Persistence of Size and Value Premia and the Robustness of the Fama-French Three Factor Model: Evidence from the Hong Stock Market

Gilbert V. Nartea
Lincoln University, New Zealand
narteag@lincoln.ac.nz
fax: 64-3-325-3847
phone: 64-3-325-3627 extn 8368

Christopher Gan
Lincoln University, New Zealand
ganc1@lincoln.ac.nz
fax: 64-3-325-3847
phone: 64-3-325-3627 extn 8155

Ji Wu
Lincoln University, New Zealand
wuj4@lincoln.ac.nz
fax: 64-3-325-3847
phone: 64-3-325-2811 extn 8952

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Abstract

We use Hong Kong stock market data from 1982-2001 to test the persistence of the size and value premia and the robustness of the Fama-French (FF) three-factor model in explaining the variation in stock returns. We document a statistically significant and persistent size effect or size premium that is robust even for non-January months. The book to market efffect or value premium however is weaker and less consistent than in Fama and French (1993) and Drew and Veeraraghavan (2003). Our results also support the explanation that the size and value premia are rewards for risk bearing. We further find a large improvement in explanatory power provided by the FF model relative to the CAPM but that the FF model is mis-specified for the Hong Kong market.

JEL Classification: G12

Key words: Asset pricing; Fama-French Three-factor model; CAPM; Size effect; Book to market effect; Hong Kong

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1. Introduction

Several empirical studies show that the CAPM market beta has very little relation to stock returns (Reinganum, 1981, Breeden, Gibbons and Litzenberger, 1989, Fama and French, 1992, Chui and Wei, 1998, Lam, 2002) while a number of studies document relationships between returns and variables such as size or market capitalisation (Banz 1981; Reinganum 1981; Blume and Stambaugh, 1983; Brown, Keim, Kleidon and Marsh,1983) and book to market ratio (BM) (Rosenberg, Reid and Lanstein, 1985; Davis 1994; Chan, Hamao, and Lakonishok,1991; Capaul, Rowley and Sharpe, 1993). These size and BM effects have also come to be called size and value premia. The size effect is generally accepted but the BM effect is more controversial. A recent study by Malin and Veeraraghavan (2004) of three European markets fail to find a BM effect in France, Germany and the United Kingdom. Likewise Drew, Naughton, and Veeraraghavan (2003) report that the book to market effect was not as pervasive in the Shanghai market as the size effect.

Evidence from other emerging markets generally confirm these size and book to market effects. Fama and French (1998) report firm size and BM effects in respectively, 11 and 12 out of 16 emerging markets. These effects have also been documented in Hong Kong, Korea, Malaysia, Thailand, and the Philippines (Chui and Wei,1998; Lam, 2002; Drew and Veeraraghavan, 2002, 2003). Chui and Wei (2003) use data from the Pacific Basin Capital Markets (PACAP) Databases to cover a 13 year testing period from July 1980 to June 1993. They employ Fama-MacBeth (1973) cross-sectional regressions and report significant size and BM effects in the Hong Kong stock market. However, the size effect has the expected sign only in non-January months and contrary to expectations, a reverse size effect is reported for January months with large firms significantly outperforming small firms. The authors explain this as the result of foreign institutional investors, who are the major force in the Hong Kong market, buying large stocks in January. Lam (2003) also uses a 13 year testing period from July 1984 to June 1997 obtained from PACAP and likewise uses the Fama-MacBeth procedure. By restricting the sample firms to include only those that are continuously listed for the entire period of study Lam (2003) obtained a sample of 100 companies including financial firms. Lam (2003) reports significant size and BM effects but the size effect is positive throughout all regressions, contrary to expectations. However, Lam's (2003) results cold be biased by the small sample size in addition to the presence of survival bias.

The source and nature of these size and BM effects is also contentious. Fama and French (1993, 1995, 1996) explain the size and BM effects as compensation for holding less profitable, riskier stocks, ie as risk premia. Others suggest that the BM effect is either due to investors extrapolating past performance too far into the future which leads to the underpricing of high BM firms (value stocks) and overpricing of low BM firms (growth stocks) (DeBondt and Thaler, 1987, Lakonishok, Shleifer and Vishny, 1994, and Haugen, 1995) or investors having a preference for certain firm characteristics such as a preference for growth stocks and a dislike for value stocks (Daniel and Titman, 1997). Other explanations of these size and BM effects also include data snooping and other biases in the data (Lo and MacKinlay 1990, Kothari Shanken and Sloan, 1995).

What is apparent is that the single-factor CAPM is no longer suitable to explain the relationship between risk and return, but so far there is no universally accepted model to replace it. The most well known model in the current finance literature is the Fama-French three-factor model, henceforth FF model (see Fama and French, 1993, 1995, 1998), which posits that the cross section of average returns can be explained by three factors -- the excess market return, a size factor, and a book-to-market equity factor. However, since the FF model was developed using US data, it is important that it be tested for robustness in markets outside the US. Campbell et al. (1997) argue that the usefulness of multi-factor models will not be fully known until out-of-sample checks on its performance becomes available. In response to this, Fama and French (1998) validated their model using data from several international markets, but their data set was dominated by a small number of large firms. Drew and Veeraraghavan (2002, 2003) tested the model in emerging Asian markets and find it to be a parsimonious representation of the risk factors for Hong Kong, Korea, Malaysia and the Philippines. However, their testing period ranged from only five to eight years and consequently suggest that more empirical testing of the FF model is needed before it can be accepted as a replacement for the CAPM.

The existing literature testing the robustness of the FF model in markets outside the US is sparse, especially in emerging markets, with most of these studies suffering from data problems. Hence, it is important to accumulate further out of sample evidence to advance the debate over the appropriate asset pricing model. This study aims to help fill this gap by analysing the Hong Kong Stock market which is the second largest stock market in Asia and the seventh largest in the world. The study is further motivated by Griffin (2002) who suggests that practical applications of the FF model are best performed on a country-specific basis. So far the only published testing the FF model in the Hong Kong stock market was done by Drew and Veeraraghavan (2003) (henceforth DV) who confirm a size and BM risk premium and report that the FF model can explain average returns better than the CAPM. However, their study is limited to only six years of data from December 1993 to December 1999 which was obtained from Datastream. This study aims to gain a more definitive result by using data obtained from a much longer period.

There are four objectives in this paper.

(a) We test the robustness of the size and BM effects reported in earlier studies by using a different approach and different time frames. Both studies by Chui and Wei (1998) and Lam (2003) use the cross-section regression approach of Fama and Mac Beth (1973) while the present study uses the time series regression method of Black, Jensen, and Scholes (1972) similar to DV (2003). However, unlike DV (2003) we use a much longer twenty-year testing period spanning January 1982 to December 2001. This addresses the comments of Pinfold et al. (2001) who stress that that any 'study of either the size effect or the book to market effect will be highly dependent on the time frame selected'.

(b) We examine an empirical implementation of both the CAPM and the FF model to test the robustness of the latter through out of sample evidence. The use of the Black, Jensen, and Scholes (1972) time series regression approach in implementing these competing asset pricing models allows us to use the intercept as a simple return metric and a formal test of model mis-specification. A well-specified model in this case will have an intercept that is not significantly different from zero (Merton, 1973).

(c) We verify the risk explanation of the size and value premia and contribute to the controversial debate as to the source and nature of the size and BM effects.

(d) We test for January effect and verify if the size and value premia are strictly a January phenomenon.

In this study, we employ an adaptation of the Fama and French (1993) methodology to test for the size and BM effects within the context of the FF model. As an adaptation of Fama and French (1993), six portfolios were formed based on a 2 x 3 size-BM ratio sort. Size-return and BM-return relationships are then inferred from the excess returns of these portfolios. Subsequently, both the CAPM and FF model are used to explain the variation in returns for each portfolio. Results of these estimations are used to further verify the existence of size and BM effects and to gauge the ability of the FF model to explain size and value premia. We likewise use these results to verify the risk explanation of the size and value premia.

Our results document a statistically significant and persistent size effect that is robust even for non-January months. The BM effect however is weaker and less consistent than in Fama and French (1993) and DV (2003). Our results also support a risk based explanation for the size and value premia in that they can be regarded as rewards for risk bearing. We further find a large improvement in explanatory power provided by the FF model relative to the CAPM but significant intercept terms indicate that the FF model is mis-specified for the Hong Kong market. Section 2 of the paper describes the methods and reports summary statistics for the six stock portfolios. Section 3 presents regression results comparing the CAPM with the FF model and section 4 concludes the paper.

2. Methodology and data

At the end of each calendar year from 1981 to 2000, companies are selected to be included in the study. To be included, the company must have a price record at the end of the year and publicly available accounting data as of June of the same year. The selected companies are then ranked by size (market capitalization as of December) and sorted into two groups with an equal number of companies in each group (i.e., small (S) and big (B)). The companies are also independently ranked by book to market ratio (BM) and then sorted into three groups (i.e., low BM (L), medium BM (M), and high BM (H)) based on breakpoints for the bottom 33.33 % and the top 66.67 %. BM is shareholder equity divided by market capitalization both as of June of that year. Shareholder equity is defined as total reported shareholder equity minus the value of preferred shares and outside equity interests.

Six portfolios are formed at the end of each year using companies at the intersection of the size and BM groups, ie, (e.g. small size/low BM (*S/L*), small size/medium BM (*S/M*), small size/high BM (*S/H*), big size/low BM (*B/L*); big size/medium BM (*B/M*), and big size/high BM (*B/H*)). Only six portfolios instead of the 25 used by Fama and French (1993) were formed because of the small number of firms in the Hong Kong market compared with the US market. This is consistent with the other adaptations of the Fama and French (1993) methodology for small markets, see for example Drew and Veeraraghavan (2002, 2003), and Drew, Naughton, and Veeraraghavan (2003).

Value weighted returns are computed for each of the six portfolios that are formed at the end of each year. This is conducted over a 12 month period after the portfolio formation date. For example, portfolios formed as of December 1981 will be tracked in 1982. This produces a series of 240 monthly returns over the period January 1982 to December 2001 for each of the six size/BM portfolios. Accounting and stock market data were obtained from the Pacific-Basin (PACAP) database compiled by the University of Rhode Island.

Table 1 summarises the characteristics of the six portfolios and Panel A shows that the average annual number of companies in each portfolio ranged from 35 to 52 providing an average sample size of 259 companies per year.

INSERT TABLE 1 ABOUT HERE

Panel B shows that the average market capitalization of the companies making up the portfolios ranged from HK$ 9,396 million for *S/L* to HK$ 547,946 million for *B/L*. Panel B also shows that size tends to be negatively related to BM for the big size group. Therefore care must be taken in interpreting the results, as the size effect could amplify the BM effect for the big size group. Panel C shows that BM seems to be well controlled for the two size categories.

Both the CAPM (equation 1) and the FF model (equation 2) are estimated as follows:

$$RP(t) - RF(t) = a + b[RM(t) - RF(t)] + e(t) \quad (1)$$

$$RP(t) - RF(t) = a + b[RM(t) - RF(t)] + sSMB(t) + hHML(t) + e(t) \quad (2)$$

RP(t) is the portfolio return at time *t*, *RM* is the market return calculated as the value weighted market return of all stocks in the six portfolios including negative book to market stocks which were excluded from the sample while forming the size-BM portfolios. *RF* is the risk-free rate which is the Hong Kong and Shanghai Corporation Best Lending Rate from January 1982 to June 1988 and the monthly official cash rate of Hong Kong from July 1988. *SMB* is the difference between the returns on small minus big size firms (ie., mimicking a portfolio of long small capitalisation stocks and short big capitalisation stocks) and is calculated as the difference between the simple average return of the three small size portfolios (*S/L, S/M, S/H*) and the three big size portfolios (*B/L, B/M, B/H*). *HML* is the difference between the returns of high BM firms and low BM firms (ie., mimicking a portfolio of long high BM stocks and short low BM stocks) and is calculated as the difference between the simple average return of the two high BM portfolios (*S/H, B/H*) and the two low BM portfolios (*S/L, B/L*). This procedure for calculating *SMB* and *HML* follows from the adaptation of Drew and Veeraraghavan (2002, 2003), and Drew, Naughton, and Veeraraghavan (2003) of the Fama and French (1993) procedure.

3. Empirical Results

Comparison with DV (2003)results

First we replicate the results of DV (2003) for the period December 1993 to December 1999. Our results are consistent with DV (2003) in so far as we find a positive *SMB* and *HML*, and that we document a significant improvement in the average R^2 of the FF model compared with the CAPM. We find an *SMB* and *HML* of 1.621 % and 1.001% per month, respectively while DV (2003) report lower corresponding values of .8276 % and .3108 % per month. These figures indicate that on average, small size portfolios outperform big size portfolios and high BM portfolios generate higher returns than low BM portfolios. We also report a significant improvement in the average R^2 of the FF model (92%) compared with the CAPM (78%), though the improvement is lower than that found by DV (2003) who document an average R^2 of 63% and 40% respectively for the FF model and CAPM. We present in Table 2 the FF coefficients and show that our estimated *s* and *h* coefficients are all statistically significant while DV (2003) report statistically significant *s* coefficients but also report three insignificant *h* estimates in Panel B. Therefore we our results show strong size and BM effects during the testing period, while DV (2003) find a strong size effect but a weak BM effect. On the other hand, while DV (2003) report statistically insignificant intercept terms, we find three significant intercepts and conclude that the FF model is mis-specified for the Hong Kong market. The differences in our results from DV (2003) could be due to the data source as DV (2003) obtained their data from Datastream, and possibly due to our exclusion of non-financial firms as it is unclear if DV (2003) also excluded these firms from their sample.

INSERT TABLE 2 ABOUT HERE

Full Period, January 1982 to December 2001

We further extend the testing period to cover 20 years from January 1982 to December 2001. We also test for the January effect and its impact if any, on the results, and check for structural stability in the data before and after the Asian financial crisis and turnover of Hong Kong to China in July 1997.

Raw returns

Table 3 shows the mean monthly excess returns of the portfolios for the period January 1982-December 2001. It is clear from Table 3 that small stocks generate higher returns than big stocks and that high BM stocks generate higher returns than low BM stocks except for *B/H*. For instance, *S/L* earns an excess return of 15.36% per annum while the corresponding portfolio with a bigger size, *B/L*, only earns 8.77% per annum. On the other hand, *B/H* earns 12.37% per annum while the corresponding portfolio with a lower BM, *B/L*, only earns 8.77%. *SML* and *HML* are also both positive which is further indication that on average, small stock portfolios and high BM portfolios outperform large stock portfolios and low BM portfolios The *SMB* and *HML* values suggest that over the sample period, small firms as a group have outperformed big firms by 19.78% per annum while high BM firms have outperformed low BM firms by 11.03% per annum. Hence the excess returns indicate the presence of a strong size effect and a relatively weaker BM effect over the study period.

INSERT TABLE 3 ABOUT HERE

Regression results

We confirm the presence of these size and value premia by estimating both the CAPM and FF model. Panel A of Table 4 shows the coefficients of the CAPM. All intercepts are statistically insignificant while all *b* coefficients are highly significant at the 1% level. The average adjusted R^2 for the six portfolios is 71%. Panel B presents the coefficients of the FF model and shows that the intercept of three portfolios *S/L, S/H*, and *B/M* are significantly different from zero, contrary to expectations. All *b* and *s* coefficients are highly significant but two out of six *h* coefficients, for *B/M* and *B/H*, are not statistically significant. As expected, the *s* coefficients increase from big to small portfolios while the *h* coefficients increase monotonically from low to high BM portfolios. The average R^2 is 88 % which is a marked improvement over that of the CAPM.

INSERT TABLE 4 ABOUT HERE

The raw returns and the regressions estimates therefore indicate a strong negative size-return relationship consistent with the findings of Chiu and Wei (1998) over the period July 1980-June 1993. We also document a relatively weaker BM-return relationship that appears to be sensitive to the choice of the time period considering our earlier finding of a strong BM effect for the period December 1993-December 1999. The behaviour of the factor loadings on *SMB* and *HML* support the risk based explanation of the size and value premia as compensation for risk bearing. The FF model also explains the variation in average returns better than the CAPM with an average improvement of 17 percentage points, however the presence of significant intercept terms means that the FF model is mis-specified for the Hong Kong market implying that there could very well be additional factors that can explain average returns.

January Effect

We now turn our attention to the well-known January effect and test if our results are driven by returns in January. In Panel A of Table 5 we report the portfolio returns for January months while Panel B reports the corresponding returns for non-January months. It is evident that small stocks provide higher return than big stocks in January, but the same is also true for non-January months except for *S/M*. High BM portfolios also provide higher returns than low BM portfolios except for *S/M* for January, and *S/M* and *B/M* for non-January months. These results mirror those of the full sample confirming a size effect than is stronger than the BM effect for both January and non-January months. The *SMB* and *HML* are also positive highly significant for both January and non-January months. Therefore our results show a January effect wherein small firms and high BM firms outperform big firms and low BM firms, respectively. What is more interesting however is the fact that the portfolio returns as well as *SMB* and *HML* are significantly higher in January than in the rest of the months. Hence, we conclude that the size and BM effects persist throughout the year, but are evidently heightened in January.

INSERT TABLE 5 ABOUT HERE

Chui and Wei (1998) report a large firm effect in January for the period July 1980-June 1993, contrary to expectations. We verify their results using a slightly different period from January 1982 to June 1993.[1] Panel C of Table 5 shows the excess returns of the six portfolios and confirms the findings of Chui and Wei (1998) that big firms generate higher excess returns than the corresponding small firms in January. This is evident from a comparison of corresponding portfolios (e.g., S/L vs. B/L; S/M vs. B/M; and S/H vs. B/H), as well as in the negative *SMB*. However, we argue that this apparent reversal of the size effect is unique to the period from 1980 to 1993 given the evidence presented earlier for the full sample.

We report the coefficients of the FF model for January and non-January months in Table 6. For January months, all intercepts are not statistically significant except for *S/L*. All *b*, *s*, and *h* coefficients are highly significant except for the *h* coefficient of *B/L*. The *s* coefficients all increase from big to small portfolios, however the *h* coefficients increase from low BM to high BM portfolios only for the small stock category. Big stocks apparently exhibit a reverse BM effect in January, contrary to expectations. The average R^2 is 94 per cent. For non January months, all intercept terms are insignificant except for *S/H* and *B/M*. All *b*, *s*, and *h* coefficients are highly significant except for the *h* coefficient of *B/M*. The *s* coefficients all increase from big to small stocks and the *h* coefficients increase from low BM

[1] Our data set only goes as far back as January 1982.

to high BM stocks consistent with expectations. The average R^2 is 89 %, slightly lower than for January months. These results confirm the findings from the summary return statistics that the size and BM effects are evident throughout the year and not driven by the January returns.

INSERT TABLE 6 ABOUT HERE

Structural Stability

In 1997, most Asian countries suffered a financial crisis resulting in a dramatic depreciation in currency values. Furthermore, Hong Kong was turned over to China on the 1st of July 1997. Therefore, it is interesting to test whether or not these events brought about a structural change in the Hong Kong stock market.

The Table 7 shows the results of the Chow test for the three-factor model with a breakpoint of July 1997. The evidence shows that there is a structural change in the Hong Kong stock market after July 1997, since F-statistic values are greater than the critical value except for *S/L*.

INSERT TABLE 7 ABOUT HERE

Table 8 shows the excess returns of the six portfolios pre- and post-July 1997. For the period before July 1997 shown in Panel A, there is an apparent positive size-return relationship for the low and medium BM portfolios contrary to expectations, ie, *B/L* and *B/M* earn higher returns than *S/L* and *B/M*, respectively. However as a group, small size portfolios generate higher returns than big size portfolios as indicated by the positive *SMB*, which is more consistent with expectations. A positive size-BM relationship consistent with expectations, is also evident with the exception of *B/H*. Likewise, the positive *HML* means that the average return of the two high BM portfolios is higher than the average return of the two low BM portfolios.

INSERT TABLE 8 ABOUT HERE

Lam (2002) also reports a positive size-return relationship over the period July 1984-June 1997. Hence we verify this finding with excess returns of the six portfolios over this period. Panel B of Table 8 shows that over this period, there is indeed evidence of a negative size-return relationship but this is limited low and medium BM firms. However if we include high BM firms, small firms as a group generate higher returns than big firms as shown by the positive *SMB*. Therefore we conjecture that Lam's (2003) sample may have been confined to low and medium BM firms.

The monthly excess returns for the period from July 1997 are shown in Panel C of Table 8. A negative size-return relationship, consistent with expectations, is evident from a comparison of corresponding individual portfolios as well as from the positive SMB. However, contrary to expectations, we document a strong negative BM-return relationship both at the portfolio level as well as in terms of the negative *HML*.

Given the results of the structural tests, the three-factor model was re-estimated over two time frames, January 1982-June 1997 and July 1997-December 2001. Panel A of Table 9 shows that for the period January 1982-June 1997, the intercepts for *S/H* and *B/M* are statistically significant at the 10% level, contrary to expectations. However, the *b*, *s*, and *h* coefficients are all statistically significant at the 5% level, except the *h*-coefficient of portfolio *B/M*. As expected, the s coefficients increase from big to small stock portfolios while the *h* coefficients increase monotonically from low to high BM portfolios. The empirical evidence is consistent with results reported earlier for the full period in that we document a strong size effect a relatively weaker BM effect. However as shown in Panel B, over the period July 1997-December 2001, the intercepts for *S/L*, *B/L* and *B/H* are all significant at the 10% level, contrary to expectations. The *s* coefficients are all statistically significant at 5% level except for *S/M* but only four out of six *h* coefficients are statistically significant at 10% level. The *s* coefficients increase from big to small stock portfolios consistent with expectations. Similarly, the *h* coefficients increase from low to high BM portfolios for small stocks, which when interpreted in the context of a negative *HML* confirms a reverse BM effect, contrary to expectations. The results suggests that there is still a strong size effect post-July 1997 but the BM effect is particularly weaker compared to the period before July 1997 and has a direction that is contrary to expectations.

INSERT TABLE 9 ABOUT HERE

Overall, the evidence suggests that the Asian crisis of July 1997 and the turnover of Hong Kong to China brought about structural change in the Hong Kong stock market. Though both the BM and size effects are still present after these events we observe a weakening of the BM effect with an apparent reversal in direction compared to the period before July 1997. Further research is clearly needed to determine the reasons for this change in the BM effect.

4. Conclusions

Our findings report a persistent negative size-return relationship that is robust for different testing periods. This size effect is evident throughout the year but appears to be heightened in January. We also document a relatively weaker BM effect that appears to be particularly sensitive to the testing period. There is an apparent structural break in the data from July 1997 but this does not seem to affect the size-return relationship though it has clearly further weakened the BM effect with an apparent reversal in direction. Our results also support the risk-based explanation of the size and BM effects that the size and BM return premia are not signs of market inefficiency, but are instead rewards to risk bearing. We also find that the FF model explains the variation in average returns better than the CAPM. Taken at face value, our findings imply that a) cost of capital estimates would be more accurate using the FF model rather than the CAPM, b) portfolio managers can increase portfolio returns by investing in a combination of small and high BM firms but this also involves increasing portfolio risk, and c) portfolio performance evaluation should take into account the size and BM characteristics of the portfolios and require small size and high BM portfolios to earn a higher rate of return. Finally, though the three factors – market, BM and size – appear to be robust variables in explaining stock returns, the presence of significant intercept terms means that the FF model is mis-specified for the Hong Kong market and there could very well be additional factors that can explain average returns.

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Table 1
Characteristics of six portfolios formed on size and book-to-market equity: January1982-December 2001.

Panel A: Average Annual Number of Companies in Portfolio

	Low BM	*Medium BM*	*High BM*
Small	35	49	46
Big	52	37	40

Panel B: Average Annual Market Capitalisation ($HK million)

	Low BM	*Medium BM*	*High BM*
Small	9,396	10,005	10,332
Big	547,946	214,397	135,175

Panel C: Average Annual Ratio of Book value to Market capitalisation

	Low BM	*Medium BM*	*High BM*
Small	0.45	1.07	2.60
Big	0.40	1.06	2.54

BM, book to market.

Table 2.
Replication of DV (2003) Regression results, December 1993-December 1999

Panel A. FF model coefficients from DV (2003)

RP(t) – RF(t) = a + b[RM(t) – RF(t)] + sSMB(t) + hHML(t) + e(t)

Portfolio	a	b	s	h	R^2	F	DW
S/L	-1.562 (-1.942)	0.976 (9.892)	1.557 (8.845)	-0.723 (-3.627)	0.65	45.254	2.118
S/M	-0.008 (-0.900)	0.984 (8.774)	1.590 (7.948)	-0.199 (-0.878)	0.57	32.464	2.328
S/H	-1.40 (0.163)	0.998 (11.037)	1.400 (8.675)	0.478 (2.617)	0.66	47.900	1.906
B/L	-0.743 (-1.021)	0.998 (11.171)	0.486 (3.049)	-0.447 (-2.476)	0.67	48.761	1.994
B/M	-0.676 (-0.791)	0.984 (9.378)	0.418 (2.230)	-.350 (-1.650)	0.60	34.108	2.344
B/H	-1.265 (-1.593)	0.976 (10.015)	0.644 (3.702)	0.353 (1.792)	0.60	33.934	2.186

Panel B. FF model coefficients

RP(t) – RF(t) = a + b[RM(t) – RF(t)] + sSMB(t) + hHML(t) + e(t)

Portfolio	a	b	s	h	R^2	F	DW
S/L	-1.134 (-3.028)	1.044 (33.566)	0.581 (9.652)	-0.498 (-6.370)	0.96	490.236	1.954
S/M	-0.379 (-1.733)	0.918 (50.523)	0.332 (9.451)	0.192 (4.196)	0.98	982.801	1.912
S/H	-0.935 (-1.911)	0.883 (33.105)	0.248 (4.814)	0.471 (7.027)	0.95	419.746	2.163
B/L	1.376 (2.661)	0.692 (16.125)	-0.744 (-8.960)	-0.234 (-2.166)	0.81	100.377	1.819
B/M	1.418 (2.574)	0.972 (21.261)	-0.900 (-10.181)	-0.166 (-2.447)	0.88	164.402	1.924
B/H	0.175 (0.398)	0.982 (26.872)	-0.817 (-11.553)	0.342 (3.728)	0.92	257.186	2.058

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high B; DW, Durbin-Watson;

t-statistics in parentheses.

Table 3
Mean monthly excess returns: January1982-December 2001.

		Mean monthly returns(%)		
Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	1.2803 (12.0314)	1.6634 (10.3722)	1.6488 (7.8838)	0.9192 (6.7489)
S/M	1.6113 (10.0612	1.6634 (10.3722)	1.6488 (7.8838)	0.9192 (6.7489)
S/H	2.0118 (13.2471)	1.6634 (10.3722)	1.6488 (7.8838)	0.9192 (6.7489)
B/L	0.7305 (8.9377)	1.6634 (10.3722)	1.6488 (7.8838)	0.9192 (6.7489)
B/M	1.3408 (11.0300)	1.6634 (10.3722)	1.6488 (7.8838)	0.9192 (6.7489)
B/H	1.0308 (10.6911)	1.6634 (10.3722)	1.6488 (7.8838)	0.9192 (6.7489)

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high BM; SMB, small minus big; HML, high minus low. PMRF, portfolio return minus the risk-free rate; MMRF, market return minus the risk-free rate

t-statistics in parenthesis.

Table 4
Regression coefficients, January 1982-December 2001

Panel A. CAPM coefficients

$$RP(t) - RF(t) = a + b[RM(t) - RF(t)] + e(t)$$

Portfolio	a	b	R^2	F	DW
S/L	-0.396 (-1.013)	1.007 (27.043)	0.75	731.326	2.019
S/M	0.114 (0.464)	0.900 (34.437)	0.86	1477.378	1.979
S/H	0.281 (0.558)	1.041 (21.689)	0.66	470.424	2.195
B/L	-0.423 (-1.215)	0.693 (20.898)	0.65	436.71	1.945
B/M	-0.065 (-0.149)	0.845 (20.206)	0.63	408.297	1.902
B/H	-0.425 (-1.150)	0.875 (24.817)	0.72	615.878	1.988

Panel B. FF model coefficients

$$RP(t) - RF(t) = a + b[RM(t) - RF(t)] + sSMB(t) + hHML(t) + e(t)$$

Portfolio	a	b	s	h	R^2	F	DW
S/L	-0.627 (-2.302)	0.973 (37.153)	0.452 (12.945)	-0.497 (-12.382)	0.89	610.424	1.928
S/M	-0.096 (-0.397)	0.877 (37.893)	0.096 (3.121)	0.097 (2.745)	0.87	538.981	2.000
S/H	-0.935 (-4.087)	0.909 (41.341)	0.0405 (13.800)	0.834 (24.741)	0.93	1106.338	2.071
B/L	0.320 (1.305)	0.779 (33.091)	-0.472 (-15.030)	-0.116 (-3.224)	0.83	392.476	1.938
B/M	0.879 (2.983)	0.955 (33.712)	-0.639 (-16.914)	-0.080 (-1.847)	0.84	416.593	1.987
B/H	0.319 (1.336)	0.964 (42.017)	-0.576 (-18.841)	0.064 (1.827)	0.89	631.252	1.948

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high B; DW, Durbin-Watson;

t-statistics in parentheses.

Table 5
Mean monthly excess returns for January and non January months: January1982-December 2001.

Panel A. Mean monthly returns for January months (%)

Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	3.250	3.865	5.630	3.144
	(18.423)	(14.269)	(19.579)	(18.695)
S/M	1.980	3.865	5.630	3.144
	(11.719)	(14.269)	(19.579)	(18.695)
S/H	8.439	3.865	5.630	3.144
	(31.881)	(14.269)	(19.579)	(18.695)
B/L	1.957	3.865	5.630	3.144
	(9.142)	(14.269)	(19.579)	(18.695)
B/M	2.073	3.865	5.630	3.144
	(13.582)	(14.269)	(19.579)	(18.695)
B/H	2.180	3.865	5.630	3.144
	(14.530)	(14.269)	(19.579)	(18.695)

Panel B. Mean monthly returns for non-January months (%)

Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	1.011	1.463	1.287	0.717
	(11.320)	(9.963)	(5.744)	(4.347)
S/M	1.578	1.463	1.287	0.717
	(9.927)	(9.963)	(5.744)	(4.347)
S/H	1.427	1.463	1.287	0.717
	(9.961)	(9.963)	(5.744)	(4.347)
B/L	0.619	1.463	1.287	0.717
	(8.932)	(9.963)	(5.744)	(4.347)
B/M	1.274	1.463	1.287	0.717
	(10.803)	(9.963)	(5.744)	(4.347)
B/H	0.926	1.463	1.287	0.717
	(10.310)	(9.963)	(5.744)	(4.347)

Panel C. Mean monthly returns for January months (%), January 1982-June 1993

Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	1.9317	5.5703	-1.5449	1.8335
	(5.0592)	(7.8859)	(4.6734)	(3.0919)
S/M	3.8696	5.5703	-1.5449	1.8335
	(7.2395)	(7.8859)	(4.6734)	(3.0919)
S/H	5.2577	5.5703	-1.5449	1.8335
	(6.4642)	(7.8859)	(4.6734)	(3.0919)
B/L	5.0315	5.5703	-1.5449	1.8335
	(6.9237)	(7.8859)	(4.6734)	(3.0919)
B/M	5.6862	5.5703	-1.5449	1.8335
	(10.5079)	(7.8859)	(4.6734)	(3.0919)
B/H	6.1598	5.5703	-1.5449	1.8335
	(11.3860)	(7.8859)	(4.6734)	(3.0919)

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high BM; SMB, small minus big; HML, high minus low. PMRF, portfolio return minus the risk-free rate; MMRF, market return minus the risk-free rate

t-statistics in parenthesis.

Table 6
FF model coefficients for January and non-January months, January 1982-December 2001

Panel A. January months							
	RP(t) – RF(t) = a + b[RM(t) – RF(t)] + sSMB(t) + hHML(t) + e(t)						
Portfolio	a	b	s	h	R^2	F	DW
S/L	-1.422 (-2.459)	0.929 (20.604)	0.446 (13.457)	-0.454 (-14.362)	0.99	353.201	1.921
S/M	-0.666 (-1.181)	0.831 (18.904)	-0.186 (-5.752)	0.153 (4.967)	0.97	147.472	2.680
S/H	-1.406 (1.769)	0.885 (14.284)	0.593 (13.023)	0.981 (22.569)	0.99	563.211	2.497
B/L	1.589 (1.721)	0.643 (8.927)	-0.327 (-6.185)	-0.087 (-1.724)	0.85	29.321	2.263
B/M	1.353 (1.205)	0.995 (11.363)	-0.464 (-7.213)	-0.163 (-2.650)	0.90	46.383	1.960
B/H	1.117 (1.633)	1.120 (21.019)	-0.502 (-12.821)	-0.140 (-3.733)	0.97	154.431	1.945

Panel B. Non-January months							
	RP(t) – RF(t) = a + b[RM(t) – RF(t)] + sSMB(t) + hHML(t) + e(t)						
Portfolio	a	b	s	h	R^2	F	DW
S/L	-0.555 (-1.882)	0.981 (34.153)	0.474 (9.498)	-0.543 (-8.274)	0.86	458.432	1.806
S/M	-0.356 (-1.886)	0.897 (48.739)	0.401 (12.540)	0.148 (3.526)	0.93	922.208	1.790
S/H	-0.520 (-2.992)	0.905 (53.480)	0.190 (6.484)	0.527 (13.658)	0.94	1112.419	1.930
B/L	0.370 (1.516)	0.792 (33.361)	-0.596 (-14.466)	-0.199 (-3.667)	0.85	411.673	1.866
B/M	0.983 (3.374)	0.941 (33.153)	-0.822 (-16.694)	-0.038 (-0.594)	0.85	422.941	1.979
B/H	0.201 (0.890)	0.936 (42.610)	-0.672 (-17.626)	0.307 (6.133)	0.90	680.292	2.087

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high B; DW, Durbin-Watson;

t-statistics in parentheses.

Table 7
Stability Test in the Hong Kong stock market (January 1982 - December 2001)

S-L			
Chow Breakpoint Test: July 1997			
F-statistic	0.5395	Prob. F(4,232)	0.7068
Log likelihood ratio	2.2222	Prob. Chi-Square(4)	0.6950
S-M			
Chow Breakpoint Test: July 1997			
F-statistic	7.2736	Prob. F(4,232)	0.0000
Log likelihood ratio	28.3548	Prob. Chi-Square(4)	0.0000
S-H			
Chow Breakpoint Test: July 1997			
F-statistic	13.2015	Prob. F(4,232)	0.0000
Log likelihood ratio	49.2171	Prob. Chi-Square(4)	0.0000
B-L			
Chow Breakpoint Test: July 1997			
F-statistic	5.5619	Prob. F(4,232)	0.0003
Log likelihood ratio	21.9772	Prob. Chi-Square(4)	0.0002
B-M			
Chow Breakpoint Test: July 1997			
F-statistic	3.4281	Prob. F(4,232)	0.0096
Log likelihood ratio	13.7817	Prob. Chi-Square(4)	0.0080
B-H			
Chow Breakpoint Test: July 1997			
F-statistic	17.6259	Prob. F(4,232)	0.0000
Log likelihood ratio	63.6854	Prob. Chi-Square(4)	0.0000

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high BM

Table 8
Mean monthly excess returns for Pre- and Post-July 1997.

Panel A. Mean monthly returns for January 1982-June 1997 (%)

Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	0.7646	1.6593	0.6509	1.3533
	(8.8428)	(8.6583)	(4.7196)	(3.7559)
S/M	1.6113	1.6593	0.6509	1.3533
	(10.0612)	(8.6583)	(4.7196)	(3.7559)
S/H	2.0309	1.6593	0.6509	1.3533
	(8.9233)	(8.6583)	(4.7196)	(3.7559)
B/L	1.0292	1.6593	0.6509	1.3533
	(8.4497)	(8.6583)	(4.7196)	(3.7559)
B/M	1.9328	1.6593	0.6509	1.3533
	(10.1019)	(8.6583)	(4.7196)	(3.7559)
B/H	1.8050	1.6593	0.6509	1.3533
	(9.9589)	(8.6583)	(4.7196)	(3.7559)

Panel B. Mean monthly returns for July 1984-June 1997 (%)

Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	1.3062	2.1884	0.6435	1.3869
	(8.7630)	(8.8173)	(4.4678)	(3.4877)
S/M	2.1783	2.1884	0.6435	1.3869
	(7.9577)	(8.8173)	(4.4678)	(3.4877)
S/H	2.6039	2.1884	0.6435	1.3869
	(8.8213)	(8.8173)	(4.4678)	(3.4877)
B/L	1.5971	2.1884	0.6435	1.3869
	(7.4742)	(8.8173)	(4.4678)	(3.4877)
B/M	2.5047	2.1884	0.6435	1.3869
	(9.2867)	(8.8173)	(4.4678)	(3.4877)
B/H	2.2480	2.1884	0.6435	1.3869
	(9.4085)	(8.8173)	(4.4678)	(3.4877)

Panel C. Mean monthly returns for July 1997-December 2001 (%)

Portfolio	*PMRF*	*MMRF*	*SMB*	*HML*
S/L	3.0566	1.6776	5.0859	-0.5760
	(19.3821)	(14.9488)	(13.6748)	(12.378)
S/M	1.4175	1.6776	5.0859	-0.5760
	(15.3030)	(14.9488)	(13.6748)	(12.378)
S/H	1.9457	1.6776	5.0859	-0.5760
	(22.6584)	(14.9488)	(13.6748)	(12.378)
B/L	-0.2986	1.6776	5.0859	-0.5760
	(10.4699)	(14.9488)	(13.6748)	(12.378)
B/M	-0.6982	1.6776	5.0859	-0.5760
	(13.6729)	(14.9488)	(13.6748)	(12.378)
B/H	-1.6357	1.6776	5.0859	-0.5760
	(12.6445)	(14.9488)	(13.6748)	(12.378)

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high BM; SMB, small minus big; HML, high minus low. PMRF, portfolio return minus the risk-free rate; MMRF, market return minus the risk-free rate

t-statistics in parenthesis.

Table 9
FF model coefficients pre- and post-July 1997

Panel A. January 1982-June 1997

$$R_{it} – R_{ft} = a_i + b_i (R_m-R_{ft}) + s_iSMB_t + h_iHML_t + \varepsilon_i$$

Portfolio	a	b	s	h	R^2	F	DW
S/L	-0.4811 (-1.5501)	0.9506 (27.2284)	0.4478 (6.9914)	-0.4605 (-5.6380)	0.80	249.3154	1.95
S/M	-0.1343 (-0.6650)	0.8641 (38.0564)	0.3075 (7.3833)	0.1241 (2.3366)	0.89	536.1494	1.95
S/H	0.3855 (-2.1738)	0.9253 (46.3744)	0.2824 (7.7688)	0.5144 (11.0191)	0.94	905.7962	1.86
B/L	0.3011 (1.4090)	0.8330 (34.6512)	-0.5872 (-13.3135)	-0.2009 (-3.5728)	0.90	536.2692	2.00
B/M	0.7712 (2.7028)	0.9296 (28.9600)	-0.8228 (-13.9726)	0.1144 (1.5230)	0.87	417.9504	1.96
B/H	0.1044 (0.4759)	0.9266 (37.5396)	-0.7567 (-16.7103)	0.4844 (8.3884)	0.92	725.8828	2.03

Panel B. July 1997-December 2001

$$R_{it} – R_{ft} = a_i + b_i (R_m-R_{ft}) + s_iSMB_t + h_iHML_t + \varepsilon_i$$

Portfolio	a	b	s	h	R^2	F	DW
S/L	-1.2209 (-1.7842)	0.9959 (20.4491)	0.4543 (8.2897)	-0.5147 (-9.6462)	0.95	290.0419	2.04
S/M	0.0045 (0.0055)	0.9618 (16.5501)	-0.0288 (-0.4400)	0.0941 (1.4778)	0.88	117.6003	1.99
S/H	-1.4421 (-1.8912)	0.8765 (16.1509)	0.4817 (7.8885)	0.9243 (15.5467)	0.95	320.9209	2.46
B/L	0.3934 (0.4778)	0.6687 (11.4116)	-0.3681 (-5.5824)	-0.1010 (-1.5731)	0.73	45.1472	1.90
B/M	0.4456 (0.4828)	0.9097 (13.8502)	-0.5414 (-7.3255)	0.1451 (-2.0162)	0.80	67.2523	1.96
B/H	-0.8849 (-1.4128)	0.9023 (20.2429)	-0.4549 (-9.0689)	-0.0847 (-1.7339)	0.89	139.1539	1.97

S/L, small-low; S/M, small-medium BM; S/H, small-high BM; B/L, big-low BM; B/M, big-medium BM; B/H, big-high B; DW, Durbin-Watson;

t-statistics in parentheses.