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Information Uncertainty Risk and Seasonality in International Stock Markets

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Abstract

A parsimonious two-factor model containing the market risk factor and a risk factor related to earnings information uncertainty has been developed to explain the seasonal regularity of January in international stock markets. This two-factor model shows apparently stronger power in explaining time-series behavior of stock returns and the cross-section of average stock returns in all major developed countries than do the competing models. Furthermore, the arbitrage residual return in January, which is the difference in the average residual returns between the smallest and largest size portfolios, is statistically insignificant in all the countries. These results indicate that the risk factor related to earnings information uncertainty plays a special role in explaining the seasonal pattern of stock returns in January, and that January might be a month that potentially tends to differentially reward stocks having uncertain earnings information. It could be argued, therefore, that large returns in January might be a risk premium for taking information uncertainty risk concerning earnings and unexpected earnings surprises faced at the earnings announcement, and that the previously reported strong January seasonality in stock returns might result from the use of misspecified models in adjusting for risk.

Keywords Earnings forecast errors; Earnings information uncertainty risk; International stock returns; January effect; Risk factor models

JEL Classification: G14, G12

1. Introduction

"The January effect" refers to unusually high returns commonly observed in January. It is significant in that it involves a distinctive behavior of stock prices, where firms earn a higher return in January than in any other month, and smaller firms in particular do better than larger firms do in January. Even after investors have

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become informed that high returns in January can be earned persistently, this January seasonality still has been observed for a long period of time. Lakonishok and Smidt (1988) report evidence of persistently anomalous returns in January for almost 90 years.[1] The January effect is perhaps the strongest empirical inconsistency with market efficiency as well as equilibrium asset pricing. If the markets are efficient, investors should eliminate the predictable abnormal returns in January by readjusting their portfolios, and any seasonal pattern in January should not exist for such a long period of time.

This seasonal behavior of stock prices in January has been observed in stock markets throughout the world. The January effect was first reported by Wachtel (1942). In 1976, Rozeff and Kinney (1976) reported on January seasonality in stock returns. Keim (1983) and Roll (1983) point out that the January effect is especially prominent in small firms. Numerous researchers also discuss the January seasonality in the international stock markets. Using data from 17 industrialized countries, Gultekin & Gultekin (1983) find a much higher return in January than in non-January months for all 17 countries. Brown *et al.* (1983), using Australian data, Berges *et al.* (1984), using Canadian data, Kato & Schallheim (1985), using Japanese data, and Reinganum & Shapiro (1987), using British data, also report the seasonality of stock returns in January.

Although numerous articles have suggested plausible explanations for the January effect, there is little consensus in the literature concerning the cause of such a seasonal pattern. These explanations fall into one of two categories. One category is the group that suggests non-risk-based explanations and regards the January effect as evidence of market inefficiency. This group includes the tax-loss selling hypothesis, the portfolio rebalancing hypothesis (window dressing hypothesis),[2] and a microstructure explanation.[3] The other is the group that suggests risk-based explanations and is consistent with the joint framework of efficient market hypotheses and equilibrium asset pricing models. This second group believes that the high return in January simply results from using misspecified asset pricing models and risk mismeasurement.

[1]They used the Dow Jones Industrial Average from 4 January 1897 to 11 June 1986.

[2]The portfolio rebalancing hypothesis indicates that institutional investors tend to sell losers (usually small stocks) and buy winners (usually large stocks) at the end of the year in the process of rebalancing their portfolios to make a window dressing and tend to buy back the losers at the turn of the year (see Lakonishok and Smidt, 1984; Ritter, 1988; Ritter & Chopra, 1989).

[3]A microstructure explanation suggests that there are systematic tendencies for closing prices to be recorded at the bid in the last trade in December and at the ask in early January. These tendencies cause the return to appear spuriously high in the first few days of January, even if the bid-ask spread is not changed. The tendency for stocks to be at the bid price for the last trade in December is more pronounced for small and low-priced stocks. Therefore, the relatively large returns for small firms on the first several trading days of the year are partly attributable to the trading pattern bias (see Keim, 1989; Dyl & Maberly, 1992).

Among the first group, the most extensively investigated explanation is the tax-loss selling hypothesis. This hypothesis suggests that toward the end of the calendar year tax-motivated investors sell off shares that have declined in price to realize capital losses and to take advantage of tax benefits. This selling-off creates downward pressure on stock prices. After the turn of the year, prices bounce up as the selling pressure is relieved. As the stock prices of small firms tend to be more volatile than those of large firms, small firms' stocks are more likely to have capital losses and, therefore, might be candidates for tax-loss selling. Despite its popularity, there are more empirical results inconsistent with the tax-loss selling hypothesis rather than supporting the hypothesis. For example, Jones *et al.* (1987) study the period 1871–1917, before the introduction of income taxes in the USA, and reported that the January effect, which existed long before income taxes, is not significantly different from the January effect found after the introduction of income taxes. Berges *et al.* (1984) reported that January returns in Canada exceed returns for other months of the year before and after the introduction of a capital gains tax in 1973. Brown *et al.* (1983) found that Australian stocks also show higher returns than in any other month, even though the fiscal year-end month in Australia is not January. The January seasonality is also found in countries such as Japan and Korea where there is no tax benefit for capital losses.[4] Kim (2006) extensively investigated the tax-loss selling hypothesis using US stocks, and reported that even after adjusting raw returns for the tax-loss selling effect, the systematic pattern in stock returns across firm size and a significantly high return in January are still observed in US stocks.

The second group advocating risk-based explanations believes that such an arbitrage profit opportunity cannot exist for such a long period of time and that it is a result of the risk-return trade-off. They argue that the unusually high return in January is a result of using misspecified asset pricing models and/or mismeasurement of risk. Many researchers attempted to provide risk-based explanations for the January effect.[5] However, the models that they used in measuring abnormal returns failed to capture the anomalous behavior of stock returns in January. That is, they failed to identify a risk factor that appropriately reflected the level of risk around the turn of the year. Kim (2006) examined if various risk factor models such as the one-factor model (CAPM), Fama & French's (1993) three-factor model, and a model with a combination of Fama and French's three factors plus Carhart's (1997) momentum factor can explain the January effect but found that all these models failed to explain it. However, Kim (2006) suggests a parsimonious two-factor model that explains the January effect in the US stock markets well. This two-factor model

[4]Kato & Schallheim (1985) found a significant January effect, even though there is no tax on capital gains for individual investors in Japan, nor is there a tax benefit for capital losses. There are taxes on capital gains for Japanese corporations. However, they can choose their fiscal year arbitrarily. Kim & Shin (2006) report a prominent January seasonality in Korea, even though Korea has no taxes for capital gains and no tax benefit for capital losses.

[5]See Tinic & West (1984), Chan *et al.* (1985), and Rogalski and Tinic (1986).

contains the market risk factor and a risk factor related to earnings information uncertainty. Kim argues that the high return in January is a compensation for bearing risk related to information uncertainty concerning earnings around the turn of the year.

The purpose of the present paper is to construct and suggest a common risk factor related to earnings information uncertainty to account for the January effect in international stock markets, as Kim (2006) did with US stock returns. The argument for justifying this common risk factor is that for firms with December fiscal year-ends, earnings information uncertainty is increased in December because of the impending release of important fiscal year-end accounting information. This uncertainty depresses stock prices. When this uncertainty is resolved in January, stock prices rise. Not only do firms with a December fiscal year-end have increased earnings information uncertainty in December, but firms with a non-December fiscal year-end also have this uncertainty. The reason is that because the majority of firms, especially industry leaders, have a 31 December fiscal year-end, earnings-related information uncertainty from firms with December fiscal year-ends spills over to firms with non-December fiscal year-ends.

The standard deviation of the earnings forecast errors (FESTD) is used as a proxy for earnings information uncertainty or earnings quality, as in Kim (2006). The forecast errors are computed as the difference between the actual earnings and the forecasted (fitted) earnings.[6] When actual earnings are greatly deviated from forecast earnings (or expectation), investors face increased information uncertainty regarding a firm's future earnings and cash flow and, therefore, greater risk. In this case, when actual earnings are announced, there is a greater possibility that investors will face large unexpected earnings surprises (positive or negative). Investors in firms with greater variability in earnings forecast errors would then require greater returns in the next period.

The risk factor for earnings information uncertainty is constructed in a way similar to that in Fama & French (1993). That is, the risk factor is calculated as the return on firms with greater FESTD values minus the return on firms with smaller FESTD values. When this risk factor (FESTD) is combined with the market risk factor, there is a significant improvement in explaining the January effect in all of the samples from eight developed countries (USA, Canada, UK, Japan, Germany, France, Hong Kong, and Australia). This parsimonious two-factor model (the

[6]The reason that we use the statistical earnings forecasts rather than financial analysts' earnings forecasts is that the standard deviation of financial analysts' earnings forecasts does not have a monotonic positive relation with returns (see Diether *et al.*, 2002; Kim & Kim, 2003). In particular, Diether *et al.* (2002) argue that their evidence is inconsistent with a view that dispersion in analysts' earnings forecasts proxies for risk. Therefore, the standard deviation of financial analysts' earnings forecasts is not appropriate to use as a proxy for information uncertainty under the conventional wisdom that risk comes from uncertainty.

market risk factor and FESTD) performs better than any of the other competing models in explaining January returns.

To investigate whether FESTD is a priced risk factor, the cross-sectional relationship between average returns and the factor loadings or βs on the risk factors using Fama & MacBeth's (1973) two-pass estimation methodology have been estimated. For all the countries, the factor loadings or βs on FESTD have an economically and statistically significant explanatory power for average stock returns and dominate the factor loadings on the other risk factors in explaining the cross-section of stock returns in January. These results indicate that the risk factor related to earnings information uncertainty plays a special role in explaining the seasonal pattern of stock returns in January, and that January might be a month that potentially tends to differentially reward stocks having uncertain earnings information.

The paper is organized as follows. Section 2 describes the data. Section 3 revisits the January effect in each country. Section 4 explains the method of constructing the earnings information uncertainty risk factor. Section 5 describes the empirical results and Section 6 provides concluding remarks.

2. Data

Annual earnings per share data and monthly stock returns of firms in the USA and Canada are obtained from Compustat. Annual earnings per share data of firms in the UK, France, Germany, Japan, Hong Kong, and Australia are obtained from the Worldscope database. The reason that the present study uses annual earnings data is that quarterly earnings data are not available for these countries (only available for the USA). Stock return data are obtained from the Datastream database. The sample period is January 1987 to December 2004. The minimum number of annual earnings per share data needed to compute the FESTD is four. As a result, the numbers of firms used for each country are 5291 for the USA, 842 for Canada, 2083 for the UK, 1026 for France, 946 for Germany, 3406 for Japan, 277 for Hong Kong, and 424 for Australia. Three-month Treasury bill rates of each country are obtained from the Datastream database and are used as a risk-free rate of return.

3. January Effect and Basic Characteristics of Size Portfolios in Each Country

Each year all sample firms in each country are ranked on the market value of their common equity at the end of the year, and then each of the firms is allocated to one of 10 decile equally weighted size portfolios. Therefore, each portfolio is rebalanced annually. Table 1 shows the average raw returns on each of the size portfolios in all months (in Panel A), in January only (in Panel B), and in non-January months (in Panel C) over the period from January 1992 to December 2004. Firms in the USA, Canada, the UK, Japan, and Australia have a strong negative relation between average raw returns and firm size, whereas firms in Germany, France, and

Table 1 Average monthly returns (in %) on 10 decile size portfolios in each country: January 1992 to December 2004

Size portfolio	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
Panel A: All months								
1	3.06	4.56	1.69	1.21	1.90	1.02	3.14	3.38
2	2.20	2.45	0.90	0.61	0.73	0.40	1.90	1.30
3	1.87	1.79	0.85	0.20	1.18	0.25	0.74	1.45
4	1.42	1.54	0.83	0.23	0.63	0.09	0.95	1.25
5	1.27	0.97	0.86	−0.20	0.68	0.03	0.54	0.80
6	0.92	0.83	0.59	−0.06	0.84	0.02	1.01	0.98
7	0.72	0.66	0.60	0.14	0.75	0.06	0.89	0.82
8	0.60	0.58	0.57	0.11	1.11	−0.08	0.51	0.81
9	0.50	0.68	0.65	0.43	0.78	−0.06	1.22	0.57
10	0.31	0.67	0.61	0.60	0.88	0.01	1.09	0.66
P1 − P10	2.75	3.89	1.09	0.62	1.02	1.01	2.06	2.72
Average	1.42	1.69	0.84	0.35	0.95	0.25	1.28	1.34
Panel B: January only								
1	18.31	14.39	6.50	5.13	9.94	6.17	4.91	9.33
2	10.74	7.11	3.85	2.85	4.35	4.38	1.23	4.87
3	7.82	3.85	3.61	3.64	4.84	4.19	1.10	3.74
4	4.31	4.36	3.53	3.39	3.47	3.27	−0.64	5.03
5	3.03	2.50	4.15	3.57	3.62	3.37	−1.46	2.61
6	2.06	2.24	2.69	3.69	4.49	3.50	0.19	2.73
7	1.10	2.18	2.88	3.54	3.97	3.09	−0.3	2.80
8	0.36	1.05	3.16	3.55	4.78	2.56	−1.68	1.66
9	0.36	0.52	2.04	1.78	3.32	1.52	−1.04	0.77
10	0.32	0.79	0.29	1.53	2.65	0.68	−0.82	−0.24
P1 − P10	17.98	13.60	6.22	3.60	7.28	5.50	5.73	9.57
Average	6.04	4.78	3.54	3.30	4.79	3.47	0.66	3.90
Panel C: Non-January months								
1	1.67	3.67	1.25	0.86	1.16	0.55	2.98	2.84
2	1.43	2.03	0.64	0.41	0.40	0.04	1.96	0.98
3	1.33	1.60	0.60	−0.11	0.85	−0.10	0.70	1.25
4	1.16	1.28	0.58	−0.06	0.37	−0.20	1.09	0.91
5	1.11	0.84	0.56	−0.55	0.42	−0.28	0.72	0.63
6	0.82	0.70	0.40	−0.41	0.51	−0.30	1.08	0.82
7	0.69	0.52	0.39	−0.17	0.46	−0.22	1.00	0.64
8	0.63	0.54	0.33	−0.20	0.78	−0.33	0.71	0.74
9	0.52	0.69	0.53	0.31	0.55	−0.20	1.42	0.55
10	0.31	0.66	0.64	0.51	0.71	−0.05	1.26	0.75
P1 − P10	1.36	3.01	0.62	0.35	0.45	0.61	1.72	2.10
Average	1.00	1.41	0.59	0.09	0.61	−0.04	1.33	1.11

Hong Kong have a weak negative relation. However, there is clearly a strong negative relation between average stock returns in January and firm size, and returns in January are higher than non-January returns in all sample countries. In particular, returns in January on the smallest size portfolio are much higher than those on the other size portfolios. Among the eight sample countries, the January effect in the USA is the strongest in that the difference in average January returns between the smallest portfolio and the largest portfolio (P1 − P10) is the greatest (17.89%). Canada (13.60%) has the second strongest January effect. Australia (9.57%), France (7.28%), the UK (6.22%), Hong Kong (5.73%), Japan (5.50%), and Germany (3.60%) follow. We have confirmed that all our sample countries show the strong January effect.

4. Construction of a New Risk Factor: Earnings Information Uncertainty Risk

4.1. Computation of the Proxy for Uncertainty of Earnings Forecasts

This section describes the method of forecasting earnings and computing the FESTD, which is a surrogate of earnings information uncertainty. Within a country, the forecast error (FE) of firm i in year y is defined as

$$FE_{i,y} = Q_{i,y} - E(Q_{i,y}), \tag{1}$$

where $Q_{i,y}$ is the actual earnings (EPS) for firm i in year y and $E(Q_{i,y})$is the forecasted yearly earnings for firm i in year y. To obtain $E(Q_{i,y})$for year y (y = 1988, 1990,…, 2004), within each country we *cross-sectionally* regress $Q_{i,y}$ on $Q_{i,y-1}$ and regard the fitted value of $Q_{i,y}$ as the forecasted earnings, $E(Q_{i,y})$. In the cross-sectional regression (CSR), we assume that the slope and intercept coefficients are constant across firms but time varying over years. Earnings (per share) data are scaled by stock price by dividing the actual earnings by the stock price at the end of the year. Therefore, 17 forecast errors (1988–2004) are obtained for each firm. Then, the FESTD is computed each year by using the most recently available forecast errors (a maximum of nine and a minimum of four forecast errors). Therefore, we obtain the FESTD from 1991 to 2004. The FESTD is regarded as a proxy for the earnings information uncertainty for the year.

There are two main reasons that the CSRs are used to forecast each firm's earnings rather than time-series regressions.[7] The first reason is that there are no sufficient times-series earnings observations to carry out time-series regressions.[8] If time-series regression models are used, a sufficiently large number of time-series

[7]Ball *et al.* (1993) also use the CSR market models to generate residuals (abnormal returns) by assuming non-stationarity of market βs.

[8]Kim (2006) uses quarterly earnings observations of US firms and uses time-series regression to forecast earnings.

observations are needed to obtain reliable estimates. Consequently, the actual testing period is short. For example, if we use 12-yearly observations for a time-series regression model, the testing period is only 6 years from 1999 to 2004 because the first 12 years (from 1987 to 1998) are used to estimate the earnings forecasts and the FESTD. The second reason is that the standard deviation of residuals from CSR could also be a consistent measure of earnings uncertainty like the standard deviation of residuals from time-series regressions. The CSR approach assumes that the regression coefficients are constant across firms but might vary over time. Therefore, the residuals (or forecast errors) from CSR models represent how far the actual earnings of a firm is deviated from the market-wide expectation for a given year. That is, the residuals indicate the distance between actual earnings and the market-wide expectation for the firm. The more the fluctuation in the distance, the higher the uncertainty in earnings, and the greater is the risk for investors. Furthermore, the use of CSR models is more sensible in some circumstances than the use of time-series models because CSR models allow the market-wide slope coefficient to be time-varying, which is sensible in that this coefficient captures the market-wide sensitivity of this year's earnings to last year's, and this sensitivity is governed by time-varying macroeconomic conditions. However, time-series models assume that the sensitivity of this year's earnings to last year's is independent across firms.

4.2. Characteristics of Portfolios Formed by the Standard Deviation of Earnings Forecast Error

At the end of each year, firms are assigned into one of 10 decile portfolios according to the magnitude of their FESTD, and firms are maintained within the same portfolio during the next year. Therefore, portfolios are formed from January 1992 to December 2004. Portfolio returns are then computed with equal weights.

Table 2 shows the average monthly returns, firm size, and the look-ahead standard deviations of earnings and sales growth rates of the 10 FESTD portfolios in each country. Portfolio 1 (Portfolio 10) contains firms with the smallest (largest) FESTD values. The average monthly returns are almost monotonically increasing with the magnitude of the FESTD in all countries. For example, the spreads in average monthly returns between the largest FESTD portfolio and the smallest FESTD portfolio are 2.60% (Portfolio 10) to 0.38% (Portfolio 1) in USA, 2.93% to 0.40% in Canada, 1.25% to 0.17% in the UK, 0.73% to 0.42% in Germany, 1.20% to 0.40% in France, 0.76% to −0.10% in Japan, 1.70% to 1.26% in Hong Kong, and 2.10% to 0.77% in Australia. These results indicate that firms with greater earnings information uncertainty risk have earned higher returns in all countries. As expected, firms with smaller (greater) FESTD are larger (smaller) firms.

To examine whether the FESTD is *a priori* a good proxy for earnings information uncertainty, the standard deviations of the earnings (per share) and sales growth rates

Table 2 Basic characteristics of 10 decile portfolios formed by the standard deviation of earnings forecast errors (FESTD) in each country: January 1992 to December 2004

At the end of each year, firms are assigned to one of 10 decile portfolios according to their FESTD. The ahead-standard deviation is the standard deviation of earnings per shares (or sales growth rates) of each firm over the upcoming 5 years.

FESTD portfolios	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
Panel A: Average monthly return (%)								
1	0.38	0.40	0.17	0.42	0.40	−0.10	1.26	0.77
2	0.58	0.73	0.50	0.26	0.68	−0.08	1.03	0.40
3	0.72	0.77	0.68	0.37	0.93	−0.06	1.04	0.66
4	0.88	1.06	0.72	0.41	0.76	−0.10	1.20	0.52
5	1.06	1.37	0.87	0.46	0.93	−0.11	0.61	0.75
6	1.26	1.07	0.79	0.36	1.14	0.03	0.82	0.46
7	1.37	1.31	1.03	0.46	1.45	0.00	0.83	0.56
8	1.34	1.41	1.25	0.44	1.35	0.29	1.41	1.11
9	1.59	2.01	1.23	0.75	1.45	0.51	1.41	1.40
10	2.60	2.93	1.25	0.73	1.20	0.76	1.70	2.10
P10 − P1	2.22	2.52	1.08	0.30	0.79	0.86	0.44	1.33
Panel B: Firm size (in million in the corresponding country's currency)								
1	7049	3186	3781	2490	3900	8186	14,571	5506
2	6627	2761	2982	3095	2882	3987	5999	3723
3	7273	2318	2287	3326	2035	2913	3122	2890
4	4941	2502	1990	3043	1735	2026	2058	2667
5	3487	1486	1257	2624	2339	1777	1107	2580
6	1807	1481	1232	2357	1739	1856	931	2514
7	1068	905	959	1354	1487	1851	665	1692
8	480	534	752	959	1397	1798	390	1386
9	178	323	541	666	969	1932	388	688
10	65	125	302	325	495	1261	592	117
Panel C: Ahead-standard deviation of earnings per share over future years								
1	0.022	0.021	0.134	0.035	0.086	0.036	0.035	0.033
2	0.021	0.039	0.171	0.199	0.085	0.082	0.091	0.090
3	0.022	0.025	0.093	0.110	0.053	0.069	0.123	0.034
4	0.022	0.034	0.104	0.110	0.084	0.076	0.170	0.029
5	0.025	0.058	0.137	0.092	0.111	0.082	0.216	0.042
6	0.038	0.039	0.139	0.158	0.114	0.109	0.306	0.074
7	0.036	0.046	0.219	0.115	0.117	0.112	0.718	0.087
8	0.047	0.049	0.216	0.211	0.197	0.130	0.456	0.075
9	0.071	0.074	0.265	0.226	0.222	0.186	0.415	0.294
10	0.228	0.252	1.425	0.337	0.414	0.294	0.823	1.033

Table 2 (*Continued*)

FESTD portfolios	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
Panel D: Ahead-standard deviation of sales growth rates over future years								
1	0.156	0.189	0.194	0.219	0.189	0.130	0.067	0.141
2	0.173	0.175	0.188	0.169	0.247	0.114	0.078	0.185
3	0.162	0.198	0.163	0.188	0.240	0.105	0.092	0.150
4	0.156	0.203	0.161	0.181	0.230	0.107	0.110	0.185
5	0.164	0.182	0.149	0.171	0.278	0.105	0.139	0.197
6	0.153	0.181	0.164	0.193	0.261	0.123	0.160	0.200
7	0.183	0.234	0.149	0.211	0.243	0.123	0.210	0.212
8	0.193	0.240	0.157	0.193	0.283	0.130	0.276	0.240
9	0.244	0.307	0.167	0.182	0.265	0.126	0.312	0.240
10	0.248	0.314	0.268	0.235	0.259	0.157	0.443	0.316

of each firm over the upcoming 5 years are computed each year.[9] In fact, this standard deviation is a look-ahead volatility measure. Panel C of Table 2 reports the averages of the look-ahead standard deviations of the earnings in each FESTD portfolio. This shows that firms that currently have greater FESTD values have greater volatility in earnings in the future. That is, if a firm currently has greater information uncertainty risk, investors would anticipate a greater return on this firm's stock because the cash flows from the firm will be volatile in the coming years. Panel D also shows the averages of the look-ahead standard deviations of the sales growth rates in each portfolio over the upcoming 5 years. Firms that currently have a greater FESTD are also anticipated to have greater volatility in sales growth. These results indicate that the FESTD might be a good proxy for risk related to earnings information uncertainty.

4.3. Constructing a Risk Factor Related to Earnings Information Uncertainty

A method similar to that in Fama & French (1993) is used to develop a common risk factor related to earnings information uncertainty. Specifically, the risk factor is the difference between the equal-weighted average return on the top 30% firms and on the bottom 30% firms with respect to the magnitude of the FESTD value in each country. This is a zero-investment arbitrage portfolio involving selling short the bottom 30% of the firms and buying long the top 30% of the firms. We call this risk factor FESTD. The average monthly returns on FESTD, which is the risk premium for earnings information uncertainty risk, is 1.28% in the USA, 1.48% in Canada, 0.79% in the UK, 0.29% in Germany, 0.66% in France, 0.60% in Japan, 0.40% in Hong Kong, and 0.93% in Australia. These results are presented in Table 3, along with the results of the other risk factors.

[9]Sales growth rates for year y are calculated as log(sales per share at year y) minus log(sales per share at year $y-1$).

Table 3 Average monthly returns of the risk factors and correlation coefficients among the risk factors

MKTRFT is the equally weighted market returns minus the 1-month rate of each country's 3-month Treasury Bill, SMB (small minus big) and HML (high minus low) are Fama & French's (1993) factors related to firm size and book-to-market, respectively, FESTD is the risk factor related to earnings information uncertainty, and MMTM (a 6-month momentum factor) is related to Jegadeesh & Titman's (1993) stock price momentum. The standard deviation of earnings forecast errors (FESTD) is constructed as the difference between the equal-weighted average return on the top 30% firms and on the bottom 30% firms with respect to the magnitude of the FESTD. MMTM is constructed as follows: I first form 10 decile portfolios by assigning firms based on the past 6-month returns and holding them 1 month later for 6 months, as in Jegadeesh & Titman's (1993) trading strategy, and then have the equal-weight average return on the top decile portfolio minus the equal-weight average return on the bottom decile portfolio.

	MKTFT	SMB	HML	FESTD	MMTM	MKTFT	SMB	HML	FESTD	MMTM	MKTFT	SMB	HML	FESTD	MMTM
	USA					Canada					UK				
Ave return (%)															
All months	1.02	0.97	0.86	1.28	0.86	1.26	0.95	0.79	1.48	2.50	0.39	0.16	0.72	0.79	1.28
January	4.49	3.95	−1.44	10.25	−6.58	3.66	2.98	−0.98	6.46	1.92	2.96	3.78	0.11	4.17	1.52
Non-January	0.71	0.69	1.07	0.47	1.53	1.04	0.77	0.95	1.03	2.56	0.16	−0.17	0.77	0.49	1.26
Correlation coefficients															
MKTFT	1.00					1.00					1.00				
SMB	0.65	1.00				0.46	1.00				0.46	1.00			
HML	−0.45	−0.49	1.00			−0.39	−0.14	1.00			−0.35	−0.41	1.00		
FESTD	0.37	0.56	−0.29	1.00		0.48	0.57	−0.10	1.00		0.42	0.66	−0.08	1.00	
MMTM	−0.34	−0.14	0.23	−0.45	1.00	−0.16	−0.07	0.15	−0.06	1.00	−0.01	0	0.06	0.03	1.00
	Germany					France					Japan				
Ave return (%)															
All months	0.06	−0.64	1.09	0.29	0.76	0.68	−0.10	0.76	0.66	0.27	−0.02	−0.15	0.91	0.6	−0.31
January	3.15	1.52	0.37	3.50	−1.74	4.51	2.15	−0.06	5.06	−4.35	3.08	2.37	0.68	5.89	−3.15
Non-January	−0.22	−0.84	1.16	−0.00	0.98	0.33	−0.21	0.83	0.26	0.67	−0.30	−0.38	0.94	0.12	−0.05
Correlation coefficients															
MKTFT	1.00					1.00					1.00				

Table 3 (*Continued*)

	MKTFT	SMB	HML	FESTD	MMTM	MKTFT	SMB	HML	FESTD	MMTM	MKTFT	SMB	HML	FESTD	MMTM
	USA					Canada					UK				
SMB	−0.17	1.00				0.11	1.00				0.52	1.00			
HML	0.01	−0.18	1.00			−0.38	−0.32	1.00			0.02	0.21	1.00		
FESTD	0.60	0.27	0.11	1.00		0.31	0.42	−0.05	−0.09		0.72	0.65	0.24	1.00	
MMTM	0.00	0.03	0.02	−0.01	1.00	0.00	−0.04	−0.02	1.00	1.00	0.13	−0.03	−0.05	0.04	1.00
	Hong Kong					Australia									
Average return (%)															
All months	1.04	−0.62	1.37	0.40	−0.16	1.22	0.34	0.47	0.93	−0.24					
January	0.89	0.11	3.41	4.07	1.76	4.74	2.60	−0.15	4.46	−1.95					
Non-January	1.05	−0.69	1.18	0.06	−0.33	0.90	0.14	0.53	0.61	−0.09					
Correlation coefficients															
MKTFT	1.00					1.00									
SMB	0.39	1.00				0.48	1.00								
HML	0.06	−0.40	1.00			−0.27	−0.34	1.00							
FESTD	0.45	0.67	0.03	1.00		0.64	0.56	−0.07	1.00						
MMTM	−0.03	0.02	−0.08	−0.08	1.00	−0.07	0.06	−0.02	−0.01	1.00					

4.4. Basic Characteristics of the Risk Factors

In addition to the earnings information uncertainty risk factor, FESTD, we consider four other widely accepted risk factors to explain stock returns on the size portfolios: the market risk factor, MKTRFT ($R_{mt} - R_{ft}$; the equally weighted market returns minus 1-month rate of each country's 3-month Treasury Bill), SMB (small minus big) and HML (high minus low) factors related to firm size and book-to-market, respectively, and MMTM (a 6-month momentum factor), which is related to Jegadeesh & Titman's (1993) stock price momentum. A country's market returns are the returns on an equally weighted portfolio containing all sample firms of the country. SMB and HML factors are constructed using the sample firms in each country as in Fama & French (1993). To construct a momentum factor, MMTM, we first form 10 decile portfolios by assigning firms based on the past 6-month returns and holding them 1 month later for 6 months, as in Jegadeesh & Titman's (1993) trading strategy. We then have the equal-weight average return on the top decile portfolio minus the equal-weight average return on the bottom decile portfolio. A 6-month/6-month trading strategy is used because the difference in the average returns between the top decile portfolio and the bottom decile portfolio is the largest in most sample countries. Note that firms in the USA, Canada, the UK, Germany, and France show a significant momentum phenomenon, while firms in Japan, Hong Kong, and Australia do not show the momentum phenomenon, and even show the opposite of the momentum phenomenon.[10] Canadian firms show the strongest momentum phenomenon.

Table 3 summarizes the average monthly return (or risk premium) of these five risk factors and the correlation coefficients among the factors in each country over the period from January 1992 to December 2004. As mentioned in the previous section, the magnitude of the FESTD risk premium is significantly large in all sample countries. In particular, the January return on FESTD is remarkably large: 10.25% in the USA, 6.46% in Canada, 4.17% in the UK, 3.50% in Germany, 5.06% in France, 5.89% in Japan, 4.07% in Hong Kong, and 4.46% in Australia. This magnitude dominates the January return of the other risk factors. Another risk factor with a consistently positive large risk premium in all sample countries is HML. However, SMB and MMTM do not have a robust risk premium in our sample countries. Specifically, SMB in Germany, France, Japan, and Hong Kong even has a negative risk premium, whereas in the UK it has a marginally small positive risk premium. MMTM in Japan, Hong Kong, and Australia also has a negative risk premium. MMTM in France has a small positive risk premium.

5. Main Results

5.1. Testing the Time-Series Risk Factor Models

A well-specified factor model should explain the intertemporal and cross-sectional behavior of stock returns. In this section, we examine whether a factor model

[10]The detailed results are available upon request.

explains a time-series behavior of stock returns, especially in January. If all five factors are included in the model, a five-factor time-series model to be estimated for portfolio p in each country is:

$$R_{pt} - R_{ft} = \alpha_p + \beta_{1p}(R_{mt} - R_{ft}) + \beta_{2p} \times \text{SMB}_t + \beta_{3p} \times \text{HML}_t + \beta_{4p} \times \text{MMNT}_t + \beta_{5p} \times \text{FESTD}_t + \varepsilon_{pt}, \quad (2)$$

where R_{pt} is the rate of return on the size portfolio p at time t; R_{mt} is the market portfolio's return at time t; R_{ft} is the risk-free rate of return at time t; β_ps are factor loadings of the portfolio p to the corresponding risk factor; and ε_{pt} is the residual returns on the portfolio p at time t. If equation (2) is a well-specified model, the intercept α_p should not be different from zero in any portfolio, and the residual or firm-specific returns, ε_{pt}, should not show any systematic pattern in the cross-section.

Table 4 presents the estimation results of the intercept, α_p, of the time-series risk factor models with various sets of the risk factors in each country. Seven different models are considered: Model 1 is the capital asset pricing model (CAPM) one-factor model; Model 2 is Fama and French's three-factor model; Model 3 is a four-factor model (Fama and French's three-factor model plus the momentum factor MMTM); Model 4 is another four-factor model (Fama and French's three-factor model plus FESTD); Model 5 is a two-factor model (the market factor plus FESTD); Model 6 is a one-factor model with FESTD only; and Model 7 is another two-factor model (the market factor plus SMB).[11] For Model 1 (CAPM), the α_p estimates on the smallest size portfolio (P1) are positively significant in all countries except for Australia, and their magnitude is also large. The monotonic pattern, the α_p estimate across firm size, is similar to the pattern of raw returns found in Table 1. That is, the magnitude of the α_p estimate is inversely related to firm size. In particular, the α_p estimate of the model of regressing the returns on the smallest size portfolio minus the returns on the largest size portfolio (P1 − P10) on the market factor is also large and statistically significant in most countries (2.296% with t-statistic of 3.77 in the USA, 2.987% with t-statistic of 4.73 in Canada, 1.045% with t-statistic of 2.56 in the UK, 1.034% with t-statistic of 2.18 in France, and 1.021% with t-statistic of 2.47 in Japan). Note that P1 − P10 indicates an arbitrage abnormal return by selling short Portfolio 10 and buying long Portfolio 1. The results found in Model 1 are similar to those found in Model 2 (MKTFT, SMB, HML), Model 3 (MKTFT, SMB, HML, MMTM), Model 4 (MKTFT, SMB, HML, FESTD), and Model 7 (MKTFT, SMB). That is, the addition of factors such as SMB, HML, and MMTM to the market factor does not help to explain the cross-sectional behavior of stock returns across firm size.

[11]The reason that the two-factor model, Model 7, is considered is for comparison with another two-factor model with the market risk factor and FESTD, and to show the distinctive explanatory power of FESTD for the January effect. Note that FESTD is relatively closely correlated with SMB.

Table 4 Intercept estimates (in %) of the various factor models in each country

The intercept estimate, α_p, of the time-series risk factor model is presented. Numbers in parentheses are *t*-statistics. "P1 − P10" indicates the intercept estimate of the model of regressing the returns on Portfolio 1 minus Portfolio 10 on the corresponding factors. GRS is the *F*-statistic of Gibbons *et al.* (1989) for testing the hypothesis that the intercepts of all 10 size portfolios are all zero, and the numbers in parentheses by GRS *F*-statistic indicate *P*-values. Definitions of the risk factors are presented in Table 3.

Country	Size portfolio	Risk factors included in the factor model						
		Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
USA	1	1.648 (3.54)	1.442 (3.06)	1.679 (3.79)	0.903 (3.73)	0.662 (2.82)	1.024 (2.67)	1.402 (3.16)
	2	0.685 (2.79)	0.619 (2.59)	0.743 (3.33)	0.373 (2.46)	0.210 (1.38)	0.717 (1.58)	0.524 (2.33)
	3	0.359 (2.15)	0.161 (1.11)	0.212 (1.50)	0.065 (0.51)	0.112 (0.82)	0.658 (1.37)	0.204 (1.50)
	4	−0.047 (−0.45)	−0.211 (−2.09)	−0.215 (−2.10)	−0.168 (−1.74)	−0.026 (−0.24)	0.551 (1.11)	−0.110 (−1.12)
	5	−0.176 (−1.33)	−0.374 (−2.88)	−0.428 (−3.43)	−0.255 (−2.70)	−0.042 (−0.34)	0.540 (1.07)	−0.245 (−1.95)
	6	−0.398 (−2.97)	−0.528 (−3.78)	−0.575 (−4.20)	−0.409 (−3.78)	−0.214 (−1.89)	0.318 (0.69)	−0.383 (−2.83)
	7	−0.570 (−3.95)	−0.511 (−3.40)	−0.570 (−3.93)	−0.361 (−3.61)	−0.302 (−3.17)	0.231 (0.50)	−0.512 (−3.63)
	8	−0.579 (−3.65)	−0.463 (−3.31)	−0.532 (−4.04)	−0.326 (−3.43)	−0.280 (−2.74)	0.204 (0.48)	−0.438 (−3.33)
	9	−0.621 (−3.60)	−0.425 (−3.34)	−0.462 (−3.68)	−0.299 (−3.52)	−0.303 (−2.64)	0.155 (0.38)	−0.426 (−3.56)
	10	−0.648 (−3.14)	−0.287 (−2.57)	−0.316 (−2.85)	−0.195 (−2.20)	−0.329 (−2.02)	0.048 (0.14)	−0.371 (−3.48)
	P1 − P10	2.296 (3.77)	1.729 (3.16)	1.995 (3.87)	1.098 (4.05)	0.991 (3.38)	0.976 (3.35)	1.773 (3.46)
	GRS	2.895 (0.0025)	3.594 (0.0003)	3.450 (0.0004)	4.168 (0.0001)	2.430 (0.0105)	1.789 (0.0675)	2.874 (0.0027)
Canada	1	2.472 (4.87)	2.080 (4.17)	1.878 (3.60)	1.956 (5.18)	1.905 (5.19)	2.531 (5.33)	2.147 (4.44)
	2	0.664 (2.69)	0.626 (2.53)	0.520 (2.01)	0.592 (2.57)	0.505 (2.22)	1.206 (2.92)	0.541 (2.25)
	3	0.151 (0.73)	0.005 (0.02)	−0.003 (−0.01)	−0.002 (−0.01)	0.088 (0.42)	0.763 (1.95)	0.054 (0.27)
	4	−0.112 (−0.66)	−0.125 (−0.72)	−0.073 (−0.40)	−0.118 (−0.68)	−0.102 (−0.60)	0.626 (1.57)	−0.177 (−1.05)
	5	−0.669 (−3.59)	−0.747 (−3.89)	−0.673 (−3.35)	−0.720 (−4.01)	−0.592 (−3.26)	0.171 (0.41)	−0.720 (−3.86)

Table 4 (*Continued*)

Country	Size portfolio	Risk factors included in the factor model: Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
	6	−0.818 (−4.44)	−0.721 (−3.80)	−0.554 (−2.85)	−0.694 (−3.94)	−0.697 (−4.11)	0.097 (0.23)	−0.766 (−4.15)
	7	−0.804 (−4.56)	−0.800 (−4.45)	−0.711 (−3.79)	−0.772 (−4.70)	−0.684 (−4.24)	0.006 (0.01)	−0.741 (−4.22)
	8	−0.872 (−4.63)	−0.826 (−4.37)	−0.701 (−3.57)	−0.799 (−4.56)	−0.743 (−4.32)	−0.054 (−0.14)	−0.778 (−4.23)
	9	−0.645 (−3.47)	−0.581 (−3.52)	−0.535 (−3.09)	−0.560 (−3.58)	−0.521 (−3.05)	0.093 (0.27)	−0.475 (−2.90)
	10	−0.515 (−2.56)	−0.313 (−2.27)	−0.224 (−1.57)	−0.294 (−2.28)	−0.358 (−2.02)	0.199 (0.61)	−0.236 (−1.74)
	P1 − P10	2.987 (4.73)	2.392 (4.22)	2.102 (3.56)	2.251 (5.30)	2.264 (5.10)	2.332 (5.32)	2.383 (4.34)
	GRS	4.759 (0.0000)	4.988 (0.0000)	3.547 (0.0003)	6.968 (0.0000)	5.592 (0.0000)	5.264 (0.0000)	4.424 (0.0000)
UK	1	0.858 (3.69)	0.727 (3.45)	0.707 (3.33)	0.487 (2.72)	0.405 (2.36)	0.375 (1.15)	0.854 (4.31)
	2	0.154 (1.07)	0.051 (0.40)	0.049 (0.38)	−0.064 (−0.54)	−0.100 (−0.87)	−0.131 (−0.42)	0.151 (1.24)
	3	−0.015 (−0.12)	−0.108 (−1.01)	−0.107 (−0.98)	−0.136 (−1.25)	−0.166 (−1.48)	−0.199 (−0.62)	−0.017 (−0.17)
	4	0.059 (0.56)	−0.069 (−0.66)	−0.068 (−0.64)	−0.081 (−0.77)	−0.023 (−0.23)	−0.059 (−0.17)	0.058 (0.58)
	5	0.023 (0.25)	−0.105 (−1.20)	−0.097 (−1.10)	−0.074 (−0.84)	−0.007 (−0.08)	−0.046 (−0.12)	0.022 (0.25)
	6	−0.320 (−3.40)	−0.440 (−4.54)	−0.428 (−4.39)	−0.383 (−4.05)	−0.261 (−2.77)	−0.300 (−0.80)	−0.320 (−3.41)
	7	−0.278 (−2.75)	−0.306 (−2.87)	−0.305 (−2.83)	−0.236 (−2.29)	−0.182 (−1.86)	−0.222 (−0.57)	−0.277 (−2.79)
	8	−0.323 (−2.53)	−0.364 (−3.05)	−0.362 (−3.00)	−0.286 (−2.48)	−0.149 (−1.31)	−0.192 (−0.46)	−0.320 (−2.87)
	9	−0.203 (−1.25)	−0.112 (−0.92)	−0.115 (−0.94)	−0.008 (−0.07)	0.100 (0.81)	0.058 (0.14)	−0.199 (−1.74)
	10	−0.187 (−0.87)	−0.058 (−0.55)	−0.056 (−0.52)	0.020 (0.20)	0.219 (1.35)	0.181 (0.47)	−0.179 (−1.75)
	P1 − P10	1.045 (2.56)	0.785 (2.81)	0.763 (2.71)	0.467 (1.97)	0.186 (0.67)	0.194 (0.68)	1.033 (3.90)
	GRS	3.533 (0.0003)	3.601 (0.0003)	3.439 (0.0005)	3.163 (0.0011)	2.795 (0.0034)	2.681 (0.0049)	3.581 (0.0003)
Germany	1	0.847 (3.48)	0.749 (3.14)	0.759 (3.16)	0.582 (2.60)	0.669 (3.14)	0.584 (2.41)	1.008 (4.28)
	2	0.237 (1.37)	0.278 (1.69)	0.301 (1.83)	0.182 (1.15)	0.116 (0.76)	−0.012 (−0.05)	0.394 (2.48)

Table 4 (*Continued*)

Country	Size portfolio	Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
		Risk factors included in the factor model						
	3	−0.174 (−1.12)	−0.063 (−0.42)	−0.061 (−0.40)	−0.102 (−0.69)	−0.249 (−1.69)	−0.393 (−1.60)	−0.030 (−0.21)
	4	−0.154 (−1.24)	−0.071 (−0.55)	−0.074 (−0.57)	−0.070 (−0.53)	−0.176 (−1.41)	−0.348 (−1.30)	−0.084 (−0.69)
	5	−0.587 (−4.39)	−0.492 (−3.61)	−0.492 (−3.58)	−0.503 (−3.64)	−0.623 (−4.69)	−0.805 (−2.85)	−0.499 (−3.86)
	6	−0.451 (−3.42)	−0.347 (−2.49)	−0.337 (−2.40)	−0.274 (−2.02)	−0.403 (−3.12)	−0.618 (−1.92)	−0.437 (−3.25)
	7	−0.239 (−1.92)	−0.242 (−1.82)	−0.251 (−1.87)	−0.217 (−1.62)	−0.216 (−1.74)	−0.407 (−1.40)	−0.255 (−2.02)
	8	−0.267 (−1.90)	−0.209 (−1.40)	−0.236 (−1.59)	−0.144 (−0.98)	−0.211 (−1.54)	−0.411 (−1.34)	−0.293 (−2.05)
	9	0.058 (0.43)	0.028 (0.21)	0.037 (0.28)	0.111 (0.86)	0.151 (1.24)	−0.032 (−0.11)	−0.047 (−0.37)
	10	0.218 (1.00)	−0.311 (−2.66)	−0.318 (−2.69)	−0.268 (−2.30)	0.366 (1.88)	0.142 (0.39)	−0.173 (−1.49)
	P1 − P10	0.630 (1.68)	1.061 (3.66)	1.077 (3.69)	0.850 (3.15)	0.303 (0.99)	0.442 (1.23)	1.181 (4.28)
	GRS	4.332 (0.0000)	3.215 (0.0009)	3.405 (0.0005)	2.858 (0.0028)	4.145 (0.0001)	4.199 (0.0001)	4.075 (0.0001)
France	1	0.867 (3.19)	0.745 (2.89)	0.748 (2.88)	0.524 (2.29)	0.505 (2.23)	0.812 (2.23)	0.891 (3.55)
	2	−0.169 (−1.09)	−0.321 (−2.19)	−0.323 (−2.19)	−0.375 (−2.59)	−0.295 (−2.00)	−0.025 (−0.09)	−0.158 (−1.07)
	3	0.194 (1.17)	0.051 (0.31)	0.076 (0.46)	0.026 (0.15)	0.116 (0.70)	0.443 (1.28)	0.202 (1.23)
	4	−0.392 (−3.10)	−0.402 (−3.27)	−0.395 (−3.18)	−0.336 (−2.83)	−0.365 (−2.84)	−0.008 (−0.02)	−0.381 (−3.23)
	5	−0.297 (−2.20)	−0.335 (−2.46)	−0.346 (−2.52)	−0.307 (−2.24)	−0.304 (−2.21)	0.028 (0.08)	−0.290 (−2.21)
	6	−0.225 (−1.67)	−0.237 (−1.70)	−0.245 (−1.74)	−0.191 (−1.37)	−0.194 (−1.42)	0.192 (0.50)	−0.221 (−1.65)
	7	−0.311 (−2.49)	−0.338 (−2.63)	−0.356 (−2.75)	−0.307 (−2.38)	−0.260 (−2.07)	0.127 (0.33)	−0.316 (−2.56)
	8	0.001 (0.01)	0.030 (0.21)	0.033 (0.24)	0.095 (0.70)	0.120 (0.90)	0.543 (1.31)	−0.009 (−0.07)
	9	−0.266 (−1.51)	−0.365 (−2.69)	−0.374 (−2.73)	−0.309 (−2.30)	−0.105 (−0.64)	0.287 (0.72)	−0.293 (−2.22)
	10	−0.167 (−0.60)	−0.096 (−0.81)	−0.094 (−0.79)	−0.040 (−0.35)	0.151 (0.61)	0.564 (1.23)	−0.225 (−1.89)
	P1 − P10	1.034 (2.18)	0.842 (2.71)	0.843 (2.69)	0.564 (2.07)	0.354 (0.94)	0.248 (0.64)	1.117 (3.62)

Table 4 (*Continued*)

Country	Size portfolio	Risk factors included in the factor model: Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
	GRS	3.012 (0.0017)	3.624 (0.0003)	3.750 (0.0002)	3.262 (0.0008)	2.483 (0.0090)	2.425 (0.0106)	3.139 (0.0012)
Japan	1	0.836 (3.60)	0.915 (5.14)	0.908 (5.06)	0.873 (4.94)	0.633 (2.99)	0.173 (0.46)	0.936 (5.67)
	2	0.219 (1.49)	0.225 (1.91)	0.227 (1.91)	0.218 (1.84)	0.114 (0.82)	−0.339 (−1.00)	0.279 (2.54)
	3	0.068 (0.57)	0.058 (0.68)	0.054 (0.62)	0.053 (0.62)	−0.024 (−0.22)	−0.498 (−1.46)	0.122 (1.52)
	4	−0.096 (−1.21)	−0.117 (−1.96)	−0.115 (−1.91)	−0.103 (−1.74)	−0.136 (−1.75)	−0.621 (−1.83)	−0.062 (−1.09)
	5	−0.158 (−2.48)	−0.145 (−2.29)	−0.137 (−2.16)	−0.166 (−2.70)	−0.208 (−3.49)	−0.703 (−2.05)	−0.142 (−2.43)
	6	−0.169 (−2.38)	−0.260 (−3.51)	−0.261 (−3.49)	−0.272 (−3.67)	−0.185 (−2.58)	−0.710 (−1.94)	−0.172 (−2.43)
	7	−0.130 (−1.43)	−0.199 (−2.19)	−0.202 (−2.19)	−0.205 (−2.23)	−0.111 (−1.21)	−0.631 (−1.72)	−0.150 (−1.76)
	8	−0.272 (−2.22)	−0.368 (−3.71)	−0.366 (−3.65)	−0.361 (−3.61)	−0.193 (−1.64)	−0.717 (−1.90)	−0.321 (−3.47)
	9	−0.249 (−1.66)	−0.305 (−3.10)	−0.307 (−3.09)	−0.284 (−2.90)	−0.112 (−0.83)	−0.609 (−1.67)	−0.322 (−3.53)
	10	−0.185 (−0.85)	−0.035 (−0.45)	−0.034 (−0.44)	−0.020 (−0.26)	0.039 (0.21)	−0.435 (−1.16)	−0.306 (−3.37)
	P1 − P10	1.021 (2.47)	0.950 (4.55)	0.942 (4.47)	0.893 (4.33)	0.594 (1.65)	0.608 (1.71)	1.242 (6.13)
	GRS	3.854 (0.0001)	5.280 (0.0000)	5.137 (0.0000)	5.075 (0.0000)	3.603 (0.0003)	3.543 (0.0003)	5.317 (0.0000)
Hong Kong	1	1.463 (2.64)	1.832 (3.90)	1.900 (3.99)	1.797 (3.89)	1.471 (3.07)	2.409 (2.65)	2.023 (4.36)
	2	0.407 (0.86)	0.600 (1.49)	0.654 (1.60)	0.600 (1.48)	0.412 (0.94)	1.252 (1.53)	0.862 (2.13)
	3	−0.619 (−2.18)	−0.531 (−1.93)	−0.497 (−1.79)	−0.551 (−2.04)	−0.616 (−2.34)	0.154 (0.22)	−0.445 (−1.65)
	4	−0.503 (−1.85)	−0.474 (−1.71)	−0.420 (−1.50)	−0.456 (−1.67)	−0.502 (−1.84)	0.399 (0.50)	−0.413 (−1.53)
	5	−0.808 (−2.85)	−0.837 (−2.84)	−0.878 (−2.95)	−0.815 (−2.82)	−0.809 (−2.86)	0.032 (0.04)	−0.792 (−2.76)
	6	−0.290 (−0.95)	−0.143 (−0.47)	−0.139 (−0.45)	−0.129 (−0.42)	−0.292 (−0.98)	0.526 (0.71)	−0.344 (−1.12)
	7	−0.392 (−1.10)	−0.445 (−1.28)	−0.470 (−1.34)	−0.407 (−1.23)	−0.396 (−1.24)	0.459 (0.59)	−0.593 (−1.73)
	8	−0.634 (−1.66)	−0.883 (−2.66)	−0.861 (−2.56)	−0.843 (−2.68)	−0.640 (−2.03)	0.137 (0.19)	−1.002 (−3.07)

Table 4 (*Continued*)

Country	Size portfolio	Risk factors included in the factor model						
		Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
	9	0.032 (0.07)	−0.505 (−1.58)	−0.531 (−1.64)	−0.460 (−1.55)	0.023 (0.07)	0.889 (1.12)	−0.612 (−1.95)
	10	0.056 (0.13)	−0.331 (−1.57)	−0.330 (−1.54)	−0.303 (−1.53)	0.047 (0.15)	0.786 (1.15)	−0.618 (−2.65)
	P1 − P10	1.407 (1.56)	2.164 (3.76)	2.230 (3.83)	2.100 (3.82)	1.424 (1.75)	1.623 (2.35)	2.640 (4.48)
	GRS	3.213 (0.0009)	3.231 (0.0009)	3.252 (0.0008)	3.216 (0.0009)	3.254 (0.0008)	3.424 (0.0005)	3.466 (0.0004)
Australia	1	0.456 (0.76)	0.481 (0.80)	0.486 (0.81)	0.443 (0.75)	0.390 (0.66)	1.481 (2.00)	0.489 (0.83)
	2	0.034 (0.09)	0.028 (0.07)	−0.058 (−0.15)	0.009 (0.02)	0.001 (0.00)	0.773 (1.55)	0.051 (0.13)
	3	−0.192 (−0.55)	−0.188 (−0.54)	−0.231 (−0.66)	−0.218 (−0.64)	−0.241 (−0.71)	0.339 (0.82)	−0.174 (−0.50)
	4	−0.139 (−0.47)	−0.126 (−0.43)	−0.132 (−0.45)	−0.101 (−0.35)	−0.118 (−0.40)	0.401 (1.10)	−0.113 (−0.39)
	5	−0.578 (−2.17)	−0.505 (−1.97)	−0.452 (−1.77)	−0.514 (−2.00)	−0.599 (−2.25)	−0.051 (−0.14)	−0.552 (−2.17)
	6	−0.176 (−0.65)	−0.193 (−0.71)	−0.149 (−0.55)	−0.173 (−0.64)	−0.152 (−0.57)	0.518 (1.34)	−0.171 (−0.64)
	7	−0.019 (−0.08)	−0.025 (−0.10)	0.005 (0.02)	−0.018 (−0.07)	−0.010 (−0.04)	0.421 (1.41)	−0.021 (−0.09)
	8	−0.608 (−2.49)	−0.592 (−2.53)	−0.583 (−2.47)	−0.581 (−2.48)	−0.580 (−2.41)	−0.049 (−0.15)	−0.632 (−2.72)
	9	−0.275 (−1.04)	−0.301 (−1.25)	−0.254 (−1.06)	−0.287 (−1.20)	−0.239 (−0.93)	0.176 (0.57)	−0.312 (−1.31)
	10	−0.223 (−0.87)	−0.239 (−1.16)	−0.204 (−0.99)	−0.221 (−1.09)	−0.176 (−0.72)	0.236 (0.80)	−0.272 (−1.33)
	P1 − P10	0.679 (0.94)	0.720 (1.05)	0.690 (1.00)	0.664 (0.98)	0.567 (0.81)	1.245 (1.67)	0.762 (1.12)
	GRS	1.045 (0.4094)	0.906 (0.5298)	0.907 (0.5285)	0.906 (0.5292)	1.053 (0.4023)	1.166 (0.3181)	1.048 (0.4064)

However, the addition of FESTD to the market factor or FESTD itself shows significant improvement. The α_p estimate of P1 − P10 with Model 5 (the market factor and FESTD) is substantially smaller than that with the other competing models, such as Model 1, Model 2, and Model 3. For example, the α_p estimates of P1 − P10 by Model 2 (Fama and French's three-factor model) are 1.729% (*t*-statistic of 3.16) in the USA, 2.392% (*t*-statistic of 4.22) in Canada, 0.785% (*t*-statistic of 2.81) in the UK, 1.061% (*t*-statistic of 3.66) in Germany, 0.842% (*t*-statistic of 2.71) in France, 0.950% (*t*-statistic of 4.55) in Japan, 2.164% (*t*-statistic of 3.76) in Hong Kong, and 0.720% in Australia (*t*-statistic of 1.05). Except for Australia, Fama and French's three-factor model produces statistically significant arbitrage abnormal returns across firm size and fails to explain even the firm size effect in all the sample countries.[12] By contrast, Model 5 (the market factor and FESTD) produces statistically significant arbitrage abnormal returns across firm size only in two countries: the USA and Canada. Specifically, the α_p estimates of P1 − P10 by Model 5 are 0.991% (*t*-statistic of 3.38) in the USA, 2.264% (*t*-statistic of 5.10) in Canada, 0.186% (*t*-statistic of 0.67) in the UK, 0.303% (*t*-statistic of 0.99) in Germany, 0.354% (*t*-statistic of 0.94) in France, 0.594% (*t*-statistic of 1.65) in Japan, 1.424% (*t*-statistic of 1.75) in Hong Kong, and 0.567% (*t*-statistic of 0.81). Other remarkable results for FESTD are obtained when the one-factor model, Model 6 (FESTD only), is used. When this one-factor model is used, the α_p estimates of the 10 size portfolios in all countries are mostly statistically insignificant, except for the smallest portfolio (P1) and the inverse relation between the α_p estimate and firm size disappears. However, the other models produce several statistically significant α_p estimates among the 10 portfolios, and the inverse relation is still alive in every country.

Kim (2006) reports, however, that the two-factor model of the market factor and FESTD is very good at explaining the firm size and January effect and produces insignificant α_p estimates of P1 − P10 by using the US stock return. The reason that the present study has obtained slightly different results for the USA is that in the paper by Kim (2006), quarterly earnings data are used to construct FESTD, whereas this paper uses annual earnings data. The use of quarterly earnings data could generate a risk factor that more often and more accurately updates the change of earnings prospects than the use of annual earnings data would. Therefore, the use of FESTD, using quarterly earnings data, would produce insignificant α_p estimates of P1 − P10, even for the USA and Canada.

5.2. Residual Returns Across Firm Size

To examine whether there is a seasonally systematic pattern in stock returns after adjusting for risk, the residual returns are generated by regressing the portfolio

[12]In fact, the cross-section difference in stock returns across firm size in Australia is explained by all considered models.

returns on the corresponding risk factors, and the average residual returns in January and non-January months are computed. Table 5 reports the average residual returns in January only, generated from all considered models on each of the size portfolios. When the well-known models such as the CAPM (Model 1), Fama–French's three-factor model (Model 2), and Fama–French's three-factor plus MMTM (Model 3) are used, the average residual returns in January across firm size are not much different from the cross-section of raw returns observed in Table 1. This means that the market risk factor, SMB, HML, MMTM, and their combination do not succeed in explaining the January return across firm size. The differences in the average January residual returns generated from the CAPM between the smallest and largest size portfolios are 13.72% (11.56% to −2.16%) in the USA, 7.98% (6.51% to −1.47%) in Canada, 4.66% (2.26% to −2.41%) in the UK, 3.69% (1.60% to −2.09%) in Germany, 6.35% (4.34% to −2.00%) in France, 3.14% (1.59% to −1.55%) in Japan, 3.76% (1.94% to −1.82%) in Hong Kong, and 2.64% (0.02% to −2.62%) in Australia. These spreads in January residual returns are similar when Fama–French's three-factor model (Model 2) is used. When MMNT is added to Fama–French's three-factor model, a negligible improvement in the magnitude of the residual returns is observed.

By contrast, the differences in January residual returns generated from the two-factor model containing the market factor and FESTD are remarkably reduced in all countries. Specifically, those are 1.66% (2.45% to 0.79%) in the USA, 3.12% (2.70% to −0.42%) in Canada, 0.37% (−0.01% to −0.38%) in the UK, 1.48% (0.40% to −1.08%) in Germany, 1.73% (1.89% to 0.15%) in France, 0.85% (0.50% to −0.35%) in Japan, −0.73% (−0.17% to 0.56%) in Hong Kong, and 1.10% (−0.88% to −1.98%) in Australia. These differences are all statistically insignificant. In addition, the residual returns from this two-factor model do not show any systematic pattern across firm size. It is worth noting that when FESTD is added to Fama–French's three-factor model, a substantial improvement in the magnitude of the January residual returns is observed.

As the factor has a greater correlation with SMB than the other factors do, SMB is substituted for FESTD in the above two-factor model. This is done to compare the estimation results from both two-factor models. The results are quite different. The differences in January residual returns generated from the two-factor model containing the market factor and SMB are very similar to those from the CAPM or Fama–French's three-factor model. These results indicate that FESTD plays a special role in explaining the seasonal pattern of stock returns in January.

5.3. Testing the Cross-Section of Stock Returns

To examine whether the cross-sectional difference in stock returns is explained by the cross-section of the factor loadings (or βs), the cross-sectional relationship between average returns and the factor loadings on the risk factors is estimated using Fama & MacBeth's (1973) two-pass estimation methodology. This is a formal procedure to determine whether a risk factor is priced into stock returns. As in

Table 5 Residual returns in January (in %) generated from the factor models in each country: January 1992 to December 2004

Residual returns are obtained by regressing the portfolio returns on the risk factors and then residuals in January are collected. "P1 – P10" is the difference between the average residual returns of Portfolio 1 and Portfolio 10. *Significance level of 5% or below.

		Risk factors included in the factor model						
Country	Size portfolio	Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
USA	1	11.56*	10.86*	9.22*	2.15	2.45*	2.08*	10.88*
	2	4.49*	4.00*	3.14*	0.02	0.10	−0.42	4.04*
	3	1.92*	1.51*	1.16*	−0.04	−0.37	−0.93	1.49*
	4	−1.01*	−1.14*	−1.11*	−0.44	−0.81*	−1.40	−1.19*
	5	−2.03*	−2.16*	−1.79*	−0.24	−0.80*	−1.39	−2.22*
	6	−2.27*	−2.15*	−1.83*	−0.24	−0.56	−1.11	−2.22*
	7	−2.92*	−2.77*	−2.36*	−0.35	−0.45	−0.99	−2.77*
	8	−3.18*	−2.77*	−2.29*	−0.56	−0.42	−0.91	−2.78*
	9	−2.87*	−2.33*	−2.07*	−0.28	0.07	−0.40	−2.33*
	10	−2.16*	−1.43*	−1.23*	0.05	0.79	0.41	−1.39*
	P1 − P10	13.72*	12.29*	10.45*	2.10	1.66	1.68	12.27*
	Average	1.39*	1.26*	1.03*	0.20	0.15	−0.31	1.25*
Canada	1	6.51*	5.79*	5.78*	2.59	2.70	2.76	5.76*
	2	1.93*	1.61	1.60	0.72	0.86	0.93	1.65
	3	−0.39	−0.59	−0.59	−0.78	−0.82	−0.75	−0.62
	4	0.34	0.16	0.17	0.36	0.40	0.47	0.19
	5	−0.94	−1.04	−1.04	−0.35	−0.42	−0.35	−1.06*
	6	−1.06*	−0.96	−0.95*	−0.26	−0.25	−0.17	−0.94*
	7	−0.60	−0.43	−0.42	0.30	0.20	0.26	−0.46
	8	−1.63*	−1.39*	−1.38*	−0.67	−0.77	−0.70	−1.41*
	9	−2.02*	−1.57*	−1.57*	−1.04	−1.18	−1.12	−1.62*
	10	−1.47*	−0.80	−0.79*	−0.31	−0.42	−0.37	−0.83
	P1 − P10	7.98*	6.59*	6.57*	2.90	3.12	3.13	6.59*
	Average	0.79*	0.67*	0.67*	0.32	0.31	0.37	0.66*
UK	1	2.26	1.00	0.90	−0.07	−0.01	0.19	1.06
	2	0.44	−0.35	−0.36	−0.87	−0.82	−0.61	−0.31
	3	0.52	−0.18	−0.17	−0.31	−0.24	−0.03	−0.14
	4	0.24	−0.13	−0.12	−0.18	−0.17	0.07	−0.07
	5	0.55	0.24	0.28	0.38	0.40	0.66	0.30
	6	−0.32	−0.26	−0.19	0.00	−0.02	0.24	−0.20
	7	−0.22	−0.04	−0.04	0.27	0.26	0.53	−0.03
	8	−0.07	0.51	0.52	0.86*	0.79	1.08	0.53
	9	−1.16	−0.01	−0.02	0.46	0.35	0.64	−0.04

Table 5 (*Continued*)

Country	Size portfolio	Risk factors included in the factor model: Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
	10	−2.41*	−0.53	−0.51	−0.18	−0.38	−0.13	−0.58
	P1 − P10	4.66*	1.53	1.41	0.11	0.37	0.32	1.64
	Average	0.41	0.16	0.15	0.04	0.05	0.27	0.19
Germany	1	1.60	1.02	1.07	0.43	0.40	0.62	0.93
	2	−0.50	−1.13*	−1.00	−1.46*	−1.32*	−0.99	−1.17*
	3	0.65	0.06	0.07	−0.08	0.14	0.53	0.05
	4	0.17	−0.13	−0.15	−0.12	0.03	0.48	−0.12
	5	0.54	0.17	0.17	0.13	0.30	0.78	0.17
	6	0.38	0.29	0.35	0.55	0.71	1.28	0.32
	7	0.31	0.37	0.33	0.46	0.46	0.97	0.38
	8	0.36	0.44	0.29	0.67	0.74	1.27	0.47
	9	−1.25*	−0.83	−0.78	−0.54	−0.62	−0.13	−0.81
	10	−2.09*	−0.39	−0.43	−0.24	−1.08	−0.49	−0.44
	P1 − P10	3.69*	1.41	1.49*	0.67	1.48	1.11	1.36
	Average	0.35	0.12	0.13	0.04	0.11	0.49	0.10
France	1	4.34*	3.59*	3.60*	1.92	1.89	3.41*	3.73*
	2	0.65	0.22	0.20	−0.19	−0.21	1.13	0.38
	3	0.18	−0.15	−0.01	−0.34	−0.35	1.27	0.00
	4	−0.79	−1.07	−1.03	−0.57	−0.61	1.16	−1.05
	5	−0.48	−0.71	−0.77	−0.50	−0.52	1.12	−0.67
	6	−0.28	−0.41	−0.46	−0.06	−0.08	1.84	−0.40
	7	−0.69	−0.59	−0.69	−0.36	−0.35	1.57	−0.57
	8	−0.50	−0.20	−0.18	0.29	0.31	2.40	−0.24
	9	−1.25	−0.65	−0.70	−0.22	−0.15	1.79	−0.58
	10	−2.00	−0.42	−0.40	0.01	0.15	2.20*	−0.54
	P1 − P10	6.35*	4.00*	4.01*	1.91	1.73	1.21	4.28*
	Average	0.50	0.33	0.32	0.17	0.17	1.73*	0.39
Japan	1	1.59*	0.47	0.43	0.20	0.50	−0.59	0.46
	2	0.78	0.13	0.14	0.09	0.22	−0.85	0.10
	3	0.66	0.09	0.07	0.06	0.16	−0.96	0.05
	4	0.01	−0.35	−0.34	−0.26	−0.21	−1.36	−0.38
	5	0.07	−0.11	−0.07	−0.25	−0.20	−1.37	−0.11
	6	0.14	0.24	0.23	0.16	0.06	−1.19	0.18
	7	−0.16	0.09	0.08	0.06	−0.06	−1.29	0.06
	8	−0.37	0.22	0.23	0.26	0.06	−1.18	0.19
	9	−1.07	−0.26	−0.27	−0.13	−0.34	−1.52	−0.25
	10	−1.55*	−0.35	−0.35	−0.25	−0.35	−1.47	−0.18

Table 5 (*Continued*)

Country	Size portfolio	Model 1: MKTFT	Model 2: MKTFT, SMB, HML	Model 3: MKTFT, SMB, HML, MMTM	Model 4: MKTFT, SMB, HML, FESTD	Model 5: MKTFT, FESTD	Model 6: FESTD	Model 7: MKTFT, SMB
		Risk factors included in the factor model						
	P1 − P10	3.14*	0.82	0.77	0.45	0.85	0.88	0.64
	Average	0.29	0.09	0.09	0.04	0.06	−0.99*	0.07
Hong Kong	1	1.94	1.01	1.30	0.42	−0.17	−2.92	1.46
	2	−0.52	−1.53	−1.29	−1.52	−1.91	−4.37	−0.90
	3	0.50	0.14	0.29	−0.20	−0.32	−2.57	0.35
	4	−1.44	−1.66	−1.42	−1.35	−1.46	−4.10	−1.51
	5	−1.87	−1.99	−2.16	−1.62	−1.63	−4.10	−1.88
	6	−0.69	−0.17	−0.15	0.07	−0.18	−2.58	−0.65
	7	−1.07	−0.54	−0.65	0.09	0.12	−2.39	−0.89
	8	−2.09	−1.50	−1.40	−0.83	−0.47	−2.75	−1.78
	9	−2.15	−1.34	−1.46	−0.59	0.25	−2.29	−1.60
	10	−1.82	−0.57	−0.56	−0.10	0.56	−1.61	−1.25
	P1 − P10	3.76	1.58	1.86	0.51	−0.73	−1.31	2.71
	Average	−0.49	−0.60	−0.51	−0.47	−0.54	−2.82*	−0.54
Australia	1	0.02	−0.55	−0.52	−1.24	−0.88	1.19	−0.57
	2	−1.82	−2.06	−2.56*	−2.39*	−2.27	−0.81	−2.11
	3	1.83	1.54	1.29	0.99	1.16	2.26	1.51
	4	−0.70	−1.14	−1.17	−0.69	−0.42	0.57	−1.17
	5	−1.24	−1.80	−1.49	−1.96	−1.52	−0.48	−1.70
	6	−1.96*	−1.99*	−1.74	−1.63	−1.63	−0.36	−2.04
	7	−1.68	−1.65	−1.47	−1.53	−1.55	−0.73	−1.65
	8	−1.60	−1.27	−1.22	−1.06	−1.22	−0.21	−1.18
	9	−2.32*	−1.70	−1.43	−1.44	−1.83	−1.04	−1.68
	10	−2.62*	−1.84*	−1.64*	−1.52	−1.98*	−1.20	−1.77*
	P1 − P10	2.64	1.29	1.12	0.28	1.10	2.39	1.20
	Average	−0.86	−1.02*	−0.99*	−1.11*	−1.01*	0.14	−1.01*

Fama & French (1992), the full-period post-ranking β of a size portfolio is allocated to each individual stock that is contained in the portfolio. Fifty size portfolios are formed according to the market value of common equity in June of each year. The allocated full-period post-ranking β are used in the CSR for individual stocks. The CSR model to be estimated at time t is as follows:

$$R_{it} - R_{ft} = \alpha + \gamma_{1t}\hat{\beta}_{i,\mathrm{MKT}} + \gamma_{2t}\hat{\beta}_{i,\mathrm{SMB}} + \gamma_{3t}\hat{\beta}_{i,\mathrm{HML}} + \gamma_{4t}\hat{\beta}_{i,\mathrm{MMTM}} + \gamma_{5t}\hat{\beta}_{i,\mathrm{FESTD}} + \varepsilon_{it}, \quad (3)$$

where $\hat{\beta}_i$, is the allocated full-period post-ranking β (or factor loading) of the corresponding risk factor for individual stock i, and γs are the risk premium for the corresponding risk. Note that as a stock can move across portfolios with year-to-year changes in the stock's firm size, the stock's β is allowed to change over time in the CSR estimation.

Table 6 reports the time-series averages (or risk premia estimates) of the slope coefficients from the month-by-month Fama–MacBeth OLS CSR of stock excess returns on β. The focus of this CSR test is whether the βs can explain the cross-sectional difference in average stock returns and thus the β risk premia estimates (or γ estimates) are statistically significant. Another focus of the CSR test is whether the intercept α estimate is statistically insignificant because a well-specified model should have an insignificant intercept. When only the market β, β_{MKT}, is used (in Model 1), the USA and Canada have statistically positively significant β risk premia estimates. However, these two countries also have significant intercept estimates. The other countries (except for Australia) have insignificant or even negatively significant γ estimates for β_{MKT}. These results indicate that the market β alone might be inappropriate for universal application to all countries to explain the cross-section of average stock returns. When the Fama–French's three-factor loadings, β_{MKT}, β_{SMB}, and β_{HML}, are used (in Model 2), the statistical significance and sign of the corresponding risk premium estimates are also inconsistent across the countries as the market β risk premium estimates in Model 1. For example, the γ estimate for β_{MKT} is positive in Canada, France, Hong Kong, and Australia. However, it is negative in the other countries. The γ estimates for β_{SMB} and β_{HML} also have a similarly inconsistent pattern across the countries. When the momentum risk factor loading β_{MMTM} is added to the three-factor loadings (in Model 3), the pattern of the γ estimates for the four-factor loadings is also similar. Note that the negative γ estimates for the factor loadings are inconsistent with economic intuition.

Unlike the γ estimates for the factor loadings β_{MKT}, β_{SMB}, β_{HML}, and β_{MMTM}, the γ estimate for the earnings information uncertainty risk factor loading β_{FESTD} is robustly consistent across the countries in its statistical significance and sign. It is statistically positively significant in all countries when β_{FESTD} is added to Fama–French's three-factor loadings (in Model 4). In the parsimonious two-factor model containing β_{MKT} and β_{FESTD} (Model 5), the γ estimates for β_{FESTD} are all positive and statistically significant in most of the countries. Although the natural logarithm of firm size and book-to-market equity ratio are included in the model with β_{MKT} and β_{FESTD} (in Model 8), the pattern of the γ estimate for β_{FESTD} is not changed. More remarkable results are obtained when β_{FESTD} is alone in the model (in Model 6). The γ estimates for β_{FESTD} in this one-factor model are all positive and statistically significant in most countries, and the intercept estimates are all insignificant.

More noticeable results for β_{FESTD} are obtained in January only. Table 7 presents the time-series averages of the slope coefficients in January only, from the month-by-month CSR estimation. The cross-sectional explanatory power of β_{MKT} and β_{SMB} for average stock returns is relatively strong in January. When β_{MKT} alone is used in the model, the γ estimates in January are positively very significant in

Table 6 Time-series averages of the coefficient estimates (×100) of the cross-sectional regression estimates over the whole months: January 1992 to December 2004

The coefficient estimates of the month-by-month cross-sectional regression model of individual stocks' excess returns on their post-ranking βs are obtained by Fama & MacBeth (1973) two-pass methodology. The time-series averages and their *t*-statistics (in parentheses) are reported. Individual stocks' βs are obtained: as in Fama & French (1992), the full-period post-ranking β of a size portfolio is allocated to each individual stock that is contained in the portfolio. Fifty size portfolios are formed according to the market value of common equity on June of each year. The allocated full-period post-ranking βs are used in the cross-sectional regressions (CSR) for individual stocks. As a stock can move across portfolios with year-to-year changes in the stock's firm size, the stock's β is allowed to change over time in the CSR estimation.

	Explanatory variables	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
Model 1	α	−1.873	−3.089	0.376	1.286	0.328	−1.167	−1.114	−0.276
		(−2.94)	(−4.50)	(0.91)	(3.65)	(0.78)	(−1.45)	(−0.90)	(−0.66)
	β_{MKT}	3.180	4.671	0.466	−1.013	0.650	1.342	2.401	2.059
		(4.08)	(5.83)	(0.83)	(−2.07)	(1.16)	(1.41)	(1.67)	(3.06)
Model 2	α	3.069	−1.742	0.817	1.013	−0.446	0.441	−1.276	−0.407
		(3.43)	(−2.40)	(1.91)	(3.47)	(−1.00)	(0.81)	(−1.52)	(−0.92)
	β_{MKT}	−5.735	3.232	−0.941	−0.755	1.922	−1.446	2.102	2.474
		(−3.05)	(2.85)	(−1.28)	(−1.68)	(2.71)	(−1.42)	(1.55)	(3.00)
	β_{SMB}	4.757	1.423	0.723	0.013	0.762	1.309	0.542	−0.365
		(4.29)	(2.41)	(1.70)	(0.03)	(1.96)	(2.50)	(0.61)	(−0.70)
	β_{HML}	−0.140	2.650	−0.865	0.867	1.354	−0.886	1.478	0.114
		(−0.18)	(2.88)	(−1.96)	(1.81)	(2.14)	(−2.46)	(1.82)	(0.16)
Model 3	α	3.133	−2.268	0.820	0.987	−0.391	0.632	−1.259	−0.414
		(3.52)	(−2.98)	(1.92)	(3.32)	(−0.86)	(1.16)	(−1.50)	(−0.93)
	β_{MKT}	−5.893	5.091	−0.086	−0.593	1.578	−1.709	1.847	2.517
		(−3.04)	(4.05)	(−0.10)	(−0.89)	(2.05)	(−1.67)	(1.29)	(2.99)
	β_{SMB}	4.855	0.353	0.565	0.081	0.653	0.973	0.514	−0.306
		(4.26)	(0.62)	(1.30)	(0.19)	(1.66)	(1.91)	(0.58)	(−0.57)
	β_{HML}	−0.059	3.271	−0.487	0.855	1.011	−0.645	1.334	0.187
		(−0.08)	(3.45)	(−1.09)	(1.77)	(1.52)	(−1.84)	(1.58)	(0.26)
	β_{MMTM}	−0.336	4.644	1.334	0.333	−0.768	−1.068	−0.726	0.527
		(−0.24)	(3.54)	(1.96)	(0.31)	(−1.05)	(−1.93)	(−0.77)	(0.46)
Model 4	α	1.443	0.431	−0.212	0.845	−0.321	1.325	−1.343	−0.312
		(1.91)	(0.65)	(−0.47)	(3.14)	(−0.76)	(2.05)	(−1.60)	(−0.66)
	β_{MKT}	−1.653	−0.182	0.039	−1.812	0.349	−5.713	2.084	2.090
		(−1.20)	(−0.16)	(0.06)	(−2.50)	(0.54)	(−3.26)	(1.54)	(1.84)
	β_{SMB}	1.731	−0.669	−2.196	−1.090	−1.192	−0.080	−2.072	−0.431
		(1.83)	(−1.12)	(−2.86)	(−2.07)	(−2.47)	(−0.16)	(−1.43)	(−0.79)
	β_{HML}	1.044	0.840	−1.372	0.091	−0.442	−0.788	0.684	0.188
		(1.73)	(0.94)	(−2.82)	(0.17)	(−0.76)	(−2.25)	(0.76)	(0.28)
	β_{FESTD}	1.596	3.754	2.154	1.321	2.095	5.863	2.838	0.464
		(3.04)	(5.46)	(3.70)	(2.31)	(3.90)	(3.60)	(1.89)	(0.49)

Table 6 (*Continued*)

	Explanatory variables	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
Model 5	α	0.332	1.020	0.653	1.112	−0.318	2.090	0.019	−0.255
		(0.68)	(2.01)	(1.62)	(3.84)	(−0.75)	(2.73)	(0.02)	(−0.54)
	β_{MKT}	0.160	−1.364	−0.303	−1.063	0.870	−5.849	0.777	1.982
		(0.22)	(−1.67)	(−0.51)	(−2.00)	(1.57)	(−2.78)	(0.58)	(1.74)
	β_{FESTD}	1.915	3.621	0.762	0.279	1.062	4.927	0.872	0.066
		(3.79)	(5.63)	(2.42)	(0.68)	(2.70)	(2.74)	(0.96)	(0.07)
Model 6	α	0.592	0.493	0.411	0.290	0.560	−0.830	0.624	0.513
		(1.38)	(1.32)	(1.03)	(0.68)	(1.43)	(−1.70)	(0.88)	(1.72)
	β_{FESTD}	1.836	2.392	0.696	0.053	0.988	1.257	1.174	1.626
		(4.20)	(5.40)	(2.37)	(0.13)	(2.51)	(2.03)	(1.60)	(2.78)
Model 7	α	3.332	2.459	0.875	0.911	0.461	−0.209	−0.126	−0.020
		(5.70)	(4.55)	(1.93)	(2.46)	(1.09)	(−0.42)	(−0.15)	(−0.05)
	β_{MKT}	−6.120	−3.441	−0.532	−0.659	0.479	−0.183	1.155	1.843
		(−5.36)	(−5.05)	(−0.87)	(−1.48)	(1.06)	(−0.26)	(0.92)	(2.41)
	β_{SMB}	5.004	4.189	0.876	−0.171	0.525	0.601	0.477	−0.087
		(5.27)	(6.41)	(2.07)	(−0.48)	(1.47)	(1.45)	(0.58)	(−0.19)
Model 8	α	2.800	1.782	0.386	1.073	−0.674	1.620	−3.050	0.860
		(2.25)	(1.46)	(0.63)	(2.74)	(−1.39)	(1.52)	(−2.36)	(1.06)
	β_{MKT}	−0.867	−1.861	−0.517	−0.750	0.210	−5.648	1.643	0.359
		(−1.00)	(−2.10)	(−0.90)	(−1.21)	(0.40)	(−2.98)	(1.26)	(0.35)
	β_{FESTD}	1.435	3.949	1.129	−0.096	1.829	4.764	1.641	1.016
		(2.61)	(5.53)	(2.57)	(−0.19)	(3.63)	(3.08)	(1.59)	(1.09)
	log(SIZE)	−0.175	−0.042	0.101	0.031	0.189	0.095	0.357	−0.024
		(−1.70)	(−0.39)	(1.27)	(0.47)	(2.37)	(1.10)	(2.67)	(−0.26)
	log(BM)	0.301	−0.017	0.333	0.283	0.419	0.495	0.340	0.488
		(1.62)	(−0.09)	(2.87)	(2.47)	(2.41)	(4.24)	(1.78)	(2.72)

most of the countries. When Fama–French's three-factor loadings are in the model, the γ estimates in January for β_{SMB} are also positively very significant in most of the countries. However, after β_{FESTD} is added to the model with β_{MKT} or with Fama–French's three-factor loadings, the γ estimates for β_{MKT} and β_{SMB} turn out to be insignificant or even negatively significant. By contrast, the γ estimates for β_{FESTD} are robustly positive and statistically significant. These results indicate that the risk factor, FESTD, is robust and significantly priced, and its factor loading dominates the factor loading on the other risk factor in explaining the cross-section of stock returns in January.

6. Concluding Remarks

In this paper, in order to explain the seasonal regularity observed in January in international stock markets, I construct a common risk factor related to earnings

Table 7 Average coefficient estimates (×100) of the cross-sectional regression estimates over January only: January 1992 to December 2004

The coefficient estimates of the month-by-month cross-sectional regression model of individual stocks' excess returns on their post-ranking βs are obtained using Fama & MacBeth's (1973) two-pass methodology. The time-series averages of the coefficient estimates in January only and their *t*-statistics in parenthesis are reported. The matching procedure of individual stocks' returns and βs in the CSR estimation is the same as in Table 6.

	Explanatory variables	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
Model 1	α	−12.196	−11.815	−4.265	1.809	0.767	−7.305	−6.404	−2.583
		(−3.41)	(−7.40)	(−2.22)	(1.56)	(0.42)	(−2.31)	(−0.85)	(−1.68)
	β_{MKT}	17.123	16.084	7.752	1.567	3.978	10.620	6.790	7.965
		(3.50)	(7.15)	(3.44)	(1.14)	(1.83)	(2.38)	(0.75)	(3.83)
Model 2	α	21.722	−5.167	−1.122	0.488	−4.204	−2.182	−2.659	−2.161
		(4.69)	(−1.63)	(−0.62)	(0.70)	(−2.07)	(−1.46)	(−0.79)	(−1.32)
	β_{MKT}	−47.137	6.871	2.462	3.400	12.082	1.809	0.210	6.744
		(−5.47)	(1.29)	(0.98)	(2.25)	(4.52)	(0.81)	(0.05)	(2.29)
	β_{SMB}	29.901	6.644	4.864	3.095	5.915	4.101	4.242	1.218
		(5.30)	(2.21)	(1.93)	(1.74)	(2.83)	(1.96)	(1.23)	(0.64)
	β_{HML}	−10.555	5.194	0.923	0.958	8.759	−2.687	4.617	0.259
		(−2.95)	(1.31)	(0.61)	(0.53)	(5.31)	(−2.23)	(1.39)	(0.12)
Model 3	α	22.865	−6.638	−1.120	−0.271	−3.878	−1.395	−2.679	−2.067
		(5.20)	(−2.15)	(−0.62)	(−0.30)	(−1.86)	(−0.94)	(−0.79)	(−1.29)
	β_{MKT}	−50.003	12.297	4.748	7.495	9.983	0.592	0.458	6.370
		(−5.79)	(2.26)	(1.78)	(2.30)	(2.95)	(0.29)	(0.10)	(2.19)
	β_{SMB}	31.718	3.466	4.440	4.775	5.238	2.661	4.282	0.969
		(5.43)	(1.23)	(1.83)	(2.58)	(2.69)	(1.42)	(1.23)	(0.48)
	β_{HML}	−8.977	6.992	1.923	0.679	6.676	−1.775	4.824	−0.012
		(−3.40)	(1.67)	(1.12)	(0.36)	(3.69)	(−1.77)	(1.58)	(−0.01)
	β_{MMTM}	−6.323	13.944	3.562	8.190	−4.671	−4.940	0.744	−3.398
		(−1.17)	(2.49)	(1.94)	(1.26)	(−1.19)	(−1.49)	(0.23)	(−0.89)
Model 4	α	7.351	1.393	−3.808	0.301	−3.423	1.338	−2.942	−1.496
		(1.60)	(0.44)	(−2.12)	(0.37)	(−1.85)	(0.70)	(−0.84)	(−0.80)
	β_{MKT}	−11.019	−3.433	4.987	2.174	4.306	−15.005	0.103	3.817
		(−1.42)	(−0.63)	(2.09)	(1.64)	(1.93)	(−2.28)	(0.03)	(0.80)
	β_{SMB}	3.130	0.323	−2.632	1.830	−3.512	−1.408	−7.282	0.605
		(0.72)	(0.11)	(−0.89)	(1.12)	(−1.79)	(−0.87)	(−1.14)	(0.31)
	β_{HML}	−0.048	−0.307	−0.419	0.068	0.040	−2.228	1.107	0.736
		(−0.02)	(−0.07)	(−0.25)	(0.03)	(0.03)	(−2.06)	(0.26)	(0.35)
	β_{FESTD}	14.123	11.312	5.557	1.528	10.029	23.094	12.526	3.696
		(6.61)	(5.35)	(1.79)	(0.71)	(4.07)	(2.55)	(1.46)	(0.81)
Model 5	α	5.210	1.085	−2.852	−0.125	−2.958	3.315	0.933	−1.604
		(2.50)	(0.68)	(−1.65)	(−0.10)	(−1.38)	(1.28)	(0.30)	(−0.83)
	β_{MKT}	−6.697	−2.860	3.964	0.884	4.864	−12.872	−3.738	4.038
		(−2.21)	(−1.26)	(2.29)	(0.65)	(2.24)	(−1.83)	(−0.86)	(0.84)

Table 7 (*Continued*)

	Explanatory variables	USA	Canada	UK	Germany	France	Japan	Hong Kong	Australia
	β_{FESTD}	15.078	11.360	3.752	3.293	6.944	16.132	5.645	3.872
		(6.31)	(5.47)	(1.95)	(1.64)	(3.24)	(2.12)	(1.35)	(0.88)
Model 6	α	−0.586	−0.425	0.859	0.627	1.708	−2.887	−1.911	−0.304
		(−0.72)	(−0.63)	(0.75)	(0.63)	(1.35)	(−1.59)	(−0.60)	(−0.29)
	β_{FESTD}	13.138	9.275	3.989	3.405	6.917	7.777	4.112	7.365
		(5.15)	(6.24)	(2.10)	(1.71)	(3.28)	(2.36)	(0.89)	(3.86)
Model 7	α	14.651	2.197	−1.265	0.858	−0.772	0.125	−1.348	−2.191
		(5.06)	(1.04)	(−0.68)	(0.75)	(−0.40)	(0.07)	(−0.41)	(−1.33)
	β_{MKT}	−33.405	−4.978	2.106	3.005	5.226	0.105	0.071	6.766
		(−5.44)	(−1.60)	(0.94)	(1.61)	(2.29)	(0.04)	(0.02)	(2.33)
	β_{SMB}	28.835	11.478	4.702	2.848	4.552	3.291	3.057	1.145
		(5.41)	(5.04)	(1.90)	(1.55)	(2.39)	(1.86)	(0.93)	(0.70)
Model 8	α	2.842	4.151	−2.984	1.524	−1.465	−1.113	−3.891	0.157
		(0.35)	(0.82)	(−1.36)	(0.85)	(−0.90)	(−0.39)	(−0.57)	(0.08)
	β_{MKT}	−4.184	−4.484	3.705	3.655	1.288	−13.749	−3.782	5.320
		(−0.84)	(−1.56)	(2.10)	(1.57)	(0.82)	(−1.49)	(−0.95)	(1.17)
	β_{FESTD}	13.437	11.514	3.979	−0.147	7.251	19.678	8.786	1.809
		(5.52)	(4.66)	(1.57)	(−0.06)	(3.60)	(1.99)	(1.41)	(0.40)
	log(SIZE)	0.020	−0.336	0.032	−0.296	0.327	0.509	0.733	−0.189
		(0.03)	(−0.76)	(0.11)	(−0.83)	(1.18)	(2.37)	(1.24)	(−0.88)
	log(BM)	0.171	−0.990	−0.036	0.723	0.300	0.902	0.461	1.213
		(0.29)	(−1.12)	(−0.07)	(1.03)	(0.36)	(1.59)	(0.53)	(1.61)

information uncertainty caused by earnings volatility (FESTD factor) and suggest a parsimonious two-factor model containing the market risk factor and this common factor. FESTD is used as a proxy for the earnings information uncertainty. Earnings forecasts are made using a statistical model, and annual earnings data are used in this paper rather than quarterly data due to data availability.

To examine the explanatory power of the suggested factor model for the January effect, time-series tests as well as cross-sectional tests are conducted using eight developed countries' stock returns: the USA, Canada, the UK, Germany, France, Japan, Hong Kong, and Australia. The competing models considered are the CAPM, Fama–French's three-factor model, Fama–French's three-factor model plus the momentum factor, and another two-factor model containing the market risk factor and Fama–French's firm size-related factor (SMB).

The suggested parsimonious two-factor model shows apparently stronger power in explaining time-series behavior of stock returns in all sample countries than do the competing models. With the adjustment of raw returns for risk by using this two-factor model, the systematic pattern in the residual returns (i.e. the abnormal returns) across firm size almost disappears in most countries. Furthermore, the arbitrage residual returns in January, which is the difference in the average residual returns between those in the smallest and largest size portfolios, are statistically insignificant in all countries. However, when the competing models are used, the residual returns still show an inverse relation with firm size, and the arbitrage residual returns in January are still very significant.

To examine whether the cross-sectional difference in stock returns is explained by the cross-section of the FESTD factor loading or β, the cross-sectional relationship between average returns and the factor loading is estimated using Fama–MacBeth's two-pass estimation methodology. The results show that the factor loading on FESTD has an economically and statistically significant power in explaining the cross-section of average stock returns in most of the countries. Its statistical significance and sign are consistent and robust in all the countries. In particular, the factor loading on FESTD dominates the factor loadings on the other risk factors in explaining the cross-section of stock returns in January.

The aforementioned results indicate that FESTD plays a special role in explaining the seasonal pattern of stock returns in January, and that January might be a month that potentially tends to differentially reward stocks with uncertain earnings information. It could be argued, therefore, that large returns in January might be a risk premium for taking information uncertainty risk concerning earnings and unexpected earnings surprises faced at the earnings announcement and that the previously found strong January seasonality in stock returns might result from the use of misspecified models in adjusting for risk. The present paper and Kim (2006) are the first studies to provide a risk-based explanation for the January effect.

References

Ball, R., S. P. Kothari, and R. L. Watts, 1993, Economic determinants of the relation between earnings changes and stock returns, *The Accounting Review* **68**, pp. 622–638.

Berges, A., J. J. McConnel, and G. G. Schlarbaum, 1984, The turn-of-the-year in Canada, *Journal of Finance* **39**, pp. 185–192.

Brown, P., D. B. Keim, A. W. Kleidon, and T. A. Marsh, 1983, Stock return seasonalities and the tax-loss selling hypothesis, *Journal of Financial Economics* **12**, pp. 105–127.

Carhart, M., 1997, On persistence in mutual fund performance, *Journal of Finance* **52**, pp. 57–82.

Chan, K. C., N. F. Chen, and D. A. Hsieh, 1985, An exploratory investigation of the firm size effect, *Journal of Financial Economics* **14**, pp. 451–471.

Diether, K. B., C. J. Malloy, and A. Scherbina, 2002, Differences of opinion and the cross section of stock returns, *Journal of Finance* **57**, pp. 2113–2141.

Dyl, E. A., and E. D. Maberly, 1992, Odd-lot transactions around the turn of the year and the January effect, *Journal of Financial and Quantitative Analysis* **27**, pp. 591–604.

Fama, E., and K. French, 1992, The cross-section of expected stock returns, *Journal of Finance* **47**, pp. 427–465.

Fama, E., and K. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* **33**, pp. 3–56.

Fama, E., and J. MacBeth, 1973, Risk, return, and equilibrium: Empirical tests, *Journal of Political Economy* **81**, pp. 607–636.

Gibbons, M. R., S. A. Ross, and J. Shanken, 1989, A test of the efficiency of a given portfolio, *Econometrica* **57**, pp. 1121–1152.

Gultekin, M. N., and N. B. Gultekin, 1983, Stock market seasonality: International evidence, *Journal of Financial Economics* **12**, pp. 469–481.

Jegadeesh, N., and S. Titman, 1993, Returns to buying winners and selling losers: Implications for market efficiency, *Journal of Finance* **48**, pp. 65–91.

Jones, C. P., D. K. Pearce, and J. W. Wilson, 1987, Can tax-loss selling explain the January effect? A Note, *Journal of Finance* **42**, pp. 453–461.

Kato, K., and J. S. Schallheim, 1985, Seasonal and size anomalies in the Japanese stock market, *Journal of Financial and Quantitative Analysis* **20**, pp. 243–260.

Keim, D. B., 1983, Size-related anomalies and stock return seasonality, *Journal of Financial Economics* **12**, pp. 13–32.

Keim, D. B., 1989, Trading patterns, bid-ask spreads, and estimated security returns: The case of common stocks at calendar turning points, *Journal of Financial Economics* **25**, pp. 75–97.

Kim, D., 2006, On the information uncertainty risk and the January effect, *Journal of Business* **79**, pp. 2127–2162.

Kim, D., and M. Kim, 2003, A multi-factor explanation for post-earnings-announcement drift, *Journal of Financial and Quantitative Analysis* **38**, pp. 383–398.

Kim, D., and S. Shin, 2006, The risk of earnings information uncertainty and the January effect in Korean stock markets, *Asia-Pacific Journal of Financial Studies* **35**, pp. 73–102 (written in Korean).

Lakonishok, J., and S. Smidt, 1984, Volume and turn-of-the-year behavior, *Journal of Financial Economics* **13**, pp. 435–455.

Lakonishok, J., and S. Smidt, 1988, Are seasonal anomialies Real? A ninety-year perspective, *Review of Financial Studies* **1**, pp. 403–425.

Reinganum, M. R., and A. C. Shapiro, 1987, Taxes and stock return seasonality: Evidence from the London Stock Exchange, *Journal of Business* **60**, pp. 281–295.

Ritter, J. R., 1988, The buying and selling behavior of individual investors at the turn of the year, *Journal of Finance* **43**, pp. 701–717.

Ritter, J. R., and N. Chopra, 1989, Portfolio rebalancing and the turn-of-the-year effect, *Journal of Finance* **44**, pp. 149–166.

Rogalski, R., and S. M. Tinic, 1986, The January size effect: Anomaly or risk mismeasurement?, *Financial Analyst Journal* **42**, pp. 63–70.

Roll, R., 1983, Vas Ist Das? *Journal of Portfolio Management* **9**, pp. 18–28.

Rozeff, M. S., and W. R. Kinney Jr, 1976, Capital market seasonality: The case of stock returns, *Journal of Financial Economics* **3**, pp. 379–402.

Tinic, S. M., and R. R. West, 1984, Risk and return: January vs. the rest of the year, *Journal of Financial Economics* **13**, pp. 561–574.

Wachtel, S. B., 1942, Certain observations on seasonal movements in stock prices, *Journal of Business* **15**, pp. 184–193.

