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Firm Size, Book-to-Market Equity and Security Returns: Evidence from the Shanghai Stock Exchange

by
Michael E. Drew †
Tony Naughton §
Madhu Veeraraghavan ‡

Abstract:

Capital market theory is concerned with the equilibrium relationship between risk and expected return on risky assets. Within this framework, this paper seeks to extend the mounting evidence against the view that the beta coefficient of the Capital Asset Pricing Model is the sole measure of risk. In this paper we test the multifactor approach to asset pricing in one of the most challenging international markets, the Shanghai Stock Exchange, China. Firstly, we seek to determine whether the size and value premia exists in China. Secondly, we address the challenge that size and value premia are largely determined by seasonal factors (such as the January and/or Chinese New Year effect). Our findings suggest that mean-variance efficient investors in China can select some combination of small and low book-to-market equity firms in addition to the market portfolio to generate superior risk-adjusted returns. Moreover, we find no evidence to support the view that seasonal effects explain the findings of the multifactor model. In summary, we find the market factor alone is not sufficient to describe the cross-section of average stock returns in China.

Keywords:

SHANGHAI STOCK EXCHANGE; MULTIFACTOR MODEL; ASSET PRICING; SEASONAL EFFECTS; CHINA.

† School of Economics and Finance, Queensland University of Technology, GPO Box 2434, Brisbane, Queensland, 4001.
§ School of Economics and Finance, RMIT City Campus, GPO Box 2476V, Melbourne, 3001.
‡ Department of Accounting and Finance, The University of Auckland Business School, Private Bag 92019, Auckland. Email: M.Veeraraghavan@auckland.ac.nz

The comments of Mike Dempsey, Chris Guilding, Martin Hovey and Jon Stanford are gratefully acknowledged. We are also grateful to the three anonymous referees and the editor (Stan Hurn) for their comments and suggestions. We thank the seminar participants at Griffith University, Queensland University of Technology, The 15th Annual Australasian Finance and Banking Conference, and the 2003 FMA European Conference for their helpful comments and discussions. We would also like to thank Pavlo Taranenko for excellent research assistance. Drew acknowledges the financial support of the Economics Society of Australia (Queensland). Veeraraghavan thanks the School of Accounting and Finance (Griffith University), Research Grants Scheme, for financial support. Part of the paper was completed while Tony Naughton was at Griffith University, Gold Coast Campus, Australia. We are, of course, responsible for any remaining errors. All editorial responsibilities for this paper were undertaken by Stan Hurn and Garry Twite.

Australian Journal of Management, Vol. 28, No. 2 September 2003, © The Australian Graduate School of Management

1. Introduction

Capital market theory is concerned with the equilibrium relationship between risk and return on assets with uncertain future payoffs. This theory has attracted considerable attention in the recent past as critics have questioned the empirical validity of the received position, the Capital Asset Pricing Model (henceforth CAPM). Recent research demonstrates that average returns on common stocks show little or no relation to the market betas of Sharpe (1964), Lintner (1965) and Black (1972). Mounting evidence suggests that the beta of the CAPM is lacking in cross-sectional explanatory power.

In their landmark article, Fama and French (1992) (henceforth FF) report that the market beta has little or no ability in explaining the variation in stock returns and that firm size and book-to-market equity effect seem to describe the variation in average returns in a meaningful manner. FF (1993, 1996) posit that a three-factor model largely captures the average returns on U.S. stock portfolios constructed on firm size and book-to-market equity. Moreover, they find that the CAPM average-return related anomalies disappear in their three-factor model.[1] FF (1998) provide international evidence on the value premium by observing that value stocks (high book-to-market equity) outperform growth stocks (low book-to-market equity) in 12 of 13 major markets during the 1975–1995 period and document the existence of an international size effect (with small stocks outperforming large stocks in 11 out of 16 markets). However, the risk-based explanation of FF has been challenged by Daniel and Titman (1997) (henceforth DT) who observe that it is firm characteristics rather than the covariance structure that explains the cross-sectional variation in average returns. DT (1997) argue that once controlled for firm characteristics expected returns are not positively correlated to the loadings on the overall market, firm size and book-to-market equity factors. Davis, Fama and French (2000) respond by stating that in more powerful tests, the risk-based model of FF (1993, 1996) provides a better explanation than the characteristic-based model of DT (1997).

Pastor and Stambaugh (2000) provide a rejoinder through an investigation of the portfolio choices of an investor seeking a mean-variance efficient portfolio by comparing the risk based model of FF (1993) and the characteristic based model of

1. Moskowitz (1999) states that the existence of these anomalies can be due to several sources but can broadly be grouped into three categories. He states, 'The first possibility is that these anomalies arise because the asset-pricing model is not capturing a component of systematic risk, which these firm characteristics may be correlated with. The second set of explanations are behavioral, suggesting that these anomalies arise because investors care about certain firm attributes, or that investors act irrationally to information, or have psychological biases in their interpretation of information, all of which may induce an apparent relation between average returns and these firm characteristics. Finally, the third set of explanations arises from flawed methodology, such as biases in computing returns from firm survivorship or microstructure effects, as well as other statistical errors'. (p. 1).

DT (1997).[2] They report that there is virtually no difference between the risk- and characteristic-based models, as both lead to similar portfolio choices within the investment universe. While debate continues over explanatory basis of the various multifactor models, the essence of the argument remains the same—multiple factors are required to capture the cross-section of stock returns. Miller (1999) corroborates this view, arguing that although the single-beta CAPM managed to withstand more than three decades of intense scrutiny, the current consensus is that a single risk factor is not sufficient for describing the cross-section of expected stock returns. Malkiel (1999) also observes that there is still much debate within the academic community on risk measurement and much more empirical testing needs to be done. This is a view shared by Campbell, Lo and Mackinlay (1997) who forward that the usefulness of multifactor models will not be fully known until sufficient new data become available to provide an out-of-sample check on their performance.[3] However, it is worth noting that the bulk of the existing research in the area of empirical asset pricing relates to the United States and other developed capital markets. Little, if any, has been published on the robustness of the FF multifactor model in Asian markets.

Chui and Wei (1998) were the first to conduct empirical tests on the robustness of the multifactor model in Asian region. They found a weak relationship between average stock returns and the market and stated that stock returns are more related to the FF characteristics: firm size and book-to-market equity ratio. Drew and Veeraraghavan (2001, 2002a) find that the multifactor model approach provides a parsimonious description of the cross-section of returns, with the relationship between firm size, book-to-market equity and average stock returns being robust for several Asian markets over the 1990s. To date there is no evidence on the explanatory power of these factors in the Chinese market. This paper therefore extends the literature into one of the most challenging international markets by investigating of the explanatory power of an overall market factor, firm size and book-to-market equity for equities listed on the Shanghai Stock Exchange. This study, like all tests of the multifactor asset-pricing model, must respond to the survivorship bias hypothesis of Kothari, Shanken and Sloan (1995) and the data-snooping hypothesis of Black (1993) and Mackinlay (1995). We take the position of Halliwell, Heaney and Sawicki (1999) in responding to this challenge, who state:

> ‘replication of similar results in different markets is suggestive of a more pervasive asset pricing effect than might be the case if the results were only observed in the USA’. (p. 122).

2. In the risk-based model expected returns are a linear function of k factors of risk. For instance, FF (1993, 1996) suggest that expected returns are positively related to the loadings on the overall market, firm size and book-to-market equity factors. The alternative to the FF risk based model is the characteristic based model of DT (1997). In this model DT suggest that it is the characteristics rather than factor loadings that determine expected returns. In essence, in this model low book-to-market equity firms generate low stock returns, regardless of their factor loadings. Similarly, high book-to-market equity firms generate higher returns irrespective of their factor loadings. Recall that the risk-based explanation of FF says that expected returns are determined by factor loadings irrespective of characteristics.
3. See Banz (1981), Basu (1983), Rosenberg, Reid and Lanstein (1985), Fama and French (1992, 1993, 1995, 1996 & 1998), Lakonishok, Shleifer and Vishny (1994), Kothari, Shanken and Sloan (1995), Mackinlay (1995), Daniel and Titman (1997), Malkiel (1999), Malkiel and Xu (2000), Berk (2000), Campbell (2000), Davis, Fama and French (2000), Pastor and Stambaugh (2000), Liew and Vassalou (2000) and Daniel, Titman and Wei (2001).

In light of the current asset pricing debate, the central objective of this paper is to investigate whether the multifactor model approach can explain the variation in average stock returns better than the CAPM. China is selected for analysis because existing evidence on stock price behavior (reviewed below) suggests that the market is difficult to comprehend using conventional analysis. In our view, this is a challenge that has potential to further the scholarly debate in asset pricing. Specifically we are concerned with two issues: First, whether the multifactor alternative to CAPM is robust in this market. Second, whether the multifactor model findings can be explained by the seasonal effect. We ask the second question since an extensive literature on the turn of the year effect suggests that returns on small stocks tend to be higher in January than in the rest of the year[4]. For completeness, we also explore the potential impact of the Chinese New Year effect, first documented by Ho (1990) and Tong (1992).

Our analysis reveals that the overall market factor alone is not sufficient to explain the variation in the cross-section of average stock returns in China. The analysis shows that: (a) the zero cost portfolio for size, SMB, generates a positive return of 0.9273% per month; and (b) book-to-market equity effect is not as pervasive as was found for the United States portfolios. In this respect our results challenge the findings of FF (1996) who argue that value firms[5] generate superior returns, because they are distressed. Our analysis shows that growth firms generate superior returns. In addition, we also report that the multifactor model findings cannot be explained either by January or Chinese New Year effects. The organization of the remainder of the paper is as follows. In the next section a discussion on China's stock markets is presented. Section 3 outlines the data collection and portfolio construction procedures followed in the study. Empirical evidence is presented in section 4, with section 5 presenting concluding comments.

2. Features of China's Stock Market

The Shanghai stock market reopened at the beginning of the 1990s and together with the Shenzhen stock market has grown from a handful of listed firms to over 1100 listed firms as of 2001 (see fig. 1). Similarly, the market capitalization has grown from 2.2 billion Renminbi (US$0.28 billion) to over 4800 billion Renminbi in 2001 (see figure 2). On average capitalisation growth has been 153% per annum since reopening, despite negative growth of 5.5% during the turbulent 1995 year. Much of this growth has been attributable to the steady flow of new listings. At this rate it will be one of the largest markets in the region when the planned unification of the Shanghai and Shenzhen stock exchanges takes place.

4. FF (1993) note that it is now standard in asset pricing tests to look for unexplained January effects.
5. A value firm is characterized by a high book-to-market equity ratio while a growth firm is characterized by a low book-to-market equity ratio.

Figure 1
Number Of Listed Companies

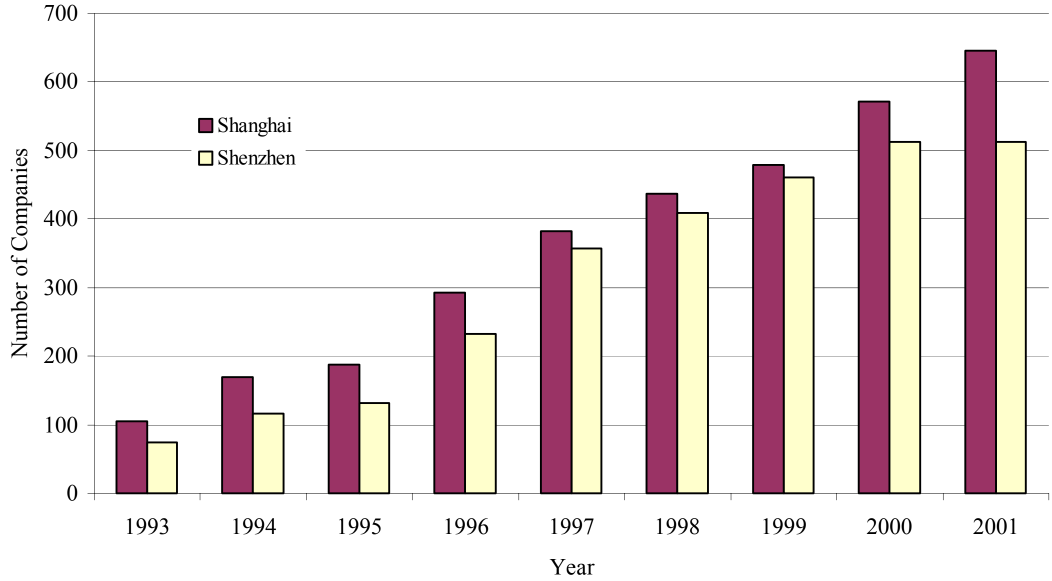
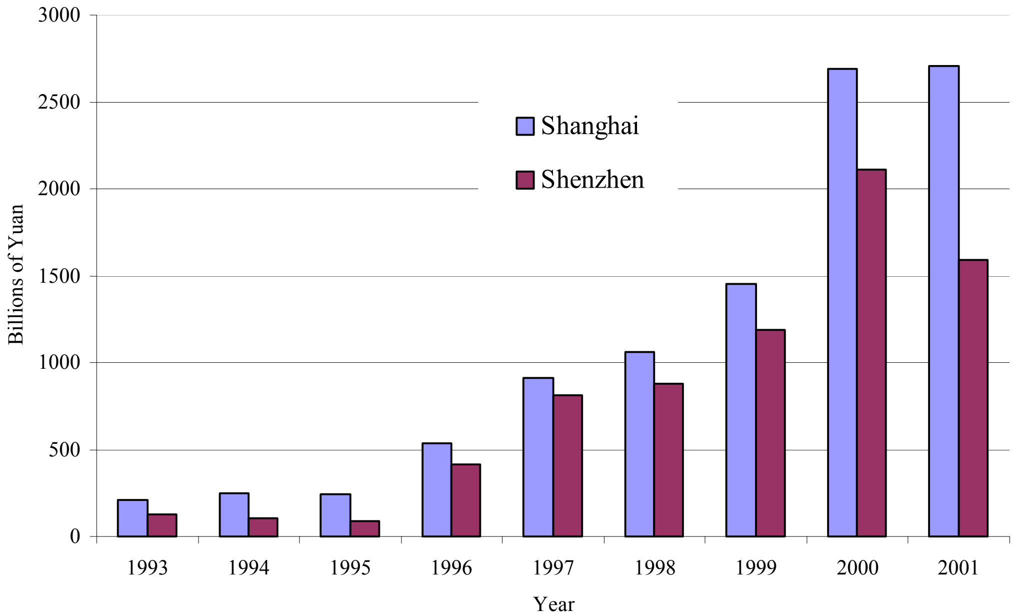


Figure 2
Market Capitalisation



In the region of 60 million investors own shares in China with an almost total absence of domestic institutional trading. While domestic institutional ownership represents 21% of market capitalisation (Naughton & Hovey 2002), these holdings are not tradeable and are primarily held by state controlled investment trusts. The most significant holding at 38% of market capitalisation is direct ownership by the state, which is again a non-tradeable category. The popularity of the market to retail investors is primarily driven by a lack of alternative investment opportunities.

There is a widely held view that the lack of sophistication of investors leads them to rely heavily on rumour for information and the market is momentum driven. While there is an abundance of anecdotal evidence to support this proposition, there remains a lack of clear empirical evidence in this regard. However, in an attempt to combat this concern this paper deals only with the Shanghai stock exchange. Shanghai is the larger of the two markets with on average larger listed firms and a more sophisticated market structure. However, tackling empirical research in stock returns in China remains a challenge.

The emerging empirical literature suggests the Chinese market displays some unusual characteristics. Much of the literature has focused on the segmentation of the market and mispricing between A shares, denominated in domestic currency, and B shares, traded in foreign currency (e.g. Sun & Tong 2000; Lee, Chen & Rui 2001). However, this anomaly has been significantly reduced following the opening of the B market to domestic investors in 2001, although it persisted throughout most of the period of this study. A related area of research that has attracted considerable attention is the issue of high government and state controlled institutional ownership of shares and their impact on returns and firm value.

The results of this work are largely contradictory and are reviewed in Hovey, Li and Naughton (2003). One area of empirical work that has documented somewhat surprising results relates to the underpricing of IPOs. A study by Mok and Hui (1998) reported average first day returns to domestic investors of 289% while Su and Fleisher (1999) found mean returns exceeding 900%. The latter study also identified the single highest first day underpricing to be 38,300%. Such levels of underpricing have not been consistently recorded elsewhere and can be taken as an indication of the mass enthusiasm for stock investing. The ability of investors to profit from contrarian strategies is documented by Kang, Liu and Ni (2002) and is attributed to persistent overreaction to firm-specific information. Lee, Chen and Rui (2001) document both a lack of a random walk in stock returns and highly persistent volatility. In terms of asset pricing models, Sun and Tong (2000) find some empirical support for both a traditional CAPM and the intertemporal CAPM when controlling for market segmentation. At this point in time there is no evidence of research tackling the issue of multifactor explanations of stock returns. This paper therefore represents the first attempt at testing the three-factor model in China.

3. Data Description and Methodology

3.1 The Model

Monthly stock returns and the accounting data are obtained from the Great China Database maintained by the Taiwan Economic Journal. We investigate, the relationship between the expected return of a certain portfolio, and the overall market factor, firm size and book-to-market equity ratio by employing the following model:

$$R_{pt} - R_{ft} = a_p + b_p\,(R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \varepsilon_{pt} \qquad (1)$$

R_{pt} is the average return of a certain portfolio[6] S/L, S/M, S/H; B/L, B/M and B/H. R_{ft} is the risk-free rate observed at the beginning of each month. We use the China 1–Year Time Deposit Rate as the risk-free rate of return. R_{mt} is the is the market return on all stocks in the six portfolios and includes the negative book equity stocks which were excluded from the sample while forming BE/ME portfolios. SMB is the monthly difference between the return on a portfolio of small stocks and a portfolio of big stocks; HML is the monthly difference between the return on a portfolio of high book-to-market equity stocks and the return on a portfolio of low book-to-market equity stocks. The factor loadings b_p, s_p and h_p are the slopes in the time-series regression.

FF (1993) suggest that the time-series regression approach is useful for studying important asset-pricing issues. The argument presented by FF (1993) is that if assets are priced rationally, variables that are related to stock returns must proxy for sensitivity to common risk factors in returns. They report that the time-series regressions give direct evidence on the issue of whether firm size and book-to-market equity effects proxy for systematic risk factors in returns. They also note that the intercepts in the time-series regressions provide a test of how well different combinations of the common factors capture the cross-section of average stock returns. In other words, a well-specified asset-pricing model produces intercepts that are indistinguishable from zero.

3.2 Portfolio Aggregation Procedures

In this paper we employ the mimicking portfolio approach of FF (1993) in constructing portfolios on firm size and book-to-market equity. At the end of December of each year *t* stocks are assigned to two portfolios of size (Small and Big) based on whether their December market equity (ME) [defined as the product of the closing price times number of shares outstanding] is above or below the median ME. The same stocks are allocated in an independent sort to three-book equity to market equity portfolios (Low, Medium, and High) based on the breakpoints for the bottom 33.33% and top 66.67%. We define book equity (BE) as the book value of common shareholder's equity plus the balance sheet deferred taxes (if any) and minus the book value of preferred stocks. The BE/ME ratio used to form portfolios in December of each year *t* is the book common equity for the fiscal year ending in calendar year *t–1* divided by the market equity at the end of December of *t–1*. While forming portfolios we exclude negative book equity firms, as they do not have meaningful explanations. Six size to book-to-market equity portfolios are formed at the intersection of the two firm size portfolios and three book-to-market equity portfolios. The six portfolios formed are (S/L, S/M, and S/H; B/L, B/M, and B/H). Monthly returns on the six portfolios are calculated from the following January to December.

The explanatory variables R_M, SMB, and HML are defined as follows: R_M (market return) is the market return on all stocks in the six portfolios and includes the negative book equity stocks which were excluded from the sample while forming BE/ME portfolios. SMB (Small minus Big) is the difference each month

6. S/L Portfolio = Small firms with low book-to-market equity; S/M Portfolio = Small firms with medium book-to-market equity; S/H Portfolio = Small firms with high book-to-market equity; B/L Portfolio = Big firms with low book-to-market equity; B/M Portfolio = Big firms with medium book-to-market equity; B/H Portfolio = Big firms with high book-to-market equity.

between the average of the returns of the three small stock portfolios (S/L, S/M, and S/H) and the average of the returns of the three big portfolios (B/L, B/M, and B/H). HML (High minus Low) is the difference between the average of the returns of the two high BE/ME portfolios (S/H, B/H) and the average of the returns on the two low BE/ME portfolios (S/L, B/L). In essence, market is long the overall market portfolio and short the risk free asset; SMB is long small capitalization stocks and short large capitalization stocks; HML is long high book-to-market equity stocks and short low book-to-market equity stocks.

Table 1, shows the average number of companies in each portfolio for the sample period. This table shows that the small cap—high book-to-market equity portfolio had an average of 90 companies per portfolio sort followed closely by the big cap—low book-to-market equity portfolio with an average of 89 companies. The table also highlights that the small cap—low book-to-market equity portfolio and the big cap—high book-to-market equity portfolio consisted of 39 companies per portfolio sort. The small cap to medium book-to-market equity and big cap to medium book-to-market equity portfolios had an average of 64 and 66 companies respectively.

Table 1

Sample Characteristics: Number of Companies in Portfolios Formed on Size and Book-to-Market Equity 12/93 to 12/00

YEAR	S/L	S/M	S/H	B/L	B/M	B/H	Total
1993	3	6	13	12	8	2	44
1994	9	21	39	37	26	7	139
1995	40	82	100	108	68	48	446
1996	23	40	66	63	47	20	259
1997	20	70	99	105	58	26	378
1998	60	91	106	110	83	64	514
1999	69	96	142	134	112	61	614
2000	88	109	153	143	128	80	701
AVERAGE	39	64	90	89	66	39	387

4. Empirical Results

4.1 Performance of Portfolios Formed on Size and BE/ME

Our first research question investigates whether a multifactor asset-pricing model largely explains the cross-section of average stock returns. Specifically, this study is interested in determining whether an overall market factor, firm size and book-to-market equity can explain the cross-sectional pattern of stock returns better than the CAPM. The summary statistics are reported in table 2 and the regression coefficients in table 3.

Table 2

Summary Statistics and Multifactor Regressions for Portfolios Formed on Size and BE-ME Ratio: Summary Statistics

	Book-to-Market Equity Portfolios					
Size	Low	Medium	High	Low	Medium	High
	Summary Statistics					
	Means			Standard Deviations (C_V)[7]		
Small	2.1979	2.4262	2.1519	18.6485 (8.48)	16.3411 (6.73)	17.2554 (8.01)
Big	1.4853	1.3833	1.1256	17.0035 (11.44)	14.3185 (10.35)	15.7800 (14.01)

Table 2, reports the performance of portfolios formed on firm size and book-to-market equity ratio. Our tests on the six size to book-to-market equity sorted portfolios show that the mean monthly returns (RPTRFT) are positive for all six portfolios. We find that the three small stock portfolios produce returns in excess of the three big stock portfolios. Our findings also reveal that the three small stock portfolios have lower coefficient of variation when compared with the three big stock portfolios. For instance, (S/M) portfolio has the lowest coefficient of variation of 6.73% while the (B/H) portfolio has the highest coefficient of variation of 14.01%. This suggests that mean variance efficient investors can improve their risk-return profile by simply investing in the small stock portfolios. For completeness we also report in this section that the excess return on the overall market portfolio (RMRFT) and the mean monthly returns of the mimic portfolio for size, (SMB), are positive for all six portfolios. The overall market portfolio generates a monthly return of 1.00% (standard deviation = 13.26%) or 12.00% per year. The mimic portfolio for size generates a return of 0.9273% per month (standard deviation = 3.81%) or 11.04% per year, suggesting that small firms are more riskier than big firms. Interestingly, the mimic portfolio for book-to-market equity generates a return of –0.20% per month (standard deviation = 3.81%) or –2.40% per year. Hence, our findings challenge the argument of FF (1996) who suggest that value firms are distressed.

In terms of viewing our results as confirmation that the three-factors investigated in this paper offer a risk-based explanation we urge caution. We find

7. We also calculate the coefficient of variation for portfolios formed on size and book-to-market equity. We calculate this to compare the risk of portfolios with differing returns. The higher the coefficient of variation the greater the risk. This can be expressed as:

$CV_p = \frac{\sigma_p}{\overline{p}}$ where σ_p is the standard deviation and $\overline{p}$ is the expected return.

general support for the mimicking portfolio approach of FF (1996)[8] since the overall market factor and firm size effect fall neatly within a risk-based explanation. The results for the book-to-market equity factor do not fully support the risk-based explanation since the findings of this paper diverges from expectations in the sense that we document a growth effect. Two possible explanations exist for the inconsistency of the value effect.

First, we posit that investors have overexploited the value effect in the sense that the detected pattern of mispricing has been arbitraged away. This is a convenient explanation given that as trained financial economists we believe that markets are rational. This begs the question: Why have investors not exploited the size effect? Could it be that other investors are yet to detect this pattern? As rational theorists we expect that once the pattern is detected investors will act upon it and arbitrage away the pattern of mispricing. In short, both the detected return patterns for Chinese equities (small and growth firms generate superior returns) should be arbitraged when all investors act upon it. Alternatively, we suggest irrational investor behavior[9] as our second possible explanation in the spirit of Thaler (1999), Daniel and Titman (1999) and Hirshleifer (2001). At best we would posit that investors in China are quasi-rational investors in the sense of Thaler (1999). Thaler defines quasi-rational investors[10] as those who try hard to make

8. In this study we construct the six intersection and three zero cost portfolios one year prior to observing the twelve monthly returns as available data in China is at calendar year end. This results in returns being, in the extreme, 24 months later than the formation of the portfolios on which they are based. This approach is consistent with that of FF (1996). FF (1996) form portfolios as of June of each year while we construct portfolios as of December of each year since the majority of the Chinese firms have December as fiscal year end. Concerns over the length of lag motivated an alternative portfolio construction where no lag was used prior to the first observed monthly return. Without the time lag our results (available from the authors) are similar to that reported in this paper indicating that the model is robust under both approaches. To our knowledge this is the first test of the robustness of the FF (1996) model without the time lag.
9. For instance, Daniel and Titman (1999) state that asset prices are influenced by investor overconfidence. They observe that portfolio strategies suggested by the overconfidence theory realize high and persistent abnormal returns. Hirshleifer (2001) states that the 'central task of asset pricing is to examine how expected returns are related to risk and investor misvaluation.' (p. 1534). In a related vein, Daniel, Hirshleifer and Subrahmanyam (2001) offer a theory of asset pricing in which the cross-section of expected stock returns is determined by risk and investor misvaluation. They argue that some or all investors are overconfident about their abilities and hence overestimate the quality of information generated about security prices. This contradicts Campbell (2000) and Cochrane (2000) who emphasize that asset pricing is concerned with identifying real risks that drive expected returns. Campbell (2000) states 'asset pricing is concerned with the sources of risk and the economic forces that determine the rewards for bearing risk'. (p. 1516). Cochrane (2000) states, 'The central task of financial economics is to figure out what are the real risks that drive asset prices and expected returns'. (p. 455).
10 The traditional economic paradigm asserts that individuals are rational in the sense that they make decisions based on the information available to them. The implication of this view for asset pricing is that prices reflect all available information and superior returns can only be generated if one has access to private information. Note that the CAPM of Sharpe (1964), Lintner (1965) and Black (1972) is based on the premise of full rationality. Thaler (1999) states that modern financial economic theory is based on the assumption that investors: (a) make decisions according to the axioms of expected utility theory; and (b) make unbiased forecasts about the future. In short, using the axiom of transitivity one would argue that if A is preferred to B and B to C then A will be preferred to C. See Fama and Miller (1972) for an excellent discussion on the axioms of utility theory. Rubinstein (2001) states, 'Although academic models often assume that all investors are rational, this assumption is clearly an expository device not to be taken seriously. What is in contention is whether markets are 'rational' in the sense that prices are set as if all investors are rational'. (p. 15). Rubinstein (2001) categorizes market rationality as: (a) maximally rational markets; (b) rational market; and (c) minimally rational market.

good investment decisions but commit predictable mistakes. This suggests that Chinese investors are quasi-rational since they view growth firms as distressed whereas the FF (1996) approach regards value firms as distressed. Support for this view comes from Kang, Liu and Ni (2002) who report that most of the individual investors in China are inexperienced in that they possess only rudimentary knowledge on stock investments and trade like noise traders. Hu (1999) also observes that the Chinese stock market is very different from others, especially in terms of the extent of government regulations and investor composition. As observed in section 2 substantial holdings by the state and state controlled institutions mean that shares are not exposed to the market. In terms of investor composition individual investors dominate the traded ‘A’ share market. Hence, we advance the argument that the dominance has investment implications for strategies investigated in this paper. For instance, the finding that growth firms generate higher returns than value firms challenges the findings of FF (1996) and Drew and Veeraraghavan (2001 & 2002b) who report that the multifactor model is robust[11] in that it captures the cross-sectional variation in a meaningful manner.

Therefore, we offer investor irrationality as a possible explanation for the negative returns generated by the mimic portfolio for book-to-market equity. It is our conjecture that the negative returns for HML are a result of the investor’s inability to process information.[12] That is, individual investors in China make systematic errors in the way they interpret and process information.[13] In a related vein, Daniel, Hirshleifer and Subrahmanyam (2001) point out that there are investors who form erroneous expectations of asset values or do not use all available information in forming such expectations. As part of this explanation we argue that expected returns are determined by sources of risk and investor misvaluation. We now proceed to table 3 where we discuss the regression coefficients.

11. Drew and Veeraraghavan (2001) investigate the robustness of the FF three-factor model for Hong Kong, Korea, Malaysia and Philippines. They document a size and value effect for all four markets investigated in this paper. Interestingly, DT (1997) state, that the finding that SMB and HML portfolios seem to capture returns, in addition to the market portfolio, says nothing about whether these factors are rationally priced.
12. Daniel and Titman (1999) state that when rational investors value a stock, they combine information from many different sources. That is, rational investors combine information collected on their own with the information provided by others and then make decisions. DT (1999) also observe that rational investors combine these sources of information by using Bayes rule, which suggests that the weights placed on different sources of information should be proportional to their respective precision.
13. Suppose, that there are two firms in the market, A and B. Assume that A has a book value of $100 while B has a book value of $50. Also, assume that A has a market value of $80 while B has a market value of $150. Hence, A has a BE/ME of 1.25 while B has a BE/ME of 0.33. FF (1995) state that weak firms with low earnings tend to have high BE/ME and strong firms with high earnings have low BE/ME. FF (1996) show that small stocks tend to have higher returns than big stocks and high book-to-market equity stocks generate higher returns than low book-to-market equity stocks. Therefore, firm A should generate higher returns than firm B. Recall, that our findings reveal otherwise in that low book-to-market equity firms (Firm B) generate higher returns than high book-to-market equity firms. Trained financial economists would argue that a trading strategy such as this would self-destruct once other investors discover the strategy. That is, the profitability arising out of such strategies would disappear because of excessive use.

Table 3
Regression Coefficients

	Book-to-Market Equity Portfolios					
Size	Low	Medium	High	Low	Medium	High
	$R_{pt} - R_{ft} = a_p + b_p (R_{mt}-R_{ft}) + s_p SMB_t + h_p HML_t + \varepsilon_{pt}$					
		a			t(a)	
Small	–0.004	0.341	0.004	–0.050	0.733	0.081
Big	0.003	0.357	–0.001	0.066	0.807	–0.170
		b			t(b)	
Small	1.034	1.006	1.073	17.699*	27.769	22.921
Big	1.073	1.010	1.032	22.863	29.234	17.763
		s			t(s)	
Small	0.903	1.000	1.006	4.334**	7.729	6.013
Big	0.006	–0.123	–0.003	0.400	–1.000	–0.712
		h			t(h)	
Small	–1.622	–0.742	–0.467	–8.193	–6.380	–2.937***
Big	–1.521	–0.633	–0.676	–9.565	–5.406	–3.433***
		R^2			s(e)	
Small	0.85	0.92	0.89	7.12	4.42	5.71
Big	0.86	0.91	0.79	5.72	4.21	7.08
		DW				
Small	2.069	2.137	2.186			
Big	2.020	2.076	2.136			

Note: * Significant at the 1% level for all six portfolios;
** Significant at the 1% level for S/L, S/M and S/H portfolios; and
*** Significant at the 5% level. The other four portfolios are significant at the 1% level.

Our results of the regression coefficients show that the intercept, (a coefficient), is statistically indistinguishable from zero for all six size to book-to-market equity sorted portfolios. The results corroborate the position of Merton (1973) who states that standard asset-pricing models produce intercepts that are statistically indistinguishable from zero. Hence, if the multifactor model is parsimonious and describes expected return in a meaningful manner, the intercepts should be statistically indistinguishable from zero. We also observe that the overall market factor, (b coefficient), is greater than one and statistically significant at the 1% level for all six size to book-to-market equity sorted portfolios. The size factor, (s coefficient), is positive and highly significant at the 1% level for the three small portfolios (S/L, S/M and S/H). The s coefficient for the (B/L) portfolio is positive but not significant. The s coefficient for (B/M and B/H) portfolios is negative but statistically insignificant. The behavior of the s coefficient is generally consistent with the findings of FF (1996) who observe that small firms tend to have positive slopes on SMB while big firms tend to have diminishing positive or negative slopes on SMB. We also find that the book-to-market equity factor, (h coefficient), is significant at the 1% level for four out of six portfolios. Note that the h coefficient is negative for all six size-book-to-market equity sorted portfolios. As discussed earlier the behavior of the HML portfolio presents a challenge to the argument that value firms are distressed.

The existence of negative returns suggests that value firms are not riskier than growth firms. The negative returns combined with negative coefficient for the book-to-market equity factor generates a positive risk premium. In other words, the outcome in terms of risk premia is broadly consistent with the arguments of FF but the means of achieving them are not. It is also important to note that there is emerging evidence from international studies that highlight the unusual behavior of the HML portfolio (e.g. Halliwell, Heaney & Sawicki 1999; Drew & Veeraraghavan 2002a). These findings suggest that the value effect is not as pervasive in international markets as found in earlier studies in the United States. As discussed above another argument, in the case of China, is the lack of well developed stock analysis and research which has led to the common perception that prices are driven as much by sentiment as any other factor (Kang, Liu & Ni 2002).

Technical issues to do with measuring the variables may also hinder the process. While the well-recognized problems of accounting standards in China may cause concerns about book values, it is not unreasonable to assume it is common across all firms. What is perhaps of greater concern is the difficulties in capturing reliable measures of market value given the share structure of listed firms. Market value of equity is determined by summing the market value of two classes of essentially identical shares in terms of voting and dividend rights. However, throughout most of the period of the study B shares traded at a considerable discount. In addition there is the thorny issue of non-traded shares, which on average are the majority, although considerable cross-sectional differences are observed (Hovey, Li & Naughton 2003). For capitalization purposes these shares are treated in this study, and in all previously cited work in China, as having a market value equivalent to that of A shares. If the authorities were to open these shares to trading, a severe impact on prices and hence capitalization is likely to ensue.

While not investigated in this study, a potential explanation for the unusual behavior of the HML factor may lie somewhere in cross-sectional differences in the levels of non-traded state and institutional holdings. Finally, our findings reported in (table 3) show no evidence of autocorrelation for any of the six size to book-to-market equity sorted portfolios as the computed *d* statistic is higher than the upper bound value at the 1% level. Therefore, we do not reject the null hypothesis of no autocorrelation among the disturbances entering the regression function. We also conducted tests to determine if the null hypothesis of no multicollinearity is violated. We use the condition index, variance inflation factors and tolerance factors to detect evidence of multicollinearity. Once again, our findings show no evidence of multicollinearity among the regressors entering the regression function. Therefore, we do not reject the null hypothesis of no multicollinearity among the regressors in the model.

4.2 Tests for January and Chinese New Year Effects

Prior research shows that stock returns, especially returns on small sized stocks, are significantly higher in January than in rest of the year.[14] Keim (1983) was the first to document the size-seasonality effect, which has since been popularly termed the 'turn-of-the-year' or 'January' effect. Keim (1983) observed that about half of the size premium to small firms occurs in January, and more interestingly, half of this effect occurs in the first five days of the new calendar year. Roll (1983) observed that stocks with negative returns during the prior year (December) had higher returns in January, with the results also indicating a small firm effect beyond the tax selling and volatility hypothesis. Roll (1983) concluded that because of transaction costs, arbitrageurs must have not been eliminating the January tax-selling anomaly.

Moreover, Fama (1991) observes that stock returns, especially on small stocks are on average higher in January than in the remaining months. FF (1993) consider this anomaly in the context of multifactor models, recommending that it is standard in tests of asset-pricing models to look for the turn of the year effect. As international evidence suggests that stock returns, especially returns on small sized stocks, are significantly higher in January, we investigate the turn of the year effect puzzle in this paper. We test the seasonal behavior of risk premium by employing the following model:

$$R_{pt} - R_{ft} = a_p + b_p\,(R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \gamma_p\, Jan_t + \theta_p\, Feb_t + \varepsilon_{pt} \qquad (2)$$

In this model we introduce a dummy for the January effect, 1 in January and 0 in other months. In addition we also test for a Chinese New Year effect documented by Ho (1990) and Tong (1992). The Chinese New Year falls in the month of February and hence we create a dummy variable that takes the value of 1 in February and 0 in other months. Table 4 presents the regression coefficients for the turn of the year effect model.

Our analysis clearly shows that the multifactor model findings cannot be explained either by the January or Chinese New Year effects as the coefficients for the January and Chinese New Year effects, (γ and θ), are not statistically significant for any of the six size to book-to-market equity sorted portfolios. Hence, we reject the claim that the multifactor model findings are driven by seasonal influences. Table 4, also reports diagnostic measures for the multifactor model. The Durbin-Watson statistic does not show any evidence of autocorrelation for any of the six size to book-to-market equity sorted portfolios as the computed *d* statistic is higher than the upper bound value at the 1% level.[15]

14. See Branch (1977), Dyl (1977), Chan and Wu (1983) and Keim and Stambaugh (1986).
15. As with the full model we test whether the explanatory variables are interrelated. That is we conducted tests to determine if the null hypothesis of no multicollinearity is violated. This is because interpretation of the multiple factor regression equation rests implicitly on the assumption that the explanatory variables are not interrelated. Once again, our analysis does not show any evidence of multicollinearity in our multiple regression model.

Table 4

Multifactor Model Tests for January and Chinese New Year Effect

Size	Low	Medium	High	Low	Medium	High
	Book-to-Market Equity Portfolios					
	$R_{pt} - R_{ft} = a_p + b_p (R_{mt} - R_{ft}) + s_p SMB_t + h_p HML_t + \gamma_p Jan_t + \theta_p Feb_t + \varepsilon_{pt}$					
		a			t (a)	
Small	0.151	0.305	0.008	0.004	0.388	0.110
Big	0.180	0.588	0.129	0.672	0.783	0.132
		b			t(b)	
Small	1.034	1.006	1.074	17.528	27.467	22.681
Big	1.073	1.010	1.032	22.621	28.913	17.583
		s			t(s)	
Small	0.881	1.004	0.995	4.085	7.492	5.744
Big	0.005	–0.126	–0.005	0.346	–0.987	–0.253
		h			t(h)	
Small	–1.637	–0.739	–0.474	–8.075	–5.864	–2.913
Big	–1.526	–0.635	–0.689	–9.361	–5.286	–3.416
		γ			t(γ)	
Small	–1.350	0.270	–0.583	–0.490	0.158	–0.263
Big	–0.351	–0.192	–1.119	–0.159	–0.118	–0.408
		θ			t(θ)	
Small	–0.300	0.111	0.220	–0.112	0.067	0.103
Big	0.346	–0.141	–0.174	0.161	–0.089	–0.065
		R^2			s(e)	
Small	0.85	0.92	0.88	7.19	4.46	5.77
Big	0.88	0.91	0.79	5.78	4.26	7.15
		DW				
Small	2.067	2.141	2.029			
Big	2.115	2.075	2.132			

Note: * Significant at the 1% level for all six portfolios;
** Significant at the 1% level for S/L, S/M and S/H portfolios; and
*** Significant at the 5% level. The other four portfolios are significant at the 1% level.

4.3 Market, Size and Value Premium

In this section we present a discussion on the premia associated with the overall market, firm size and book-to-market equity factors. Recall that the central objective of this paper is to test whether the multifactor model approach can explain the variation in average stock returns better than the CAPM for equities listed in the Shanghai stock exchange. In addition, we also investigate whether the multifactor model findings can be explained by January or Chinese New Year effects.

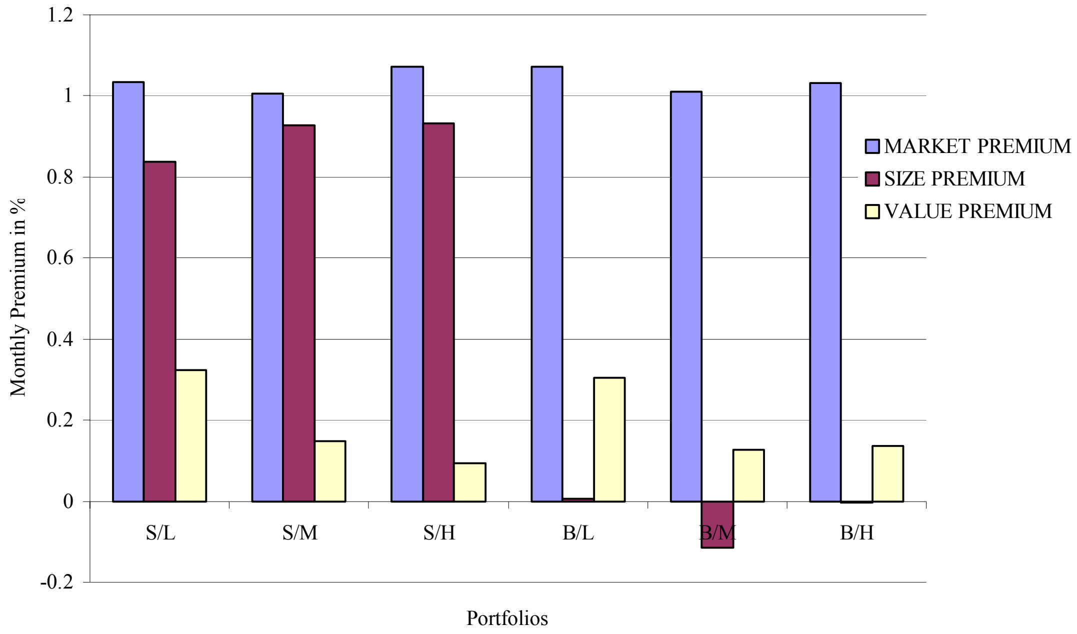
Table 5
Market, Size and Value Premium 12/93 to 12/00

Portfolio	Market Premium (%)	Size premium (%)	Value Premium (%)
S/L	1.0340 (17.699)[16]	0.8373 (4.334)	0.3244 (–8.193)
S/M	1.0060 (22.769)	0.9273 (7.729)	0.1484 (–6.380)
S/H	1.0730 (22.921)	0.9328 (6.013)	0.0934 (–2.937)
B/L	1.0730 (22.863)	0.0055 (0.400)	0.3042 (–9.565)
B/M	1.0100 (29.234)	–0.1140 (–1.000)	0.1266 (–5.406)
B/H	1.0320 (17.763)	–0.0027 (–0.712)	0.1352 (–3.433)

Our findings suggest that the market, size and value premium are real and pervasive. The (S/H and B/L) portfolios generate the highest market premia of 1.0730% per month or 12.87% per year (t–statistic = 22.921 and 22.863). Note that all six portfolios generate a positive market risk premia. As far as size premia is concerned our findings reveal that the (S/H) portfolio generates the highest size premium of 0.9328% per month or 11.19% per year (t–statistic = 6.013). We also find that the size premium increases monotonically for the three small stock portfolios. Since the three small stock portfolios generate substantial risk premia we offer a risk-based explanation for the size effect. Note that two out of the three big portfolios generate negative risk premia. Our analysis of value premium reveals that the (S/L) portfolio generates the highest premium of 0.3244% per month or 3.89% per year (t–statistic = –8.193). Note that the value premium is positive for all six size to book-to-market equity sorted portfolios. The negative returns on the HML portfolio is translated into positive premium by multiplying the returns for the HML portfolio with the regression coefficient. These results confirm our earlier observation that the pattern of the premia diverges from expectations. That is, we find that growth portfolios generate the highest premia while value portfolios generate significantly lower premia. Hence, it is suggested that multifactor mean-variance efficient investors in China should invest in some combination of small and growth firms in addition to the overall market portfolio to generate superior returns.

16. t values of regression coefficients in parentheses.

Figure 3
Market Size and Value Premia



5. Conclusions and Investment Implications

In this paper we extend the scholarly debate in the area of empirical asset pricing by investigating the robustness of the FF multifactor model for equities listed in the Shanghai stock exchange. Our analysis suggests that small and growth firms generate superior returns than big and value firms. It is interesting to note that our findings challenge the results of FF (1996) and Drew and Veeraraghavan (2001, 2002b) who report that value firms generate superior returns because they are distressed. Therefore, we report that the value effect is not as pervasive as was found for the US portfolios and other international markets. Our results are consistent with a risk-based explanation in that the overall market factor and firm size effect are priced. Recall, that the overall market factor and the mimic portfolio for size generate a return of 1.00% per month or 12.00% per year and 0.9273% per month or 11.12% per year respectively. However, the mimic portfolio for book-to-market equity generates a return of –0.20% per month or –2.40% per annum. We acknowledge that China, like many markets in the Asian region, have substantial holdings of non-traded shares which means that these shares are not effectively valued. In terms of explaining the results based on the traded shares we offer two possible explanations for this result. First, we posit that investors have overexploited the detected return pattern. That is, the pattern of mispricing where, value stocks generate higher returns than growth stocks has been arbitraged away by investors.

Our second explanation is that majority of the investors in China are 'quasi-rationals' in the sense of Thaler (1999). In any event, we find statistically significant non-beta risks associated with firm size and book-to-market equity. In summary, the major result of this paper is that the market beta alone is not sufficient to describe the variation in average equity returns for Chinese equities over the period 1993 to 2000. Our findings have implications for both, an average investor, and investors who are willing to take additional risks. Our findings suggest that an average investor must simply hold the market portfolio alone. This is because portfolio strategies investigated in this paper do not have investment implications for the average investor.

However, the strategies investigated in this paper have implications for investors who are interested in taking advantage of extra returns. We suggest that those investors must tilt their portfolios in favour of characteristics such as firm size and book-to-market equity. Note, that by tilting portfolios in favour of these characteristics investors are exposed to additional sources of risks. Cochrane (1999) states,

> ‘Value and small-cap anomalies can only work if the average investor is leery about buying financially distressed and illiquid stocks. Portfolio advice to follow these strategies must fall on deaf ears for the average investor, and a large class of investors must want to head in exactly the opposite direction; if not the strategies can’t work’. (p. 21).

Hence, it is suggested that mean-variance and multifactor mean-variance efficient investors consider the evidence reported in this paper and the investment implications for their portfolios.

As far as future direction for research is concerned we are of the view that additional empirical tests on the robustness of the multifactor model is desirable. We are also of the view that the distinction between A and B classes of shares needs further investigation. The B share market has since 2001 been opened to domestic investors who hold foreign currency to trade these shares. The increased liquidity of these previously discounted shares may impact on market capitalisation. The impact of substantial state and institutional holdings on capitalisation is also worthy of future research, particularly as the authorities have announced plans to gradually dispose of state holdings and open state-controlled institutional holdings to trading. More importantly the so far elusive search for a robust economic explanation for firm size and book-to-market equity effects needs sustained effort.

Economic explanations of the premia associated with firm size and book-to-market equity is important since these factors do not represent economically relevant aggregate risk. This paper also raises issues of whether expected returns are related to risk or investor misvaluation, which warrants further investigation. What we can conclude from the work to date is that the selected risk proxies explain the behaviour of stock returns better than the asset-pricing model of Sharpe (1964), Lintner (1965) and Black (1972). This is an area deserving further research.

(Date of receipt of final transcript: June 24, 2003.
Accepted by Michael E. Drew, Stan Hurn & Garry Twite,
Special Issue Editors.)

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