of the variation in stock returns, the regression intercepts, the alpha of the time-series regression (3), should be close to zero, as in the results for the USA. How then does Japan compare?

To test the effectiveness of the Fama–French model in Japan, we performed a parallel test using the Japanese data for the same sample period from October 1981 to April 2005. The results are shown in Table 2. The results are, surprisingly, very different from those in the USA. Namely, the 25 intercepts are all positive and all statistically significant at the 1% level except for the case of the size-4 and BE/ME-2 portfolio, which shows a 5% significance level. Furthermore, the average absolute value of the 25 intercepts is 0.72 percent (72 basis points) per month, and this figure is larger than that of the USA by 0.56 percent (56 basis points) per month. Moreover, the average of the adjusted R-squared values for the 25 regressions is 0.83 in the case of Japan, and this value is also slightly lower than that of the USA. Thus, unlike the case for the USA, in Japan, the Fama–French (1996) three-factor model leaves the positive excess returns unexplained and has positive alphas, and the average alpha exhibits a quite large value of 8.64 percent (864 basis points) per year.

Next, to examine whether the above result of the positive alphas in Japan is robust or not, we further investigated by adding the momentum and reversal factors, UMD and WML, following Chan et al. (2001). Namely, we implemented the following regression (4) using the same 25 portfolio returns formed by size and BE/ME.

$$R_{i,t} - R_{f,t} = \alpha_i + b_i(R_{M,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + w_i WML_t + d_i UMD_t + \epsilon_{i,t} \tag{4}$$

The results are displayed in Table 3, and results similar to those in Table 2 are obtained by the above five-factor regression (4). Namely, the 25 intercepts are again all positive and all statistically significant at the 1% level except for only one case of the size-4 and BE/ME-2 portfolio, which shows a 5% significance level. Furthermore, the average absolute value of the 25 intercepts is 0.73 percent (73 basis points) per month, and this figure is almost the same as for the case of applying

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[4] We used the Newey–West (1987) heteroskedasticity and autocorrelation consistent covariance matrix to derive t-values. Although not repeatedly stated, when estimating regressions (3) and (4), we always used the Newey–West (1987) covariance matrix.

Table 1
Summary statistics and the results of the three-factor regressions for simple monthly percentage excess returns on 25 portfolios formed on size and BE/ME: the case of the USA, from 10/1981 to 4/2005, 283 months

	Book-to-market equity (BE/ME) quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
Panel A Summary statistics										
	Means					Standard Deviations				
Small	-0.08	0.85	0.99	1.18	1.19	8.19	6.84	5.42	4.98	5.13
2	0.32	0.70	1.01	1.07	1.05	7.42	5.71	4.80	4.69	5.20
3	0.50	0.83	0.83	0.91	1.20	6.91	5.26	4.56	4.49	4.83
4	0.73	0.74	0.86	0.96	1.00	6.20	5.00	4.80	4.36	4.74
Big	0.71	0.80	0.71	0.73	0.81	4.90	4.70	4.38	4.21	4.80

	Book-to-market equity (BE/ME) quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
Panel B Regression: $R_{i,t} - R_{f,t} = \alpha_i + b_i(R_{M,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + \varepsilon_{i,t}$										
	α					$t(\alpha)$				
Small	-0.79 **	0.03	0.21 *	0.38 **	0.27 *	-4.75	0.32	2.45	3.35	2.31
2	-0.37 **	-0.12	0.18	0.14	-0.05	-3.44	-1.17	1.88	1.38	-0.51
3	-0.05	-0.01	-0.09	-0.06	0.13	-0.55	-0.13	-0.87	-0.47	1.02
4	0.10	-0.13	-0.12	-0.02	-0.03	0.89	-1.15	-1.03	-0.17	-0.20
Big	0.28 **	0.04	-0.09	-0.14	-0.20	3.61	0.42	-0.90	-1.37	-1.36
	b					$t(b)$				
Small	1.10 **	0.99 **	0.88 **	0.85 **	0.91 **	21.59	33.98	33.81	26.10	24.69
2	1.16 **	1.03 **	0.94 **	0.95 **	1.06 **	34.28	36.69	25.86	27.38	26.96
3	1.07 **	1.07 **	1.00 **	0.99 **	1.07 **	38.23	36.46	34.51	24.51	23.59
4	1.10 **	1.09 **	1.10 **	1.03 **	1.07 **	22.05	34.33	34.86	27.10	21.25
Big	0.95 **	1.05 **	1.00 **	0.96 **	1.07 **	36.16	41.29	25.53	28.74	16.12

	s					$t(s)$				
Small	1.39 **	1.30 **	0.98 **	0.88 **	0.86 **	14.29	15.15	35.52	11.44	6.60
2	1.03 **	0.79 **	0.60 **	0.60 **	0.70 **	16.51	9.00	4.95	4.69	4.49
3	0.80 **	0.41 **	0.26	0.24	0.25	10.21	3.46	1.75	1.48	1.27
4	0.50 **	0.14	0.05	0.06	-0.04	4.53	1.17	0.36	0.70	-0.27
Big	-0.24 **	-0.27 **	-0.26 **	-0.36 **	-0.33 **	-5.06	-4.40	-3.07	-2.98	-3.63
	h					$t(h)$				
Small	-0.25 **	0.10 *	0.23 **	0.34 **	0.48 **	-2.67	2.44	5.82	5.57	4.19
2	-0.29 **	0.15	0.31 **	0.49 **	0.66 **	-3.12	1.82	2.83	5.39	5.37
3	-0.43 **	0.20 *	0.43 **	0.55 **	0.64 **	-4.51	2.51	4.62	4.02	4.83
4	-0.27 *	0.25 **	0.46 **	0.55 **	0.60 **	-2.12	2.71	4.61	6.42	4.18
Big	-0.35 **	0.15 *	0.29 **	0.49 **	0.62 **	-4.55	2.15	3.64	4.85	5.21
	Adj.R^2					$s(e)$				
Small	0.89	0.93	0.93	0.90	0.87	2.67	1.84	1.39	1.57	1.82
2	0.95	0.92	0.88	0.87	0.88	1.67	1.65	1.64	1.67	1.78
3	0.94	0.87	0.83	0.80	0.79	1.72	1.92	1.86	2.01	2.21
4	0.91	0.86	0.83	0.85	0.77	1.81	1.90	1.99	1.67	2.27
Big	0.94	0.89	0.85	0.83	0.76	1.20	1.58	1.68	1.75	2.34

HML denotes the high-minus-low factor, and *SMB* denotes the small-minus-big factor of the Fama–French (1993) model. *t* (coefficient) denotes the *t*-value of the coefficient, and the *t*-values are adjusted using the Newey–West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. Adj.R^2 denotes adjusted *R*-squared values, and $s(e)$ denotes standard errors of the regression. ** and * attached to the coefficients denote the statistical significance of the coefficients at the 1% and 5% level, respectively. The sample period is from October 1981 to April 2005.

Table 2
Summary statistics and the results of the three-factor regressions for simple monthly percentage excess returns on 25 portfolios formed on size and BE/ME: the case of Japan, from 10/1981 to 4/2005, 283 months

	Book-to-market equity (BE/ME) quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
Panel A Summary statistics										
	Means					Standard Deviations				
Small	2.37	2.09	1.94	2.33	2.60	9.79	8.38	8.02	7.87	8.35
2	1.63	1.61	1.49	1.42	1.67	8.21	7.41	7.30	7.26	7.50
3	1.21	1.19	1.29	1.45	1.62	7.22	6.79	6.62	6.53	6.97
4	0.88	0.93	1.10	1.23	1.57	6.44	6.30	6.01	5.86	6.41
Big	0.25	0.57	0.76	1.05	1.33	6.36	6.04	5.39	5.77	5.67

	Book-to-market equity (BE/ME) quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
Panel B Regression: $R_{i,t} - R_{f,t} = \alpha_i + b_i(R_{M,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + \varepsilon_{i,t}$										
	α					$t(\alpha)$				
Small	1.26 **	0.98 **	0.88 **	1.21 **	1.27 **	5.65	5.34	4.53	6.12	5.49
2	0.86 **	0.70 **	0.54 **	0.41 **	0.46 **	4.47	4.22	3.49	2.92	3.17
3	0.76 **	0.52 **	0.52 **	0.57 **	0.55 **	4.55	3.16	2.67	3.88	3.69
4	0.65 **	0.41 *	0.52 **	0.59 **	0.72 **	3.69	2.36	3.32	3.61	4.58
Big	0.57 **	0.74 **	0.68 **	0.88 **	0.74 **	3.60	4.68	4.79	5.59	4.99
	b					$t(b)$				
Small	1.05 **	0.91 **	0.88 **	0.94 **	0.96 **	21.93	19.25	21.46	21.19	17.26
2	0.91 **	0.92 **	0.90 **	0.93 **	0.92 **	16.15	22.14	18.03	26.04	17.00
3	0.93 **	0.90 **	0.85 **	0.91 **	0.90 **	17.67	18.88	20.91	22.98	16.55
4	0.90 **	0.94 **	0.90 **	0.87 **	0.94 **	16.51	17.30	16.70	16.57	19.16
Big	0.90 **	0.94 **	0.88 **	0.95 **	0.91 **	22.09	27.57	24.69	23.88	24.91

	s					*t*(*s*)				
Small	1.38 **	1.22 **	1.13 **	0.99 **	1.05 **	13.22	29.19	21.36	18.01	18.64
2	1.11 **	0.93 **	0.95 **	0.92 **	0.93 **	13.66	24.99	25.68	30.52	22.05
3	0.73 **	0.73 **	0.75 **	0.64 **	0.75 **	12.99	16.46	17.66	15.45	18.57
4	0.42 **	0.45 **	0.41 **	0.41 **	0.48 **	9.21	11.31	7.98	9.98	11.40
Big	-0.08	-0.19 **	-0.17 **	-0.37 **	-0.14 **	-1.81	-5.02	-4.53	-6.40	-2.66
	h					*t*(*h*)				
Small	-0.24 *	0.00	0.03	0.26 **	0.51 **	-2.51	-0.04	0.41	3.48	6.26
2	-0.40 **	0.01	0.05	0.19 *	0.48 **	-3.28	0.17	0.77	2.43	8.03
3	-0.45 **	-0.12	0.05	0.29 **	0.46 **	-5.36	-1.32	0.72	4.61	6.64
4	-0.43 **	-0.03	0.11	0.21 **	0.44 **	-4.28	-0.35	1.87	3.03	6.01
Big	-0.70 **	-0.36 **	0.02	0.36 **	0.74 **	-12.02	-6.05	0.24	4.15	9.28
	Adj.R^2					*s*(*e*)				
Small	0.82	0.86	0.84	0.84	0.83	4.11	3.12	3.21	3.19	3.44
2	0.82	0.86	0.87	0.90	0.88	3.49	2.79	2.59	2.33	2.59
3	0.81	0.83	0.81	0.85	0.85	3.18	2.83	2.85	2.51	2.73
4	0.79	0.81	0.79	0.79	0.83	2.98	2.76	2.74	2.68	2.62
Big	0.83	0.83	0.80	0.82	0.81	2.59	2.45	2.43	2.46	2.46

HML denotes the high-minus-low factor, which is calculated using the Japanese data, of the Fama–French (1993) model, and *SMB* denotes the small-minus-big factor, which is calculated using the Japanese data, of the Fama–French (1993) model, respectively. *t* (coefficient) denotes the *t*-value of the coefficient, and the *t*-values are adjusted using the Newey–West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. Adj.R^2 denotes adjusted *R*-squared values, and *s*(*e*) denotes standard errors of the regression. ** and * attached to the coefficients denote the statistical significance of the coefficients at the 1% and 5% level, respectively. The sample period is from October 1981 to April 2005.

the Fama–French three-factor model (3) in Japan. Furthermore, under the application of the five-factor model (4), the average of the adjusted R-squared values for the 25 regressions is 0.84; this is also almost the same as in the case of applying the Fama–French three-factor model (3) in Japan. Therefore, we understand that the momentum and reversal factors, UMD and WML, have little power to contribute to reducing the alphas left by the Fama–French model in Japan to zero.

Furthermore, to test robustness further, we implemented the same regression (4) using different data. Namely, our first additional data set is the excess returns on 25 portfolios formed using size only, and the second additional data set is the excess returns on 25 portfolios formed using the BE/ME ratio only. The sample periods of the two data sets are from October 1981 to July 2004. The results are shown in Tables 4 and 5, and both results confirm the existence of positive alphas in Japan. That is, in the case of the size-ranked 25 portfolio returns, as shown in Table 4, 25 intercepts are all positive and all statistically significant at the 1% level except for only one case, which shows a 5% significance level in the size-17 portfolio. Also, in the case of the BE/ME-ranked 25 portfolio returns, as shown in Table 5, the 25 intercepts are all positive although the statistical significance of the alphas is a little weak: two positive alphas are insignificant, and four positive alphas are significant at the 5% level (The other 19 positive alphas are all significant at the 1% level.).

We note that these additional tests for robustness reveal two more interesting facts: first, the small size effect is clearly stronger than the high BE/ME effect in Japan. This can be judged by 1) the larger positive alphas in the smallest portfolio, the second-smallest portfolio (portfolio 24 in Table 4), and the third-smallest portfolio (portfolio 23 in Table 4). On the other hand, very different results were obtained for the BE/ME-ranked portfolios: little difference can be seen among the alphas for the higher- and lower- BE/ME portfolios, as shown in Table 5. Second, this interesting fact can also be judged by 2) the lower average positive alpha of 0.68 percent in the case of the 25 BE/ME ranked portfolio returns in Table 5 than that of 0.79 percent in the case of the 25 size-ranked portfolio returns in Table 4.[5] Next, as to the second additional interesting fact, the Fama–French model generally cannot capture the variation of the returns of the BE/ME-ranked portfolios well in Japan, even if the two additional factors of momentum and reversal are added. This is understood from the average adjusted R-squared value of 0.73 in the case of the 25 BE/ME-ranked portfolio returns, which is lower than that of 0.84 in the case of the 25 size-ranked portfolio returns (These two R-squared values are calculated by using the figures in Tables 5 and 4 respectively). We conjecture that this is because of the weaker explanatory power of the HML factor in Japan than in the USA; we can recognize that the statistical significance of the HML factor loadings in Japan shown in Table 2 is rather weaker than that in the USA shown in Table 1.

Furthermore, we also present the yearly comparison results between the USA and Japan, regarding the annual returns of $R_M - R_f$, SMB, and HML, from 1982 to 2004, in Table 6. From Table 6, regarding the differences in the Fama–French factors, we understand that the SMB factor return is higher in Japan than in the USA, although the HML factor return is almost the same in both

[5] The average values of 0.68 percent and 0.79 percent are calculated by using the values of all alphas in Table 5 and Table 4, respectively.

Table 3
Five-factor regressions for simple monthly percentage excess returns on 25 portfolios formed on size and BE/ME: the case of Japan, from 10/1981 to 4/2005, 283 months

	Book-to-market equity (BE/ME) quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
Regression: $R_{i,t}-R_{f,t}=\alpha_i+b_i(R_{M,t}-R_{f,t})+s_iSMB_t+h_iHML_t+w_iWML_t+d_iUMD_t+\varepsilon_{i,t}$										
	α					$t(\alpha)$				
Small	1.32 **	0.99 **	0.89 **	1.23 **	1.30 **	5.68	5.36	4.50	6.14	5.61
2	0.90 **	0.71 **	0.56 **	0.41 **	0.48 **	4.78	4.21	3.69	3.00	3.31
3	0.76 **	0.52 **	0.52 **	0.57 **	0.56 **	4.70	3.27	2.79	3.89	3.78
4	0.64 **	0.42 *	0.53 **	0.60 **	0.73 **	3.84	2.56	3.52	3.67	4.74
Big	0.58 **	0.76 **	0.69 **	0.89 **	0.76 **	3.58	4.74	4.92	5.71	5.26
	b					$t(b)$				
Small	1.05 **	0.92 **	0.89 **	0.94 **	0.95 **	22.57	19.68	23.11	21.58	18.73
2	0.90 **	0.93 **	0.91 **	0.94 **	0.92 **	17.35	23.17	19.21	27.63	17.97
3	0.95 **	0.91 **	0.85 **	0.92 **	0.92 **	19.94	20.24	21.84	23.48	17.69
4	0.92 **	0.95 **	0.90 **	0.87 **	0.95 **	17.74	18.82	18.03	17.12	20.10
Big	0.91 **	0.95 **	0.89 **	0.95 **	0.91 **	24.28	28.65	27.05	25.01	26.89
	s					$t(s)$				
Small	1.23 **	1.21 **	1.12 **	0.95 **	0.96 **	16.39	27.32	17.48	18.87	17.65
2	1.01 **	0.93 **	0.95 **	0.94 **	0.89 **	13.21	20.98	25.88	31.03	19.15
3	0.79 **	0.78 **	0.76 **	0.65 **	0.77 **	13.67	17.29	17.75	15.40	19.16
4	0.49 **	0.46 **	0.40 **	0.40 **	0.48 **	9.47	10.21	7.49	8.23	10.63
Big	-0.09	-0.23 **	-0.18 **	-0.40 **	-0.17 **	-1.54	-4.80	-4.53	-7.03	-3.20
	h					$t(h)$				
Small	-0.41 **	0.05	0.14	0.23 *	0.41 **	-3.56	0.66	1.40	2.04	4.41
2	-0.51 **	0.09	0.18 **	0.31 **	0.50 **	-3.58	1.02	2.80	4.07	6.67
3	-0.19 *	0.08	0.14	0.36 **	0.64 **	-2.13	0.85	1.65	4.94	9.32
4	-0.17	0.13	0.22 **	0.26 **	0.54 **	-1.47	1.08	2.91	3.03	6.88
Big	-0.63 **	-0.33 **	0.09	0.34 **	0.81 **	-6.08	-4.13	1.04	3.48	10.19

	w					*t*(*w*)				
Small	-0.24 *	0.08	0.15	-0.04	-0.15	-2.52	1.17	1.60	-0.41	-1.58
2	-0.16	0.11	0.18 **	0.17 **	0.03	-1.79	1.38	3.20	2.94	0.45
3	0.38 **	0.28 **	0.14	0.09	0.25 **	4.12	3.83	1.88	1.39	4.26
4	0.37 **	0.23 **	0.15 *	0.06	0.15 *	4.15	2.86	2.15	0.90	2.06
Big	0.11	0.04	0.11	-0.03	0.10	1.29	0.68	1.47	-0.44	1.57
	d					*t*(*d*)				
Small	-0.26 **	-0.05	-0.08	-0.08	-0.15 *	-2.99	-1.52	-1.97	-1.69	-2.24
2	-0.15 **	-0.06	-0.10 *	-0.04	-0.11 *	-2.95	-1.21	-2.04	-0.97	-2.16
3	-0.02	-0.01	-0.04	-0.02	-0.06	-0.51	-0.32	-0.78	-0.42	-1.25
4	0.00	-0.07	-0.08	-0.05	-0.05	-0.07	-1.74	-1.56	-1.32	-1.49
Big	-0.06	-0.12 **	-0.08	-0.07	-0.10 *	-1.44	-2.94	-1.89	-1.78	-2.05
	Adj.R^2					*s*(*e*)				
Small	0.84	0.86	0.84	0.84	0.84	3.93	3.11	3.17	3.18	3.38
2	0.83	0.86	0.88	0.90	0.88	3.42	2.76	2.51	2.28	2.55
3	0.82	0.84	0.82	0.85	0.86	3.04	2.75	2.83	2.50	2.64
4	0.81	0.82	0.80	0.79	0.84	2.84	2.68	2.69	2.67	2.58
Big	0.84	0.84	0.80	0.82	0.82	2.57	2.39	2.39	2.45	2.40

HML denotes the high-minus-low factor, which is calculated using the Japanese data, of the Fama–French (1993) model, and *SMB* denotes the small-minus-big factor, which is calculated using the Japanese data, of the Fama–French (1993) model, respectively. *WML* denotes the reversal factor, which is calculated using the Japanese data, of Chan et al. (1998), and *UMD* denotes the momentum factor, which is calculated using the Japanese data, of Chan et al. (1998), respectively. *t* (coefficient) denotes the *t*-value of the coefficient, and the *t*-values are adjusted using the Newey–West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. Adj.R^2 denotes adjusted *R*-squared values, and *s*(*e*) denotes standard errors of the regression. ** and * attached to the coefficients denote the statistical significance of the coefficients at the 1% and 5% level, respectively. The sample period is from October 1981 to April 2005.

Table 4
Five-factor regressions for simple monthly percentage excess returns on 25 portfolios formed on size: the case of Japan, from 10/1981 to 7/2004, 274 months

Regression: $R_{i,t} - R_{f,t} = \alpha_i + b_i(R_{M,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + w_i WML_t + d_i UMD_t + \varepsilon_{i,t}$

Portfolio	α	b	s	h	w	d	Adj.R^2	$s(e)$
Biggest-size port.	0.77 **	0.94 **	-0.45 **	-0.10	0.01	-0.09 *	0.86	2.18
t-statistic	4.58	27.28	-7.86	-1.05	0.08	-2.55		
Size-2 port.	0.76 **	0.93 **	-0.13 **	0.13	0.00	-0.08 *	0.84	2.17
t-statistic	5.76	27.31	-2.98	1.59	0.07	-2.22		
Size-3 port.	0.82 **	0.92 **	-0.03	0.11 *	0.04	-0.10 **	0.85	2.11
t-statistic	7.06	22.47	-0.68	2.04	0.73	-2.62		
Size-4 port.	0.88 **	0.92 **	0.17 **	0.06	0.23 **	-0.08	0.81	2.51
t-statistic	4.51	21.88	3.58	0.85	3.40	-1.95		
Size-5 port.	0.66 **	0.96 **	0.23 **	0.13	0.21 **	-0.05	0.83	2.43
t-statistic	4.66	22.87	5.08	1.39	2.72	-1.60		
Size-6 port.	0.59 **	0.96 **	0.34 **	0.25 *	0.19 *	-0.03	0.82	2.57
t-statistic	4.07	22.08	6.23	2.38	2.30	-0.82		
Size-7 port.	0.75 **	0.87 **	0.42 **	0.20 **	0.21 **	-0.05	0.82	2.45
t-statistic	4.77	15.55	11.40	2.71	3.59	-1.16		
Size-8 port.	0.59 **	0.92 **	0.48 **	0.22 *	0.20 **	-0.09 *	0.82	2.63
t-statistic	3.65	19.72	10.68	2.59	3.14	-2.24		
Size-9 port.	0.50 **	0.95 **	0.50 **	0.12	0.16 *	-0.06	0.82	2.74
t-statistic	3.73	16.25	8.73	1.60	2.24	-1.14		
Size-10 port.	0.67 **	0.92 **	0.61 **	0.19	0.21 *	-0.01	0.80	2.96
t-statistic	3.48	19.41	11.03	1.87	2.30	-0.29		
Size-11 port.	0.60 **	0.91 **	0.65 **	0.17 **	0.25 **	-0.04	0.84	2.64
t-statistic	3.74	17.75	16.57	2.65	4.62	-0.99		
Size-12 port.	0.81 **	0.92 **	0.72 **	0.23 *	0.27 **	0.00	0.79	3.13
t-statistic	4.14	19.29	14.78	2.51	3.28	0.09		
Size-13 port.	0.55 **	0.91 **	0.78 **	0.22 **	0.21 **	-0.01	0.86	2.53
t-statistic	3.12	21.57	19.06	2.69	3.25	-0.13		

Size-14 port.	0.54 **	0.87 **	0.83 **	0.18 *	0.20 **	-0.02	0.87	2.46
t-statistic	3.57	24.12	17.81	2.48	3.04	-0.54		
Size-15 port.	0.61 **	0.93 **	0.86 **	0.27 **	0.17 **	-0.08 *	0.88	2.45
t-statistic	4.56	24.42	21.17	5.42	2.91	-2.14		
Size-16 port.	0.64 **	0.93 **	0.90 **	0.10	0.04	-0.10	0.88	2.63
t-statistic	4.12	22.46	22.69	1.12	0.52	-1.82		
Size-17 port.	0.42 *	0.93 **	0.88 **	0.23 **	0.11	-0.09	0.87	2.64
t-statistic	2.48	20.10	19.44	2.75	1.27	-1.79		
Size-18 port.	0.72 **	0.95 **	0.99 **	0.20 **	0.23 **	-0.03	0.89	2.55
t-statistic	4.68	23.31	21.37	2.63	3.22	-0.64		
Size-19 port.	0.94 **	0.87 **	1.06 **	-0.03	-0.02	-0.09	0.81	3.57
t-statistic	4.31	15.16	12.03	-0.22	-0.25	-1.85		
Size-20 port.	0.47 **	0.90 **	0.94 **	0.08	-0.05	-0.16 **	0.88	2.64
t-statistic	3.30	21.81	27.10	1.10	-0.72	-3.49		
Size-21 port.	0.90 **	0.94 **	1.06 **	0.12	0.07	0.00	0.89	2.62
t-statistic	5.97	25.74	23.56	1.86	1.06	-0.13		
Size-22 port.	0.74 **	0.93 **	1.02 **	0.13	-0.07	-0.15 **	0.86	3.11
t-statistic	3.63	18.06	16.16	1.52	-0.79	-3.10		
Size-23 port.	1.21 **	0.92 **	1.11 **	0.01	-0.08	-0.10 *	0.82	3.58
t-statistic	5.61	21.03	23.15	0.16	-0.90	-1.99		
Size-24 port.	1.38 **	0.98 **	1.12 **	0.06	-0.06	-0.20 **	0.84	3.57
t-statistic	5.73	22.09	17.97	0.53	-0.55	-3.35		
Smallest-size port.	2.16 **	1.05 **	1.28 **	0.16	-0.08	-0.25 **	0.76	5.16
t-statistic	5.82	16.04	10.82	0.99	-0.44	-2.70		

HML denotes the high-minus-low factor, which is calculated using the Japanese data, of the Fama–French (1993) model, and *SMB* denotes the small-minus-big factor, which is calculated using the Japanese data, of the Fama – French (1993) model, respectively. *WML* denotes the reversal factor, which is calculated using the Japanese data, of Chan et al. (1998), and *UMD* denotes the momentum factor, which is calculated using the Japanese data, of Chan et al. (1998), respectively. *t* (coefficient) denotes the *t*-value of the coefficient, and the *t*-values are adjusted using the Newey –West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. Adj.R^2 denotes adjusted *R*-squared values, and *s*(*e*) denotes standard errors of the regression. ** and * attached to the coefficients denote the statistical significance of the coefficients at the 1% and 5% level, respectively. The sample period is from October 1981 to July 2004.

countries (See the 'Mean' annual return value in Table 6.). Furthermore, with regard to the market factor return, $R_M - R_f$, this is higher in the USA than in Japan. Therefore, the simple comparisons in Table 6 also suggest that the effects of the Fama–French (1993) three factors are different in the USA and Japan.

5 Conclusions

This paper has empirically investigated Jensen's (1968) alphas in Japan. Our research, following the methodology of Fama and French (1993, 1996) and Chan et al. (2001), derived new evidence from Japan. All our new evidence and implications are summarized as follows.

- First, in contrast to the US evidence, in Japan, positive alphas remain after Fama and French's three factors are applied to excess stock returns. The statistically significant positive alphas are observed in all Fama–French (1993) type 25 portfolios formed on size and BE/ME in our tests using Japanese data.
- Furthermore, the positive alphas remain even if five factors (Fama and French's three factors, and momentum and reversal factors) are applied to excess stock returns in Japan. Again, in Japan, the statistically significant positive alphas are observed in our tests using all Fama–French (1993) type 25 portfolio data formed on the basis of size only, on the basis of BE/ME only, and on the basis of both size and BE/ME.

Our empirical results summarized above demonstrate that the evidence for Japan is very different from the US evidence. Therefore, our study suggests the possibility that the empirical results or stylized facts derived in the influential existing papers are not always robust in other countries. From a very broad viewpoint, the possible source of the different results may be the differences in financial education, cultures, preferences, market systems, structures of economy, among others. However, specifying the cause is far beyond the scope of this paper; based on our evidence from Japan, our task in the future is to keep examining the empirical evidence more carefully and to accumulate the results and interpretations for international markets to deepen our knowledge of the interesting, and sometimes puzzling, real-world financial markets.

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Table 5
Five-factor regressions for simple monthly percentage excess returns on 25 portfolios formed on BE/ME: the case of Japan, from 10/1981 to 7/2004, 274 months

Regression: $R_{i,t} - R_{f,t} = \alpha_i + b_i(R_{M,t} - R_{f,t}) + s_i SMB_t + h_i HML_t + w_i WML_t + d_i UMD_t + \varepsilon_{i,t}$

Portfolio	α	b	s	h	w	d	Adj.R^2	$s(e)$
Highest-BE/ME port.	0.58 *	1.05 **	0.50 **	0.49 **	-0.39 **	-0.28 **	0.80	3.68
t-statistic	2.57	21.74	5.73	4.41	-3.07	-3.26		
BE/ME-2 port.	0.62 **	0.95 **	0.22 *	0.62 **	-0.26 *	-0.12	0.81	2.94
t-statistic	3.73	23.35	2.44	6.42	-2.23	-1.94		
BE/ME-3 port.	0.66 **	0.93 **	0.31 **	0.84 **	0.10	-0.17 **	0.77	3.23
t-statistic	3.52	17.95	5.10	8.74	1.02	-2.87		
BE/ME-4 port.	0.55 **	0.99 **	0.29 **	0.89 **	0.17 *	-0.13	0.76	3.44
t-statistic	3.22	19.11	3.71	6.93	2.05	-1.91		
BE/ME-5 port.	0.59 **	0.98 **	0.24 **	0.58 **	-0.09	-0.16 *	0.74	3.53
t-statistic	3.03	21.10	3.87	4.19	-0.83	-2.31		
BE/ME-6 port.	0.79 **	0.91 **	0.23 *	0.52 **	0.03	-0.16 *	0.69	3.63
t-statistic	3.88	19.88	2.32	4.09	0.23	-2.48		
BE/ME-7 port.	0.84 **	0.98 **	0.12 *	0.70 **	-0.10	-0.12 **	0.78	3.17
t-statistic	4.87	29.74	2.21	5.76	-1.08	-3.06		
BE/ME-8 port.	0.44 *	0.96 **	0.17 **	0.88 **	0.10	0.01	0.74	3.42
t-statistic	2.29	22.03	3.17	5.51	1.04	0.17		
BE/ME-9 port.	0.54 **	0.94 **	0.24 **	0.59 **	0.08	-0.09	0.76	3.14
t-statistic	2.96	21.71	3.89	4.94	0.94	-1.64		
BE/ME-10 port.	1.09 **	1.00 **	0.05	0.41 **	0.05	-0.09	0.67	3.86
t-statistic	5.37	20.46	0.70	2.74	0.41	-1.05		
BE/ME-11 port.	0.87 **	0.96 **	0.06	0.45 **	-0.04	-0.04	0.73	3.26
t-statistic	3.87	21.77	0.44	3.94	-0.50	-0.61		
BE/ME-12 port.	0.38	0.87 **	0.22 **	0.37 **	0.09	-0.13 *	0.71	3.23
t-statistic	1.68	16.19	3.36	3.37	1.43	-2.40		
BE/ME-13 port.	0.89 **	0.91 **	0.03	0.39 *	0.09	-0.10	0.64	3.72
t-statistic	3.89	20.52	0.31	2.19	0.57	-1.43		

BE/ME-14 port.	0.65 **	0.89 **	0.11	0.36 *	0.24 *	-0.16 **	0.68	3.42
t-statistic	2.77	20.64	1.39	2.21	2.32	-2.67		
BE/ME-15 port.	0.69 **	0.89 **	0.12 *	0.13	0.06	0.01	0.73	3.03
t-statistic	3.39	23.16	2.32	1.32	0.74	0.11		
BE/ME-16 port.	0.68 **	0.90 **	0.06	0.30 **	0.19 *	-0.05	0.69	3.26
t-statistic	3.62	15.87	1.06	3.11	2.50	-0.89		
BE/ME-17 port.	0.87 **	0.90 **	0.02	0.03	0.08	-0.11	0.64	3.76
t-statistic	3.45	13.55	0.22	0.23	0.73	-1.94		
BE/ME-18 port.	0.55 *	0.94 **	0.00	0.19	0.04	-0.11 *	0.70	3.37
t-statistic	2.49	16.33	-0.03	1.59	0.38	-2.35		
BE/ME-19 port.	0.84 **	0.88 **	-0.12	-0.25	0.10	-0.22 **	0.70	3.36
t-statistic	3.41	17.52	-1.26	-1.69	0.96	-3.74		
BE/ME-20 port.	0.62 **	0.86 **	0.09	-0.23 *	0.00	0.02	0.75	2.90
t-statistic	2.90	21.30	1.60	-2.42	0.04	0.43		
BE/ME-21 port.	0.76 **	0.94 **	0.12	-0.26	0.16	-0.06	0.74	3.28
t-statistic	4.15	16.66	1.51	-1.81	1.25	-1.05		
BE/ME-22 port.	0.88 **	0.95 **	0.05	-0.37 **	0.09	-0.01	0.78	3.04
t-statistic	4.90	20.26	0.82	-4.26	0.94	-0.09		
BE/ME-23 port.	0.65 **	0.90 **	0.09	-0.36 **	0.28 **	-0.05	0.74	3.33
t-statistic	3.05	20.92	1.21	-3.15	3.49	-0.84		
BE/ME-24 port.	0.44 *	0.90 **	0.17 *	-0.44 **	0.35 **	-0.11	0.79	3.06
t-statistic	2.47	20.80	2.53	-4.85	4.08	-1.82		
Lowest-BE/ME port.	0.54	0.87 **	0.03	-0.66 **	0.10	0.03	0.69	3.83
t-statistic	1.84	16.48	0.34	-3.75	0.82	0.68		

HML denotes the high-minus-low factor, which is calculated using the Japanese data, of the Fama–French (1993) model, and *SMB* denotes the small-minus-big factor, which is calculated using the Japanese data, of the Fama–French (1993) model, respectively. *WML* denotes the reversal factor, which is calculated using the Japanese data, of Chan et al. (1998), and *UMD* denotes the momentum factor, which is calculated using the Japanese data, of Chan et al. (1998), respectively. *t* (coefficient) denotes the *t*-value of the coefficient, and the *t*-values are adjusted using the Newey–West (1987) heteroskedasticity and autocorrelation consistent covariance matrix. Adj.R^2 denotes adjusted *R*-squared values, and $s(e)$ denotes standard errors of the regression. ** and * attached to the coefficients denote the statistical significance of the coefficients at the 1% and 5% level, respectively. The sample period is from October 1981 to July 2004.

Table 6
Annual three-factor explanatory returns: R_M–R_f, SMB, and HML,
23 years from 1982 to 2004: the case of the USA and Japan

	USA			Japan				
Year	R_M–R_f	SMB	HML	R_M–R_f	SMB	HML	WML	UMD
1982	10.35	7.27	9.76	-0.378	-3.727	-4.959	9.875	-5.963
1983	12.65	11.13	15.37	16.727	19.844	-5.346	14.492	19.735
1984	-5.39	-7.95	18.53	19.156	25.640	-11.887	7.046	5.464
1985	20.88	0.3	0.24	8.940	30.541	27.880	-34.078	-21.284
1986	9.89	-9.15	7.79	37.714	-22.053	23.370	-34.517	23.986
1987	1.16	-8.54	-3.11	8.933	37.214	18.537	-13.113	-10.054
1988	10.53	4.99	12.02	28.872	5.734	22.480	-16.374	7.725
1989	17.76	-10.1	-4.17	15.919	31.601	3.239	-8.622	9.354
1990	-12.28	-14.98	-11.78	-50.763	14.628	14.833	-5.430	0.919
1991	24.91	12.26	-10.81	-5.649	11.712	2.570	-11.086	-13.918
1992	6.41	6.89	20.35	-27.856	-3.493	8.234	-5.592	-1.095
1993	8.34	5.59	16.52	10.782	0.222	10.481	0.250	-17.682
1994	-4.12	-1.41	-0.81	8.066	8.965	11.161	-18.676	-8.224
1995	25.57	-5.6	0.92	2.972	5.595	-0.437	-7.471	-12.288
1996	14.79	-1.44	1.98	-5.629	-9.035	-1.176	3.704	-14.205
1997	22.66	-3.82	8.92	-20.771	-44.163	-6.998	15.445	52.720
1998	18.09	-21.23	-9.49	-5.243	17.082	10.498	-3.993	-36.607
1999	19.09	13.34	-28.98	48.600	-13.153	-23.801	23.250	12.435
2000	-15.74	-0.18	61.14	-27.339	6.213	27.640	-11.310	-6.598
2001	-13.54	19.75	15.28	-19.428	16.252	13.930	-15.922	0.868
2002	-22.97	4.26	12.22	-17.567	7.874	8.598	-11.083	-1.972
2003	28.52	20.17	3.21	23.621	31.963	11.173	-30.431	-31.315
2004	11.44	5.03	8.16	11.929	24.363	17.895	-12.748	10.599
Mean	8.217	1.156	6.229	2.678	8.688	7.735	-7.234	-1.626
Std. Dev.	14.435	10.586	16.747	23.073	19.207	13.028	15.092	19.087
Negative	6	11	7	10	6	7	16	13

$R_M - R_f$ is the return of the market portfolio. *SMB* is the difference between the annual average returns on the small-stock portfolios and the big-stock portfolios. *HML* is the difference between the annual average returns on the high-book-to-market portfolios and the low-book-to-market portfolios. Mean is the mean value of the annual returns. Std. Dev. denotes the standard deviation of the annual returns. Negative is the number of the negative annual returns. The sample used for the calculation of the annual returns are monthly data from January 1982 to December 2004.

were helpful in developing the ideas and important intuitions underlying the empirical analysis in this paper. Finally, we are also very much grateful to Professor Masamitsu Ohnishi (Osaka University) for inviting us to this important memorable volume.

Appendix A Data Sources and Variable Construction

The whole sample period of data analyzed in this paper is from October 1981 to April 2005. The individual data series are the risk-free percentage rate: R_f, market portfolio percentage return: R_M, Fama and French's (1993) small-minus-big factor percentage return: SMB, Fama and French's (1993) high-minus-low percentage return: HML, Chan et al.'s (1998) momentum factor percentage return: UMD, and Chan et al.'s (1998) reversal factor percentage return: WML.

In more detail, first, R_f is the gensaki rate from the Japan Securities Dealers Association from October 1981 to May 1984 and the one-month median rate on negotiable-time certificates of deposit (CD) from the Bank of Japan from June 1984 to April 2005. This is because before June 1984, one-month CD rates are not available. Thus, following Hamao (1988), we specified the gensaki rate as the risk-free rate before June 1984.

Second, the market return R_M is the value-weighted return of all stocks in the 1st Section of the Tokyo Stock Exchange (TSE), provided by the Japan Securities Research Institute.

Third, the factor returns of SMB and HML for Japan are formed following Fama and French (1993). (We also reexamined the case of the USA in this paper. The market excess return, SMB and HML factor returns for the US market were provided by Professor Kenneth French.) Namely, at the end of September of each year t (from 1981 to 2004), TSE 1st Section stocks are first allocated to two groups, small (S) or big (B), based on whether their September market equity (ME, stock price times shares outstanding) is below or above the median of ME for TSE 1st Section stocks. Next, TSE 1st Section stocks are allocated in an independent sort to three book-to-market equity (BE/ME) groups (low, medium, or high; L, M, or H) based on breakpoints for the bottom 30 percent, middle 40 percent, and top 30 percent of values of BE/ME for TSE 1st Section stocks, where BE is the book value of equity. The BE/ME ratio used to form portfolios in September of year t is the book common equity for the fiscal year $t-1$, divided by the market equity at the end of March in calendar year t. Following Fama and French (1993), we do not use negative BE firms when calculating the breakpoints for BE/ME or when forming the size-BE/ME portfolios; and only firms with ordinary common equity are included in the tests. This means that Real Estate Investment Trusts (REITs) and units of beneficial interest are excluded. By these procedures, six size-BE/ME portfolios (S/L, S/M, S/H, B/L, B/M, B/H) are defined as the intersections of the two ME and three BE/ME groups. Value-weighted monthly returns on the portfolios are then calculated from the following October to the next September. We rebalanced the portfolios every September following Fama and French's (1993) suggestion: "We calculate returns beginning in July of year t to be sure that book equity for year t – 1 is known (Fama and French 1993, p.9)." In Japan, the fiscal year for most companies closes not at the end of December as in the USA but at the end of March; that is, the end of the fiscal year in Japan is three months later than in the USA. Thus, we calculate returns not from July but from October of year t to September of year $t + 1$, after rebalancing portfolios in every September of year t, to be sure that book equity for the most recent fiscal year is known in the Japanese market. SMB is the difference, each month, between the average of the returns on the three small-stock portfolios (S/L, S/M, and S/H) and the average of the returns on the three big-stock portfolios (B/L, B/M, and B/H), while HML is the difference between the average of the returns on the two high-BE/ME portfolios (S/H and B/H) and the average of the returns on the two low-BE/ME portfolios (S/L and B/L). The 25 size-BE/ME portfolios, which are also used for the analysis in this paper, are formed in a similar manner as the above six size-BE/ME portfolios used to construct the SMB and HML factors. (The returns of 25 size-BE/ME portfolios for the US market were also provided by Professor Kenneth French.)

Finally, regarding the momentum factor return, UMD, and the reversal factor return, WML, we followed Chan et al. (1998) for the construction using the Japanese data. In particular, for the construction of UMD, we first reformed portfolios every six months beginning in July of each year according to the attributes of the past seven months' returns, from seven months before to one month before (Chan et al. (1998) denoted this attribute $R(-7, -1)$), while for the construction of WML, we reformed portfolios every July, according to the attributes of the past 49 months' returns, from 60 months before to 12 months before (Chan et al. (1998) denoted this attribute $R(-60, -12)$). We note that Chan et al. (1998) formed portfolios every April to be sure that the information of the attributes (past returns, here) are known in the US market. Like the construction of HML and SMB above, we delayed the portfolio formation time by three months in our case, taking into consideration the above-mentioned fact that the end of the fiscal year in Japan is generally three months later than in the USA. In our portfolio construction, following Chan et al. (1998), we formed five portfolios by allocating the stocks with the lowest and highest values of the attributes to Portfolios 1 and 5, respectively. Using the above procedure, we obtain five portfolios ranked by the attribute $R(-7, -1)$ and five portfolios ranked by $R(-60, -12)$, respectively. The quintile breakpoints are obtained from the distribution of the attributes for the TSE-listed stocks. Next, we compute the equally weighted return on each quintile portfolio; for $R(-7, -1)$-ranked portfolios, we calculate the subsequent six-month return, and for $R(-60, -12)$-ranked portfolios, we calculate the subsequent 12-month return. The mimicking portfolio returns, UMD and WML here, are then calculated each month: UMD is computed by deducting the calculated subsequent return of the lowest-$R(-7, -1)$ portfolio 1 from the return of the highest-$R(-7, -1)$ portfolio 5, and WML is calculated each month by deducting the subsequent return of the lowest-$R(-60, -12)$ portfolio 1 from the return of the highest-$R(-60, -12)$ portfolio 5, respectively.

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