Fama-French in China:
Size and Value Factors in Chinese Stock Returns

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Abstract

We investigate the size and value factors in the cross-section of returns for the Chinese stock market. We find a significant size effect but no robust value effect. A zero-cost small-minus-big (SMB) portfolio earns an average premium of 0.85% per month, which is statistically significant with t-value of 3.09 and important economically. In contrast, neither the market portfolio nor the zero-cost high-minus-low (HML) portfolio has average premiums statistically different from zero. In both time-series regressions and Fama-Macbeth cross-sectional tests, SMB appears to be the strongest factor in explaining the cross-section of Chinese stock returns. Our results contradict most of the existing literature which finds a significant value effect. We show that this difference comes from the extreme values in a few months in the early years of the market (1995 to 1996), which turn out to have a heavy impact on the average premiums given the relatively short history of the Chinese stock market.

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1 Introduction

A large body of asset pricing literature has been devoted to document and explain cross-sectional stock returns beyond the classic Capital Asset Pricing Model (CAPM). Earlier papers include Stattman (1980), Banz (1981), Basu (1983) and Chan, Hamao, and Lakonishok (1991), which found empirical cross-sectional return patterns inconsistent with the CAPM. In two influential papers, Fama and French (1992) and Fama and French (1993), the authors examined various factors and showed that size, as measured by market capitalization, and value, as measured the book-to-market ratio, are the two most significant factors in explaining the cross-sectional returns in the U.S. stock market. Since then, size and value premiums have become two of the most-widely used "asset-pricing" factors in the U.S. and global equity markets.[1]

There has been very limited study on the cross-sectional returns in the Chinese stock market, even though it has quickly grown to be the second largest in the world by market capitalization (see, for example, monthly report for 2014 by the World Federation of Exchanges). Research has been hindered by the lack of high quality data and by the short history of the market. Existing work rely on data of varied quality and sample periods and obtain results often inconsistent with each other.[2] Such a situation is particularly unsatisfying as most empirical work on the market needs an empirical pricing model to benchmark risk and returns. Taking advantage of a complete database recently put together, we hope to provide a more definitive empirical calibration of the return factors in the Chinese stock market.

In particular, we examine the role of size and value factors in explaining the cross-sectional returns in the Chinese A-share market from its beginning in 1990 to 2013. Our benchmark sample period is from July 1997 to December 2013, when there is enough number of stocks in the cross-section, although our main conclusions remain the same when earlier years were

[1]Studies of non-US markets include Fama and French (2012), Brückner, Lehmann, Schmidt, and Stehle (2014), Michou, Mouselli, and Stark (2013), Veltri and Silvestri (2011), Moerman (2005), Nartea, Gan, and Wu (2008), Chou, Ko, Kuo, and Lin (2012), Docherty, Chan, and Easton (2013), Cordeiro and Machado (2013), Agarwalla, Jacob, and Varma (2013), Drew and Veeraraghavan (2002), among others.

[2]See, for example, Nusret Cakici and Topyan (2011), Carpenter, Lu, and Whitelaw (2014), Chen, Kim, Yao, and Yu (2010), and Wang and Xu (2004), among others. We will discuss these papers in more detail later.

included. We find that size is strongly associated with cross-sectional returns. The average returns on the 10 portfolios formed on the basis of market capitalization show a robust negative relationship with underlying stocks' size. The average returns on the smallest size decile is 2.05% per month during the period, versus 0.42% on the largest size decile. The difference in average returns is 1.63% per month, not only economically large but also strongly positive significant at the 1% level. Moreover, the observed relationship between stock returns and firm size cannot be explained by the market factor, as the market βs are flat across the ten size-sorted portfolios. In contrast, the average returns on 10 portfolios formed on the basis of book-to-market ratios do not exhibit any clear pattern, suggesting that the value factor is not associated with cross-sectional stock returns.

We then follow the methodology in Fama and French (1993) to construct two zero-cost portfolios, SMB and HML, to mimic risk factors related to size and value in the Chinese stock market. Over the period from July 1997 to December 2013, SMB earns an average return of 0.85% per month, or 10.2% per year. The average return of SMB is not only economically large but also strongly positive significant with t-value 3.09. In contrast, neither the market portfolio $R_M - R_f$ nor the factor mimicking portfolio HML has significant average returns during the same sample period. The average excess return of the market portfolio is 0.60% per month with t-value 0.97; the average return of HML is 0.34% per month with t-value 1.61. The dominant performance of SMB over the market portfolio and HML implies that size is likely to be important in explaining cross-sectional returns, while the market portfolio and HML are not.

For formal asset pricing tests, we employ both the time-series and the Fama-Macbeth regressions approaches. In the time-series regressions, we first form 25 portfolios on the basis of size and book-to-market ratio. There is a large dispersion in average excess returns across the 25 portfolios, ranging from 0.11% per month to 1.91% per month. Among them, eight portfolios have significant positive average excess returns. We then regress the excess returns of 25 stock portfolios on the market portfolio $R_M - R_f$ and the two factor mimicking portfolios SMB and HML.

The time-series regressions results show that the three factors capture strong common variations in stock returns of the 25 portfolios, as reflected in the significant slopes on the three risk factors and the high R^2 values of the regressions. More important, judging on the basis of the intercepts of the time-series regressions, the three factors together successfully capture the cross-sectional variations in average returns on the 25 portfolios. The remaining intercepts, αs, of the regressions of the excess returns on the 25 portfolios on the three factors, $R_M - R_f$, SMB and HML, are small in magnitude, ranging from -0.28% to 0.26% per month, and are not significantly different from zero. The Gibbons-Ross-Shanken F-statistic is 0.93 with probability 0.435, therefore we can't reject the hypothesis that the intercepts across the 25 portfolios are jointly zero.

Moreover, the three factors contribute differently to the reduction of αs. Using the market factor alone, the intercepts are decreased relative to the excess returns, but remain strongly significant and widely dispersed. Ten out of the 25 portfolios still have positive significant αs and one portfolio has negative significant α. In contrast, SMB, when used as the sole risk factor, makes all intercepts in the time-series regressions not statistically significantly different from zero. However, 24 out of the 25 αs remain positive and large. The highest α is at 0.74% per month. Adding the market factor with SMB can further reduce the size of αs to be within a range from -0.42% to 0.31%. Among the 25 portfolios, only one portfolio's excess returns is over-corrected with negative α of -0.41% and t-value of -1.99. In contrast to the strong explanatory power of SMB, HML plays a weak role in explaining cross-sectional returns. Whether used alone or in combination with the market factor, the intercepts for most portfolios in the bottom two size quintiles remain large and statistically significant. Putting all evidence together, it is clear that SMB is the most important factor in explaining the cross-sectional variations in average stock returns.

We also perform Fama-Macbeth regressions to estimate the risk-premiums associated with the market, SMB and HML factors. The results are consistent with the time-series regression findings. SMB is estimated to have a risk premium of 0.98% per month, strongly positively significant with t-value of 3.22. The positive risk premium associated with SMB is also robust to the inclusion of various accounting variables. In addition, the magnitude of the size premium estimated from the Fama-Macbeth regressions is close to the time-series average of the SMB factor, which is at 0.85% per month with standard error 0.28% per month. The Fama-Macbeth regressions also confirm that the market factor and HML don't carry significant risk premiums, again, consistent with the observation that the time-series averages of the market and HML factors are not statistically significant from zero.

Thus, we find a strong size effect and no value effect cross returns in China's stock market. These results, although consistent with Wang and Xu (2004), which is based on a much shorter sample period from 1996 to 2002, contradict with most of the existing literature on the Chinese stock market. For example, Chen, Kim, Yao, and Yu (2010), Nusret Cakici and Topyan (2011) and Carpenter, Lu, and Whitelaw (2014) all document strong size and value effect. We find that the disagreement stems mainly from different choices of sample periods. Our sample period starts from July 1997, while other papers usually include an earlier period from 1995 to 1996.

To reconcile the differences, we test the robustness of our results by expanding our sample period to start from July 1995 and end at December 2013, covering a total of 222 months. The size effect remains robust. However, the significant value effect documented in the previous literature is very fragile and largely driven by extreme estimates in several months during the early period. The estimated slopes on the HML betas are extremely noisy before July 1997. For examples, the estimated slope is 42.12% on October 1996 and 38.35% on July 1996, much higher than the average level of 0.65% per month, especially when considering the time-series standard deviation is a mere 4.83% from July 1995 to December 2013. If our sample were large enough, a few outliers are harmless. However, due to the short-history of the Chinese stock market, the outliers in the earlier period turn out to have a heavy impact on the estimated average premiums and the associated t-values. In fact, once we weight the monthly premium slopes by the number of stocks in the Fama-Macbeth regressions or remove two extreme months, July 1996 and October 1996, the premium of HML is no-longer statistically significant. By comparison, the risk premium of size survives all robustness tests. As a result, we conclude that the previous documented value effect in the Chinese market is not robust.

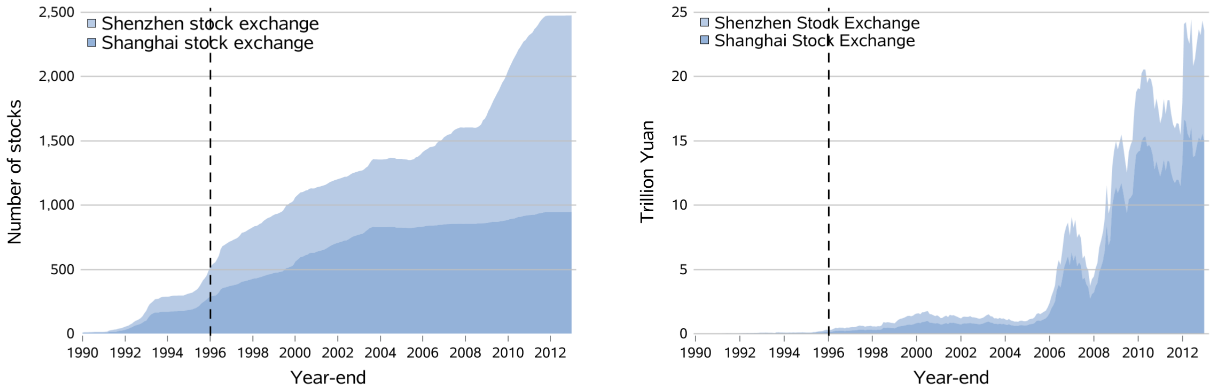
The rest of paper is organized as follows. Section 2 gives a short summary of China's stock market. Section 3 describes the data we use for this paper. Section 4 discusses the cross-sectional returns related to size and book-to-market ratio. Section 5 performs formal asset-pricing tests on the two factor mimicking portfolios SMB and HML. Section 6 conducts several robustness checks. Section 7 concludes the paper.

2 Background on China's Stock Market

The contemporary Chinese stock market is marked by the founding of two major stock exchanges, the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SSE), in 1990. Despite its short history, China's stock market has experienced a rapid growth. Figure 1 shows the number of stocks and total market capitalization of the Shanghai and Shenzhen exchanges from 1990 to 2013. We only mention some relevant facts here. A more comprehensive summary of the history of China's stock market and its empirical properties can be found in Wang, Hu, and Pan (2014).

Starting with only eight stocks listed on Shanghai and six listed on Shenzhen, the number of stocks on the two exchanges rose to 311 by the end of 1995, 720 by 1997, 1,060 by 2000 and 2,349 by 2013. The two exchanges shared similar growth path in terms of the number of stocks until 2004, when the Shenzhen exchange expanded more quickly with the creation of the Small and Medium Enterprise (SME) board. The introduction of the Growth Enterprise Market (SEM) later at 2009 also substantially increased the number of stocks on the Shenzhen exchange. By the end of 2013, the number of stocks listed on the Shenzhen Stock Exchange has reached 1,438, 58% more than that on the Shanghai Exchange. Though with multiple boards and significantly more stocks, the total market capitalization of the Shenzhen exchange is still less than that of Shanghai since firms listed on the Shenzhen exchange are usually smaller companies. Combined the two exchanges together, the total market capitalization reached 37.2 trillion RMB (6 trillion USD) by the end of 2014, putting China in second place globally, only after the United States (from the World Federation of Exchanges monthly report of Dec 2014).

The Chinese stock market is marked by a number of unique characteristics. One feature is the co-existence of different share classes. There are three different types of shares in China's stock market: A, B and H shares. A shares are dominated in renminbi (RMB) and are open mostly to domestic investors. B shares, usually dominated in U.S. dollars on the Shanghai Stock Exchange and Hong Kong dollars on the Shenzhen Stock Exchange, are



(a) Number of Listed Firms (b) Total Stock Market Capitalization

Figure 1: Growth of the Shanghai and Shenzhen Stock Exchanges from 1990 to 2013.

mainly for foreign investors. Domestic investors are restricted from investing abroad and foreign investors are also restricted from investing in the A-share market in mainland China. However, the issuance and trading activities in the B shares market have decreased sharply recently, due to various programs that relax the cross-trading restrictions. By the end of 2013, there are only 104 listed companies with B shares traded on the Shanghai and Shenzhen exchanges, accounting for only a tiny proportion of the total market. H shares, dominated in Hong Kong dollars, refer to shares of companies registered in mainland China but listed and traded on the Hong Kong Stock Exchange. Several empirical studies, such as Chan, Menkveld, and Yang (2008), Mei, Scheinkman, and Xiong (2009), have shown that there are often substantial price discrepancies between B and H shares and their A-share counterparts issued by the same company.

Even for just A-shares, many listed Chinese firms have two different types of shares, "floating" and "non-floating" shares, often referred as the "split-share structure." Floating shares are shares issued to the public, which are listed and traded on exchanges and can be invested by domestic individuals and institutions. They are regarded as different from the pre-existing "non-floating" shares that often belong to different parts of government. The latter are often traded via negotiations between various government and semi-government entities and later other legal entities, typically at book value. Through various reforms aimed at reducing state-ownership in most state-owned enterprises and shifting them toward a more market driven environment, non-floating shares are gradually converted into floating shares.

By the end of 2013, the proportion of the market capitalization of non-floating shares dropped to 16.5% from the peak of near 90% in early 1990. In this paper, we will mainly focus on floating A shares, which represent what domestic investors can trade publicly in China's stock market.

The Shanghai and Shenzhen stock exchanges have a similar trading mechanism, in which orders are executed through a centralized electronic limit order book, based on the principle of price and time priority. Both exchanges impose daily price limits on traded stocks. The policy on price limits has gone through several different stages. When the two exchanges were established in 1990, there were very strict rules on transaction prices and volumes. In the first few years, trading was quite thin on both exchanges. To encourage trading and improve market liquidity, the regulators withdrew price limits and adopted a free trading policy on May 12, 1992. Four years later on December 16, 1996, the government re-introduced the price limits policy amid concerns over speculation, an overheated market and social stability. The price limits were set at $\pm 10\%$ of the previous closing price, and has remained unchanged.

Unlike many open international stock markets, there are strict regulations on who can invest directly in China's domestic stock market. Major investors can be classified into four major classes: domestic individuals, domestic institutions, financial intermediaries and financial service providers (including brokers, integrated securities companies, investment banks and trust companies) and qualified foreign institutional investors (QFII). It is worth emphasizing that, commercial banks in mainland China are forbidden by law from participating in security underwriting or investing business, except for QFIIs. Commercial banks are also forbidden from lending funds to their clients for security business. Insurance companies are permitted to invest in common stocks only indirectly, through asset management products operated by mutual funds.

3 Data

The data for our study are from the Chinese Capital Market (CCM) Database provided by the China Academy of Financial Research (CAFR). The CCM database covers basic accounting data and historical A-share returns for all Chinese stocks listed on the Shanghai and Shenzhen exchanges from 1991 to 2013.[3]

Although the Chinese stock market began in 1990, our main results are based on a sample from 1997 to 2013. There are a number of considerations for this choice. The first is that the number of stocks available in the early period was too limited to conduct any meaningful cross-section tests. There were very few stocks traded on the Shanghai and Shenzhen exchanges in their early days - eight stocks were listed in Shanghai in 1990 and six were listed in Shenzhen in 1991. It was until late 1996 when the number of stocks listed on the two exchanges first crossed the 500 benchmark. In addition, the stock market was extremely volatile in the early 1990s. For example, realized volatility measured over a one-month horizon was above 60% on May 1995 and December 1996. Since 1997, the stock market has became more stable. Market volatility moves around 20% most of the time, except during the 2007-2008 financial crisis. The last consideration is regulation changes, especially the price limits policy. The current 10% price limits were imposed on December 16, 1996. Before that, the price limit policy was changed for several times. Balancing these factors and the desire to have a sample as long as possible, we decide to use the sample from 1997 to 2013 for our main analysis. Though it covers a shorter period, our sample has a rich number of cross-sectional firms during a period with a relatively stable market and regulatory environment. In the robustness check section, we test the robustness of our main results by expanding the sample to include two earlier years, 1995 and 1996. Our main results stay the same by including these two years.

We match the accounting data for all Chinese firms in calendar year $t-1$ (1996 - 2012) with the returns from July of year t to June of $t+1$. The accounting data is extracted from annual reports filed by companies listed on the Shanghai and Shenzhen stock exchanges. Because all public Chinese firms end their fiscal year in December and are required by law to submit their annual reports no later than the end of April, the six-month lag between accounting data and returns ensures that accounting variables are publicly available and the embedded information has been properly reflected in market prices. This match is also consistent with the standard approaches used in the literature for the U.S. market.

Our main accounting variables are size and book-to-market equity ratio. A firm's size is

[3]For details on the CCM database, readers can refer to Wang, Hu, and Pan (2014) and the data manual published by CAFR.

measured as the floating A-share market capitalization at the end of June each year. We use only floating A shares to compute the size of a listed company for two reasons. First, only floating A shares are investable for general domestic investors, while non-floating shares or other types of floating shares such as B and H are not. Second, non-floating shares are not actively traded and their transaction prices are not determined in the open market but through private negotiations. Therefore, floating A-share is the only share class that can be invested by a general domestic investor and has precise market prices. We think it is the most proper variable for measuring the size of a listed company. There are, of course, many other ways to construct the size variable. In the robustness check section, we confirm that our main results are robust to different size measures.

Following the same spirit, we calculate the book-to-market ratio (B/M) as the fraction of book value of equity per share and floating A-share prices at the end of December in the previous year $t-1$. The numerator is the total book value divided by the total number of shares, which include A-, B-, H- share classes and both floating and non-floating shares. This adjustment ensures that the numerator for the B/M ratio calculation represents the book value for one unit of floating A-share. Other accounting variables include A/ME, A/BE, E/P and D/P ratios. A/ME is market leverage, measured as asset per share divided by floating A-share price at the end of December of year $t-1$; A/BE is book leverage, measured as asset per share divided by book value of equity per share. E(+)/P is total positive earnings divided by price; E/P dummy is a dummy variable which takes zero if earning is positive and one otherwise. The price P in the denominators for the above ratios is the floating A-share price at the end of December in the previous year t-1. D/P is the ratio between all dividends distributed in the one year horizon before the end of June and the floating A-share price at the end of June.

4 Cross-sectional returns in China's Stock Market

4.1 Univariate Sorted Portfolios

To investigate potential size and value effect in cross-sectional returns of Chinese listed firms, we first look at performances of 10 size- and B/M-sorted portfolios. At the end of June of each year from 1997 to 2012, we divide all non-financial firms listed on the Shanghai and Shenzhen exchanges into 10 equally populated groups on the basis of their size or B/M ratios. The portfolios are kept unchanged for the following twelve months, from July to June next year. returns for the 10 portfolios are calculated as the equal-weighted average of individual stock returns.

Table 1 reports the average excess returns and firm characteristics of the 10 univariate sorted portfolios, panel A for the size-sorted portfolios and panel B for the B/M-sorted portfolios. When portfolios are formed on size, we observe a strong negative relationship between size and average returns. Though not strictly monotonic, there is a general decreasing trend in average returns as portfolio size increases from the smallest to the largest portfolio. Average returns fall from 2.05% per month for the smallest size portfolio to 0.42% per month for the largest size portfolio, with the difference being -1.63% and statistically significant at the 1% level.

We also report full sample market β^Ms for the 10 size-sorted portfolios, which are the slope coefficients in the regressions of monthly excess returns on the excess returns of a market portfolio over the 198 months from July 1997 to December 2013. It is worth emphasizing that there is no correlation between a firm's size and its market β^M in the Chinese market. The market β^Ms for the 10 size-sorted portfolios are close in magnitudes. The market β^M for the largest size portfolio is 1.04, only slightly higher than the market β^M (1.03) for the smallest size portfolio. This observation differs from the strong negative correlation between size and market β^Ms in the U.S. market, where smaller U.S. firms tend to have larger market β^Ms. Given that the market β^Ms are flat across different size portfolios in the Chinese market, variations in average returns are likely to be driven by the portfolios' differences in size, not by their exposures to market risk.

On average, there are 110 to 111 firms in each portfolio during the sample period. Average floating A-share market capitalization (ME) for stocks in the smallest size group is 479 millions RMB, representing only 2.17% of total market capitalization. By contrast, stocks in the largest size group have ME close to 15 billion RMB, or 41% of the total market capitalization. Smaller firms tend to have lower earnings to price and lower dividend ratios. There is no strong correlation between a firm's size and its book-to-market ratios. For example, the average

Table 1: Properties of Portfolios Formed on Size and Book-to-Market Ratios (July 1997 - December 2013)

Panel A: Portfolios formed on size

Variables	Small	2	3	4	5	6	7	8	9	Big	Big-Small
Return	2.05***	1.77**	1.52**	1.45**	1.17*	1.18*	0.86	0.88	0.84	0.42	−1.63***
	[2.71]	[2.39]	[2.12]	[2.04]	[1.66]	[1.68]	[1.26]	[1.30]	[1.24]	[0.65]	[−3.38]
ME	479	718	907	1,102	1,324	1,626	2,001	2,703	4,077	15,151	14,671
B/M ratio	0.30	0.35	0.36	0.39	0.40	0.40	0.40	0.40	0.40	0.39	0.10
% of market value	2.17	3.20	3.90	4.70	5.48	6.64	7.93	10.25	14.68	41.04	38.88
A/ME	0.63	0.70	0.75	0.81	0.87	0.84	0.85	0.84	0.87	0.84	0.21
A/BE	3.40	2.40	2.22	2.22	2.36	2.28	2.13	2.13	2.14	2.10	−1.30
E(+)/P (%)	1.67	2.10	2.21	2.31	2.55	2.81	2.89	3.19	3.54	4.38	2.71
E/P dummy	0.20	0.11	0.12	0.09	0.10	0.07	0.06	0.05	0.03	0.02	−0.18
D/P (%)	0.30	0.40	0.43	0.44	0.56	0.65	0.65	0.69	0.82	0.91	0.61
Floating ratio	0.34	0.43	0.47	0.50	0.52	0.53	0.54	0.55	0.56	0.56	0.22
β^M	1.03	1.07	1.05	1.06	1.06	1.06	1.05	1.05	1.06	1.04	0.00
N	110	111	111	111	111	111	111	111	111	110	

Panel B: Portfolios formed on B/M ratio

Variables	Low	2	3	4	5	6	7	8	9	High	High-Low
Return	0.82	1.02	1.16*	1.17*	1.19*	1.38**	1.40**	1.37*	1.35*	1.27*	0.45
	[1.18]	[1.54]	[1.71]	[1.72]	[1.72]	[1.98]	[2.05]	[1.89]	[1.90]	[1.81]	[1.59]
ME	3,567	2,765	2,438	2,428	2,283	2,510	2,676	3,888	3,405	4,164	597
B/M ratio	0.12	0.20	0.25	0.29	0.33	0.37	0.42	0.48	0.57	0.76	0.63
% of market value	10.75	9.91	9.01	8.80	8.70	8.91	9.29	10.77	10.72	13.15	2.40
A/ME	0.37	0.44	0.53	0.58	0.66	0.77	0.86	0.98	1.19	1.63	1.26
A/BE	5.04	2.20	2.08	1.94	1.97	2.01	1.98	2.00	2.06	2.09	−2.95
E(+)/P (%)	1.89	2.30	2.42	2.55	2.73	2.91	3.04	3.19	3.31	3.61	1.72
E/P dummy	0.20	0.10	0.08	0.07	0.06	0.07	0.07	0.07	0.08	0.09	−0.11
D/P (%)	0.19	0.34	0.44	0.53	0.58	0.68	0.69	0.73	0.82	0.83	0.64
Floating ratio	0.48	0.48	0.48	0.48	0.49	0.49	0.50	0.52	0.54	0.56	0.08
β^M	1.03	1.01	1.03	1.04	1.06	1.07	1.05	1.10	1.09	1.07	0.04
N	110	111	111	111	111	111	111	111	111	110	

Ten portfolios are formed every year at the end of June from 1997 to 2013, on the basis of underlying stocks' size or book-to-market ratios. returns are the time-series averages of the monthly equal-weighted portfolio returns, reported in percent. The time-series t-values for the average returns are reported in square brackets. ME (in millions) is the floating market capital measured in millions of Chinese Renminbi (RMB). B/M ratio is the ratio of book value of equity per share and floating A-share price. % of market value is the fraction of a portfolio's total ME out of the total market's ME. A/ME is asset per share divided by stock price. A/BE is asset per share divided by book value of equity per share. E(+)/P is total positive earnings divided by price. E/P dummy takes one if earnings is negative and zero otherwise. D/P is total cash dividends, scaled by price. The price P in the above denominators is the floating A-share price at the end of December each year from 1997 to 2012. Floating ratio is the fraction of floating A shares out of a firm's total outstanding shares. β^M is the slope on the market excess returns, $R_M - R_f$, in a full-sample CAPM regression. N is the average number of stocks within each portfolio. *, ** and *** correspond to statistical significance at 10%, 5% and 1%, respectively.

book-to-market ratios for the 5th to the 9th size deciles are all at the 0.40 level.

In contrast to the strong negative relation between size and average returns, we observe no clear trend in average returns of portfolios sorted on B/M ratios. Average returns range from 0.82% per month to 1.40% per month. Though returns tend to increase with respect to B/M ratios, the pattern is weak. For example, average returns on the portfolio with the highest average B/M ratios is 1.27% per month, 0.45 percentage points higher than the lowest group, but the difference is not statistically significant. In fact, the portfolio with the highest average returns is the 7th book-to-market deciles. Large spread in B/M ratios don't generate large variations in average returns, an indication that the value effect, if exists, is not strong in the Chinese stock market. The 10 B/M ratio portfolios also have very flat β^Ms, which rule out that possibility that lack of returns pattern is caused by different exposures to market risk. In terms of other firm characteristics, low B/M ratio firms are generally the ones with low market leverage, high book leverages. They also have low earnings-to-price and dividend ratios.

Figure 2 gives a graphic picture of the average returns across the 10 size and B/M ratio sorted portfolios. In addition to average returns and their associated 95% confidence intervals, we also plot a trend line through the average returns of the 10 ranked portfolios. The downward sloping trend line in the top panel confirms the strong negative relation between returns and size. By comparison, the upward sloping trend line in the bottom panel is much flatter.

4.2 Construction of the Size and Value Factor

To mimic underlying risk factors related to size and book-to-market ratios, we first construct six portfolios by intersecting two size-sorted portfolios with three B/M-sorted portfolios. At June of each year t, we form two size portfolios, Small and Big, by dividing all non-financial stocks listed on the Shanghai and Shenzhen exchanges equally into two groups on the basis of their floating A-share market capitalization. Similarly, three B/M portfolios are formed by assigning all stocks into three groups by their book-to-market ratios: Low, Medium, and High. The three subgroups represent the bottom 30%, middle 40%, and top 30%, respectively. The two size-sorted portfolios and three B/M-sorted portfolios produce six portfolios: Small-Low, Small-Medium, Small-High, Big-Low, Big-Medium and Big-High. For example, the Small-Low portfolio contains the stocks in the Small size group that are also in the Low book-to-market group. Monthly value-weighted returns on the six portfolios are calculated from July of year t to June of $t + 1$, where the weight for each stock is its floating A-share market capitalization.

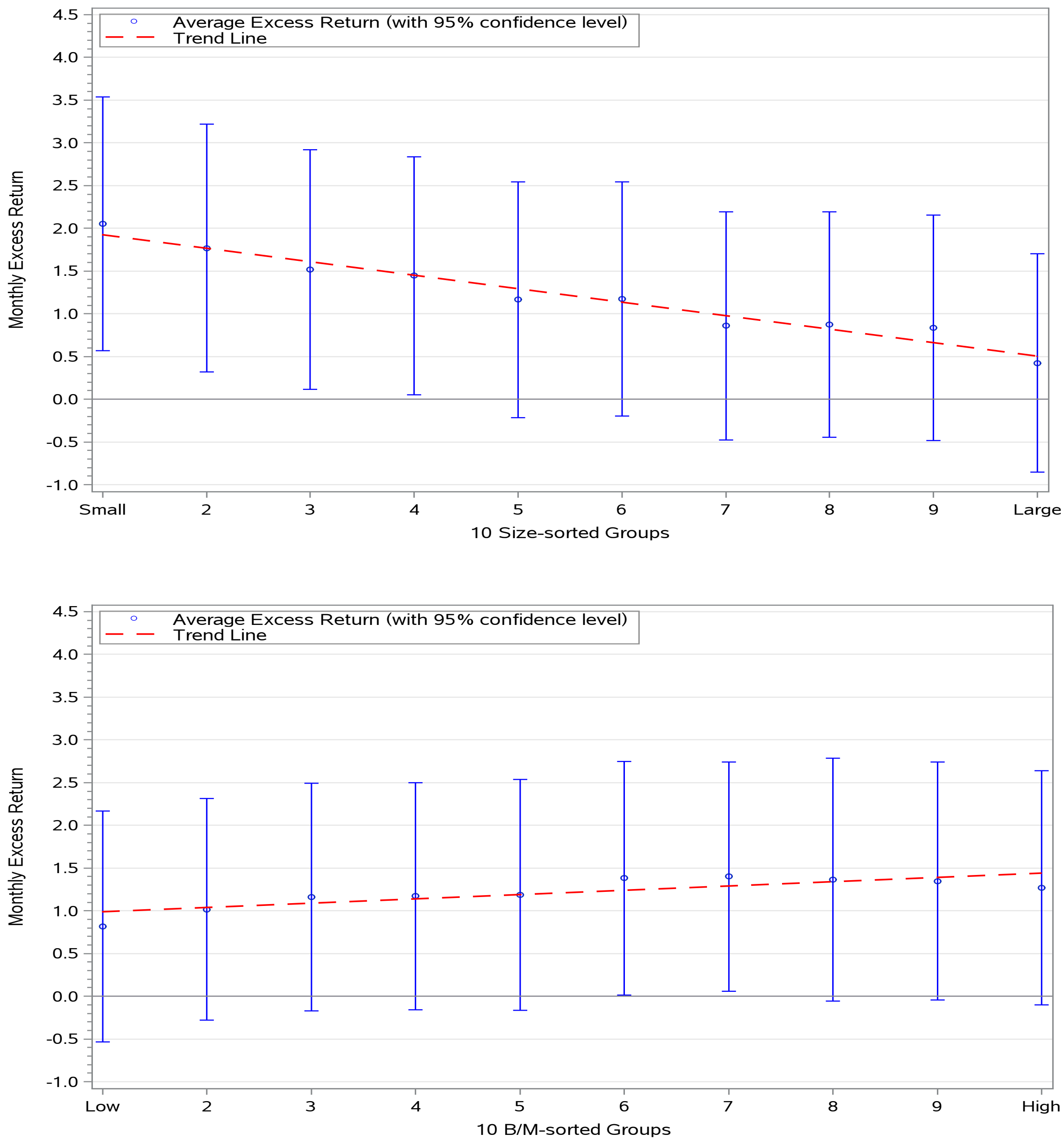


Figure 2: Monthly excess returns of 10 size- and B/M-sorted portfolios.

The portfolios are reformed in June of $t + 1$.[4]

We then construct two portfolios, SMB and HML, which mimic risk factors in returns related to size and book-to-market ratios. SMB (small minus big) is the difference between the

[4]We follow the existing literature to sort firms into three groups on B/M ratios and only two on size. The main consideration for the split is to be consistent with the classic Fama-French factors for the U.S. market. Given that the size effect is actually stronger in the Chinese market, we also consider two different splits in robustness check section. The results remain similar.

simple average of the returns on the three small-stock portfolios (Small-Low, Small-Medium and Small-High) and the three big-stock portfolios (Big-Low, Big-Medium and Big-High). Since the two components of SMB are returns on small and big-stock portfolios with about the same weighted-average book-to-market ratios, SMB captures the different returns behaviors of small and big stocks and is largely free of the influence related to book-to-market ratios. Similarly, we construct a HML (high minus low) portfolio which is the difference between the simple average of the returns on the two high B/M portfolios (Small-High and Big-High) and the two low B/M portfolios (Small-Low and Big-Low).

Table 2 summarizes the returns of the market factor, SMB and HML. In the A-share Chinese market, the average value of market excess returns $R_M - R_f$ is 0.60% per month from July 1997 to December 2013. The magnitude is large, equivalent to 7.2% annualized returns, but with t-statistics at only 0.97 and not statistically significant. SMB, the size factor mimicking portfolio, has average monthly returns of 0.85% which translates to 10.2% annual returns. The magnitude is not only economically large but also strongly statistically significant with t-value 3.09. By comparison, the mimicking portfolio for book-to-market ratios, HML, produces an average returns of 0.34% per month, but with t-value of only 1.61. Among the three factors for the Chinese market ($R_M - R_f$, SMB and HML), SMB has the largest average returns and is the only one that is statistically significant, highlighting the strong size effect in Chinese stock returns.

The dominant performance of SMB over another two factors is also clear in Figure 3, which plots the accumulated value of investing 1 RMB at the end of June 1997 over the sample period from July 1997 to December 2013.

To draw a parallel between the factors of the Chinese market and that of the U.S. market, we put the summary statistics of the three factors we constructed for the Chinese market along with those in the U.S. market. Since one concern of our study is that our sample period covers only 198 months from July 1997 to December 2013 , we report summary statistics for the three factors in the U.S. market separately for two sample periods: One is the same sample period from July 1997 to December 2013 and another one is a much longer period since 1962 (July 1962- December 2013). For the factors of the U.S. market, the average excess returns from July 1962 to December 2013 is 0.53% per month for the market portfolio; 0.24%

Table 2: Summary Statistics of $R_M - R_f$, SMB, HML and the Six Size-B/M Sorted Portfolios

	$R_M - R_f$	SMB	HML	Small-Low	Small-Medium	Small-High	Big-Low	Big-Medium	Big-High
Panel A: China's A share market: July 1997 - December 2013									
mean	0.60	0.85***	0.34	1.18*	1.44**	1.47**	0.32	0.53	0.70
T	[0.97]	[3.09]	[1.61]	[1.69]	[2.07]	[2.04]	[0.52]	[0.81]	[1.07]
std	8.63	3.86	2.95	9.79	9.77	10.20	8.66	9.17	9.21
skewness	0.37	−0.28	0.28	0.33	0.27	0.35	0.55	0.26	0.56
Panel B: The U.S. market: July 1997 - December 2013									
mean	0.49	0.32	0.26	0.59	0.95**	1.03**	0.49	0.53	0.58
T	[1.44]	[1.25]	[1.08]	[1.12]	[2.34]	[2.41]	[1.48]	[1.57]	[1.54]
std	4.77	3.61	3.44	7.37	5.70	6.02	4.68	4.78	5.30
skewness	−0.68	0.87	0.01	−0.19	−0.50	−0.67	−0.58	−0.64	−0.79
Panel C: The U.S. market: July 1962 - December 2013									
mean	0.53***	0.24**	0.38***	0.53*	0.91***	1.08***	0.51***	0.55***	0.73***
T	[2.93]	[1.96]	[3.33]	[1.92]	[4.15]	[4.77]	[2.69]	[3.18]	[3.85]
std	4.49	3.09	2.86	6.88	5.45	5.61	4.67	4.34	4.69
skewness	−0.52	0.54	−0.01	−0.35	−0.49	−0.39	−0.34	−0.36	−0.39

The summary statistics of monthly excess returns on $R_M - R_f$, SMB, HML and the six size-B/M sorted portfolios are reported, separately for the Chinese and the U.S. stock markets. $R_M - R_f$ is the excess return on a value weighted market portfolio, in which the weights are stocks' floating A-share market capital. At June of each year t, six size-B/M double sorted portfolios are formed by intersecting two size portfolios (Small and Big) and three value portfolios (Low, Medium and High). The summary statistics are calculated based on the excess returns on the six portfolios: Small-Low, Small-Medium, Small-High, Big-Low, Big-Medium and Big-High. SMB (small minus big) is the difference between the simple averages of the returns on the three small-stock portfolios (Small-Low, Small-Medium and Small-High) and the three big-stock portfolios (Big-Low, Big-Medium and Big-High). HML (high minus low) is the difference between the simple averages of the returns on the two high-B/M portfolios (Small-High and Big-High) and the two low-B/M portfolios (Small-Low and Big-Low). Mean is the time-series mean of a monthly returns, std is its time-series standard deviation, T is mean divided by its time-series standard error, and skewness is the time-series skewness of monthly returns.

per month for SMB; 0.38% per month for HML. Except SMB which has a marginal t-value of 1.96, both the market and HML factor of the U.S. market have significant positive average returns. In contrast, for the shorter period from July 1997 to December 2013, none of the three U.S. factors is significant. The lack of statistical significance of the three U.S. factors during the shorter period underscores biases of cross-sectional pricing tests on small samples. To mitigate the potential small sample effect for our tests on the Chinese market, we perform a robustness check by including two more years 1995 and 1996 in our sample. However, given the short history of the Chinese stock market, we admit that our results are unavoidably limited by the small sample.

The correlation structure of the three Chinese returns factors is very different from those in the U.S. market. As seen in Table 3, among the three Chinese factors, only the market

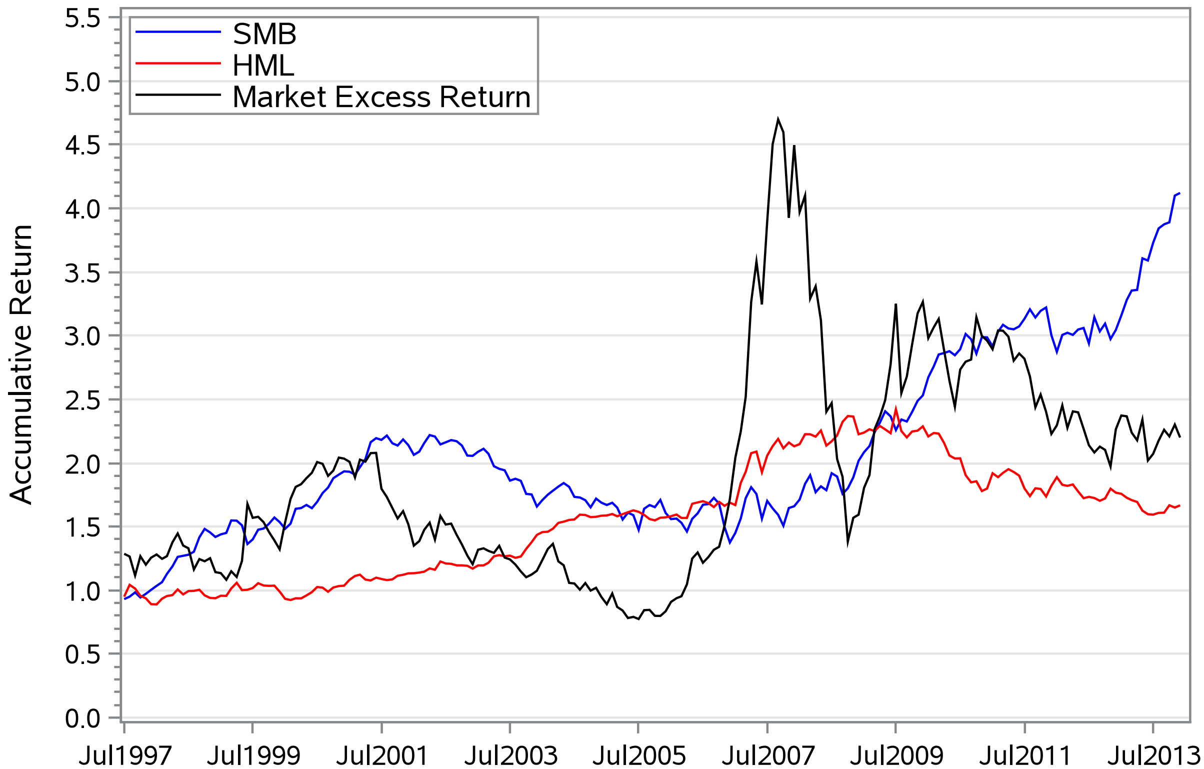


Figure 3: Accumulative returns of $R_M - R_f$, SMB and HML (July 1997 - December 2013)

and HML have significant correlation, 0.19 and statistically significant at the 1% level. On the contrary, the three factors in the U.S. market are all strongly correlated with one another. For the same time period from 1997 to 2013, the correlation is 0.27 for the market factor and SMB; -0.21 for the market factor and HML; -0.35 for SMB and HML. The correlations are all statistically significant at the 1% level. The three U.S. factors exhibit similar correlations over the longer period from 1962 to 2013. There is no strong cross-correlation between the Chinese and U.S. market factors, with the exception that the Chinese market index tends to move in the same direction with the U.S. market index.

4.3 Seasonality

The returns on the three factors, $R_M - R_f$, SMB and HML exhibit strong seasonality. Table 4 summarizes the empirical pattern. For each month, we report the average excess returns as well as the average number of trading days for the three factors and the six size- and B/M-

Table 3: Correlations of $R_M - R_f$, SMB and HML Factors

Panel A: pairwise correlations

	China's stock market: 1997-2013			U.S. stock market: 1997-2013			U.S. stock market: 1962-2013		
	$R_M - R_f$	SMB	HML	$R_M - R_f$	SMB	HML	$R_M - R_f$	SMB	HML
$R_M - R_f$		0.09	0.19***		0.27***	−0.21***		0.31***	−0.30***
SMB			0.05			−0.35***			−0.23***

Panel B: cross-correlations between the factors in the Chinese stock market and the U.S. stock market, 1997-2013

	$R_M - R_f^{US}$	SMB^{US}	HML^{US}
$R_M - R_f^{CH}$	0.19***	0.09	-0.05
SMB^{CH}	-0.02	-0.12*	0.03
HML^{CH}	-0.00	-0.02	0.07

Panel A reports the pairwise correlations of monthly returns on $R_M - R_f$, SMB and HML factors for three samples: China's stock market from July 1997 to December 2013, U.S. stock market from July 1997 to December 2013 and U.S. stock market from July 1962 to December 2013. Panel B reports the cross correlations of $R_M - R_f$, SMB and HML in China's stock market and $R_M - R_f$, SMB and HML in the U.S. stock market. *, ** and *** correspond to statistical significance at 10%, 5% and 1%, respectively.

sorted portfolios. The average number of days range from 14 to 22. The month with the lowest number of trading days is February, due to the fact that long holidays for the Chinese Lunar New Year often fall in this month. February is also the month when the market index has the highest returns 3.45% and the only month when the market excess returns is positively significant. Taking out February, the average market excess returns is 0.35% and only 0.53 standard errors from zero. Similar to the market factor, the six size- and B/M-sorted portfolios also have the highest returns in February.

In February, March, May and August, small stocks out-perform large stocks and SMB fetches significant positive excess returns. There is only one month, June, when small stocks under-perform large stocks by a marginal negative significant -1.71% (with t-value -1.87). SMB has a robust 2.77% returns in February, but its best performance of 3.07% occurs in March. Taking out February, SMB has an average returns of 0.68% and is still significant at the 5% level. HML doesn't show strong seasonality. HML doesn't have statistically significant returns, positive or negative, in any of the calendar months.

5 Asset-Pricing Tests

5.1 Time-Series Regressions

For a formal asset-pricing test, we first employ the time-series regression approach of Jensen, Black, and Scholes (1972) and Fama and French (1993). Monthly excess returns of stocks are regressed on the excess returns to a market portfolio of stocks ($R_M - R_f$) and mimicking portfolios for size (SMB) and book-to-market ratio (HML). If assets are priced rationally, the slopes and R^2 in the time-series regressions should reflect whether mimicking portfolios for the risk factors related to size and B/M captures common variations in stock returns not explained by the market factor. Moreover, the estimated intercepts in such regressions provide direct evidence on how well the combined factors explain the cross-section of average returns.

We follow the literature to form 25 double-sorted portfolios. In June of each year t, we sort, independently, all non-financial stocks listed on the Shanghai and Shenzhen exchanges to five size and book-to-market quintiles. We then form the 25 portfolios from the intersections of the size and B/M quintiles. The portfolios are kept unchanged for the next 12 months, from July

Table 4: Seasonality

Portfolios	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	No Feb	All
Panel A: returns on $R_M - R_f$, SMB and HML														
R_M-R_f	2.61	3.45***	1.25	2.16	1.74	−0.87	0.50	−2.16	−1.02	−1.24	0.35	0.81	0.35	0.60
	[1.12]	[2.67]	[0.55]	[0.95]	[0.85]	[−0.26]	[0.23]	[−0.99]	[−0.74]	[−0.57]	[0.20]	[0.43]	[0.53]	[0.97]
SMB	0.78	2.77***	3.07***	−0.06	2.17***	−1.71*	0.83	2.55***	−0.13	−0.42	1.49	−1.06	0.68**	0.85***
	[0.93]	[4.65]	[3.47]	[−0.07]	[2.63]	[−1.87]	[0.76]	[3.12]	[−0.16]	[−0.52]	[1.32]	[−1.12]	[2.33]	[3.09]
HML	0.73	1.18	1.00*	1.16*	−0.10	−0.82	1.20	−0.00	−0.34	0.40	−0.03	−0.26	0.26	0.34
	[1.00]	[1.47]	[1.91]	[1.65]	[−0.12]	[−1.02]	[1.59]	[−0.00]	[−0.60]	[0.57]	[−0.06]	[−0.37]	[1.22]	[1.61]
Trading days	18	14	22	21	19	21	22	22	21	18	21	22	21	20
Panel B: excess returns on the six size-B/M sorted portfolios														
Small-Low	3.58	5.77***	2.78	1.37	3.69	−2.54	1.19	−0.05	−0.68	−2.31	2.05	−0.28	0.77	1.18*
	[1.32]	[3.49]	[1.05]	[0.51]	[1.64]	[−0.80]	[0.49]	[−0.02]	[−0.38]	[−1.04]	[1.01]	[−0.12]	[1.05]	[1.69]
Small-Medium	3.43	6.66***	3.34	2.06	4.21*	−3.13	1.67	0.06	−0.91	−2.21	2.37	0.16	0.98	1.44**
	[1.37]	[3.84]	[1.25]	[0.78]	[1.77]	[−1.00]	[0.64]	[0.03]	[−0.55]	[−1.01]	[1.16]	[0.07]	[1.34]	[2.07]
Small-High	3.87	7.19***	3.96	2.30	4.01	−3.34	2.18	0.33	−1.02	−2.21	1.57	−0.61	0.97	1.47**
	[1.58]	[3.94]	[1.40]	[0.78]	[1.64]	[−0.92]	[0.81]	[0.13]	[−0.60]	[−1.02]	[0.79]	[−0.28]	[1.28]	[2.04]
Big-Low	2.14	3.18**	−0.28	1.12	2.12	−0.36	−0.17	−2.33	−0.70	−2.07	0.53	1.01	0.07	0.32
	[0.87]	[2.30]	[−0.13]	[0.52]	[1.07]	[−0.10]	[−0.09]	[−1.12]	[−0.47]	[−0.89]	[0.26]	[0.48]	[0.11]	[0.52]
Big-Medium	3.09	4.01***	0.59	2.30	1.67	−2.33	1.47	−2.27	−0.47	−2.02	0.07	0.63	0.22	0.53
	[1.29]	[2.76]	[0.25]	[0.92]	[0.84]	[−0.69]	[0.62]	[−0.99]	[−0.29]	[−0.91]	[0.03]	[0.30]	[0.32]	[0.81]
Big-High	3.31	4.11***	0.56	2.51	1.61	−1.19	1.26	−2.71	−1.04	−1.39	0.94	0.82	0.40	0.70
	[1.48]	[3.04]	[0.25]	[1.01]	[0.70]	[−0.31]	[0.52]	[−1.14]	[−0.73]	[−0.66]	[0.51]	[0.42]	[0.57]	[1.07]

Panel A reports the time-series averages and the associated t-values of returns on $R_M - R_f$, SMB and HML, separately for each calendar month from July 1997 to December 2013. The average number of trading days in each calendar month is also reported. Panel B reports the time-series averages and the t-values for excess returns on the six size-B/M sorted portfolios from July 1997 to December 2013. *, ** and *** correspond to statistical significance at 10%, 5% and 1%, respectively.

of year t to June of year $t+1$. We calculate monthly portfolio returns as the value-weighted average of individual stocks in each portfolio, in which the weights are the floating A-share market capitalization.

Table 5 summarizes characteristics of companies in the 25 double-sorted portfolios. The double sorting produces a wide spread in size and B/M ratios. Across the 25 portfolios, average size ranges from 591 million RMB to 11.9 billion RMB and average B/M ratio range from 0.15 to 0.70. The average number of firms in each portfolio varies from 19.4 for the smallest-size and highest-B/M ratio portfolio to 55.1 for the largest-size and highest-B/M ratio portfolio. Controlling for size, high B/M portfolios tend to have high market leverage (A/ME) and low book leverage (A/BE). They also have high dividend yields and E/P ratios. These are generally in line with patterns in the U.S. market. In addition, average floating ratios increase from the small- to large-size portfolios in each of the B/M quintiles, with differences range from 0.14 to 0.18. Average floating ratios also rise as B/M ratio increases, though the magnitudes are smaller. In other words, large and value firms also tend to be those with higher percentage of floating share in the Chinese market.

For each of the 25 size-B/M sorted portfolios, we run the following regressions:

$$R_t^p - R_{f,t} = \alpha_p + \beta_p^M (R_{M,t} - R_{f,t}) + \beta_p^{SMB} SMB_t + \beta_p^{HML} HML_t + \epsilon_t^p, \tag{1}$$

where $R_t^p - R_{f,t}$ is the excess returns on the portfolio at month t, $R_{M,t} - R_{f,t}$ is excess returns of the value-weighted Chinese market index, SMB_t and HML_t are returns on two zero-cost factor-mimicking portfolios for size and book-to-market, respectively. Table 6 summarizes the excess returns and time-series regression results. There is a large dispersion in average excess returns across the 25 portfolios, from 0.11% to 1.91%. Consistent with the patterns for the univariate sorted portfolios, average returns and size show a clear negative relation. In each of the B/M quintiles, excess returns monotonically decrease from the smaller- to the larger-size portfolios. By comparison, the relation between average returns and book-to-market equity is much weaker. Though average returns show a tendency to rise as B/M ratios increase, the pattern is not monotonic and often very flat. It's worth emphasizing that only small-size stocks have significant positive excess returns in the Chinese market in our sample of July 1997 to December 2013. None of the portfolios in the top three size quintiles has excess returns

Table 5: Summary Statistics For 25 Portfolios Formed on Size and Book-to-Market Ratios (July 1997 - December 2013)

	B/M Quitile											
Size Quintile	Low	2	3	4	High	High-Low	Low	2	3	4	High	High-Low
	ME(in million)						B/M ratio					
Small	591	596	618	620	643	52***	0.15	0.27	0.35	0.45	0.60	0.45***
2	991	973	1,022	1,012	1,019	28***	0.16	0.27	0.35	0.45	0.63	0.46***
3	1,454	1,488	1,467	1,472	1,476	22**	0.17	0.27	0.35	0.45	0.65	0.48***
4	2,388	2,335	2,319	2,399	2,298	−90***	0.17	0.27	0.35	0.45	0.66	0.49***
Big	9,072	7,433	7,709	11,920	10,888	1,816***	0.16	0.27	0.35	0.45	0.70	0.54***
Big−Small	8,480***	6,838***	7,090***	11,301***	10,245***		0.01	−0.00	0.00	0.00	0.10	
	% of market value in portfolio						N					
Small	1.36	1.30	1.29	0.90	0.51	−0.85***	53.4	53.3	52.1	42.8	19.4	−33.9***
2	1.48	1.71	1.99	1.91	1.51	0.04	41.2	45.0	48.6	47.5	39.5	−1.8
3	1.88	2.29	2.44	2.69	2.82	0.94***	36.0	41.8	44.4	47.2	52.7	16.8***
4	3.12	3.41	3.21	3.95	4.50	1.38***	41.0	40.9	40.1	45.2	54.8	13.8***
Big	12.83	9.09	8.68	10.60	14.53	1.70**	49.5	41.0	36.8	39.3	55.1	5.5***
Big−Small	11.48***	7.78***	7.39***	9.69***	14.02***		−3.8	−12.3***	−15.4***	−3.5*	35.7***	
	β^M						Floating ratio					
Small	1.03***	1.04***	1.04***	1.05***	1.10***	0.06**	0.39	0.37	0.39	0.40	0.43	0.04***
2	1.03***	1.01***	1.04***	1.11***	1.07***	0.04	0.46	0.46	0.48	0.51	0.52	0.06***
3	0.99***	1.05***	1.06***	1.06***	1.10***	0.11***	0.49	0.51	0.52	0.54	0.56	0.07***
4	0.96***	1.03***	1.07***	1.07***	1.09***	0.12***	0.50	0.53	0.55	0.56	0.57	0.07***
Big	0.99***	1.04***	1.09***	1.06***	1.08***	0.09**	0.55	0.55	0.55	0.57	0.57	0.02***
Big−Small	−0.04	−0.01	0.05	0.01	−0.02		0.16***	0.18***	0.16***	0.17***	0.14***	
	A/BE						A/ME					
Small	5.66	1.98	1.89	1.88	1.88	−3.77***	0.46	0.54	0.68	0.86	1.15	0.69***
2	3.30	2.00	1.93	2.00	2.06	−1.24***	0.42	0.55	0.70	0.92	1.32	0.90***
3	3.53	2.08	2.05	2.02	2.11	−1.42***	0.37	0.57	0.74	0.94	1.42	1.05***
4	2.61	2.01	2.07	2.03	2.04	−0.57***	0.39	0.57	0.75	0.95	1.39	1.00***
Big	2.22	2.01	2.07	2.11	2.16	−0.06***	0.36	0.54	0.75	0.98	1.55	1.20***
Big−Small	−3.44	0.03	0.18	0.23	0.27		−0.10	0.00	0.07	0.12	0.40	
	E/P ratio						D/P ratio					
Small	1.58	1.87	2.07	2.12	2.12	0.54***	0.11	0.33	0.50	0.54	0.45	0.34***
2	1.94	2.01	2.32	2.52	2.48	0.54***	0.21	0.37	0.47	0.52	0.57	0.36***
3	1.89	2.46	2.80	2.98	2.96	1.06***	0.24	0.47	0.65	0.70	0.80	0.56***
4	2.31	2.63	3.11	3.32	3.61	1.30***	0.38	0.58	0.66	0.79	0.82	0.44***
Big	2.67	3.50	4.04	4.59	4.92	2.25***	0.42	0.71	0.96	1.04	1.17	0.75***
Big−Small	1.09	1.64	1.97	2.48	2.80		0.31	0.38	0.46	0.50	0.72	

Average characteristics of 25 size-B/M portfolios are reported. Variable are defined in Table 1. The 25 portfolios are formed at the end of each June from 1997 to 2012, by intersecting five size-sorted portfolios and five B/M sorted portfolios. *, ** and *** correspond to statistical significance at 10%, 5% and 1%, respectively.

significant at the 5% level. For the remaining 10 portfolios in the bottom two size quintiles, eight portfolios have excess returns significant at the 5% level, with t-values from 2.04 to 2.57.

Slopes on the market excess returns, β^Ms, are all strongly statistically significant with t-values close or above 40.0. Unlike the U.S. market, β^Ms across the 25 portfolios are much flatter, with variation less than 0.1. More importantly, β^Ms show no relation with size and B/M ratios. Thus, the market factor can help explain the overall magnitude of average excess

Table 6: Time-Series Regressions of Excess returns of 25 Size-B/M Sorted Portfolios on $R_M - R_f$, SMB and HML (July 1997 - December 2013)

	B/M Quitile									
Size Quintile	Low	2	3	4	High	Low	2	3	4	High
	Portfolio excess return					Abnormal return: α_p				
Small	1.66**	1.61**	1.75**	1.91**	1.74**	0.08	0.04	0.20	0.26	0.03
	[2.25]	[2.19]	[2.39]	[2.57]	[2.26]	[0.45]	[0.26]	[1.28]	[1.43]	[0.17]
2	0.90	1.31*	1.43**	1.70**	1.47**	−0.28	0.11	0.05	0.19	−0.03
	[1.30]	[1.94]	[2.05]	[2.27]	[2.04]	[−1.56]	[0.71]	[0.26]	[1.07]	[−0.18]
3	0.79	1.14*	1.07	1.01	1.26*	−0.20	0.01	−0.09	−0.23	−0.15
	[1.22]	[1.65]	[1.55]	[1.45]	[1.72]	[−1.08]	[0.06]	[−0.51]	[−1.36]	[−0.85]
4	0.48	0.72	0.76	0.91	0.88	−0.26	−0.11	−0.26	−0.15	−0.21
	[0.75]	[1.08]	[1.10]	[1.30]	[1.25]	[−1.19]	[−0.53]	[−1.37]	[−0.74]	[−1.19]
Big	0.19	0.11	0.44	0.66	0.49	0.14	−0.23	−0.08	0.12	−0.03
	[0.29]	[0.17]	[0.65]	[1.00]	[0.76]	[0.86]	[−1.27]	[−0.44]	[0.71]	[−0.17]
	Coefficients of $R_{M,t} - R_{f,t}$: β_p^M					Coefficients of SMB: β_p^{SMB}				
Small	0.99***	1.01***	1.01***	0.99***	1.03***	1.29***	1.23***	1.20***	1.18***	1.14***
	[48.85]	[57.15]	[55.58]	[48.14]	[44.28]	[29.10]	[31.90]	[30.08]	[26.06]	[22.34]
2	1.02***	0.99***	0.98***	1.06***	1.00***	0.87***	0.87***	0.96***	0.95***	0.94***
	[48.25]	[52.71]	[46.98]	[50.53]	[50.57]	[18.68]	[21.09]	[20.76]	[20.72]	[21.73]
3	0.96***	1.02***	1.02***	1.03***	1.03***	0.70***	0.71***	0.68***	0.72***	0.73***
	[44.21]	[44.49]	[49.30]	[51.95]	[50.20]	[14.61]	[14.06]	[14.99]	[16.63]	[16.24]
4	0.98***	1.01***	1.05***	1.04***	1.05***	0.42***	0.42***	0.50***	0.45***	0.40***
	[38.99]	[41.23]	[48.50]	[44.78]	[51.87]	[7.52]	[7.81]	[10.52]	[8.75]	[9.03]
Big	1.02***	1.02***	1.07***	1.01***	0.97***	−0.30***	−0.21***	−0.12**	−0.24***	−0.33***
	[52.58]	[49.51]	[49.45]	[54.41]	[52.44]	[−7.09]	[−4.61]	[−2.53]	[−5.75]	[−8.23]
	Coefficients of HML: β_p^{HML}					R^2				
Small	−0.30***	−0.23***	−0.19***	0.19***	0.38***	0.95	0.96	0.96	0.95	0.94
	[−5.06]	[−4.40]	[−3.67]	[3.09]	[5.67]					
2	−0.45***	−0.37***	−0.03	0.20***	0.32***	0.94	0.95	0.94	0.95	0.95
	[−7.29]	[−6.75]	[−0.50]	[3.22]	[5.56]					
3	−0.50***	−0.24***	−0.09	0.06	0.50***	0.92	0.92	0.94	0.94	0.94
	[−7.82]	[−3.54]	[−1.54]	[0.99]	[8.32]					
4	−0.58***	−0.39***	−0.10	0.16**	0.34***	0.89	0.9	0.93	0.92	0.94
	[−7.92]	[−5.50]	[−1.53]	[2.32]	[5.82]					
Big	−0.93***	−0.29***	−0.04	0.41***	0.67***	0.94	0.93	0.93	0.94	0.94
	[−16.27]	[−4.82]	[−0.65]	[7.54]	[12.38]					

For each of the 25 size-B/M sorted portfolios, we run the regression: $R_t^p - R_{f,t} = \alpha_p + \beta_p^M(R_{M,t} - R_{f,t}) + \beta_p^{SMB} SMB_t + \beta_p^{HML} HML_t + \epsilon_t^p$, where $R_t^p - R_{f,t}$ is the excess return on the portfolio at month t, $R_{M,t} - R_{f,t}$ is excess return on the market index $R_M - R_f$, SMB_t and HML_t are returns on two zero-cost factor-mimicking portfolios for size and book-to-market ratio, respectively. *, ** and *** correspond to statistical significance at 10%, 5% and 1%, respectively.

returns of each portfolio, but it cannot explain the wide variations related to size and B/M ratios. By contrast, slopes on SMB and HML are not only statically significant but also keep the orderings of the corresponding size and book-to-market ratios. Slopes on SMB, with a large spread of 1.62, decreases as portfolio sizes move from the smallest quintile to the largest. The t-values for small-size stocks are also generally larger in magnitudes than large-size stocks. All slopes on SMB are strongly significant, even the least significant one is -2.53 standard errors from zero. Similar to the slopes on SMB, slopes on HML are also monotonically related to

B/M ratios within each of the size quintiles. The significance of the slopes on HML, however, is much weaker than both the market β^Ms and the slopes on SMB. For example, four out of five portfolios in the middle B/M quintile don't have significant exposure to the HML factor. R-squared across the 25 portfolios are quite high, from 89% to 96%.

We then turn to the most important metrics, αs, which are intercepts of the time-series regressions on the excessive returns of the 25 size and B/M sorted portfolios. The results are encouraging - all of the αs are small in magnitudes and non-significant from zeros. In addition, the remaining αs show no relation with neither size nor B/M ratios. Judging on the basis of the intercepts, the three factors, Market, SMB and HML, successfully capture the cross-section of average returns. Moreover, given the flat structure of market β^Ms, the returns variations related to size and book-to-market ratios are more likely to be driven by exposures to the two factor mimicking portfolios, SMB and HML.

To separate roles played by each of the three factors, we report intercepts for different model setups in Table 7. When the market excess returns is used alone to explain portfolio excess returns in the time-series regressions, the intercepts αs are smaller than the average excess returns, but remain strongly significant. In fact, Ten out of the 25 portfolios still have positive significant αs and one portfolio has negative significant α. In addition, the remaining αs still maintain the cross-section pattern with size and B/M ratios. In contrast, using SMB as the sole factor makes all intercepts in the time-series regressions non-significant from zeros. More important, after taking out the exposures to the SMB factor, the remaining intercepts no longer monotonically decreases with respect to size. However, that even though no α is statistically significant, 24 out of the 25 αs remain positive, and the highest α is at 0.74% per month. Next, we combine SMB with the market factor. The intercepts are further reduced in magnitude and remain non-significant for the majority of the portfolios. Out of the total 25 portfolios, only one portfolio has intercept, -0.41%, significant at the 5% level. HML, on the other hand, is not very successful in explaining cross-section returns. Whether used alone or in combination with the market factor, the intercepts for portfolios in the bottom two size quintiles remain large and statistically significant. Putting all evidence together, it is clear that SMB is the most important factor in terms of explaining cross-section returns in China's stock market.

Table 7: Intercepts From Excess Stock returns Regressions for 25 Stock Portfolios Formed on Size and Book-to-Market Ratios (July 1997 - December 2013)

	B/M Quitile									
Size Quintile	Low	2	3	4	High	Low	2	3	4	High
	$R_t^p = \alpha_p + \beta_p^M(R_{M,t} - R_{f,t}) + \epsilon_t^p$					$R_t^p = \alpha_p + \beta_p^{SMB} SMB_t + \beta_p^{HML} HML_t + \epsilon_t^p$				
Small	1.05***	0.99***	1.13***	1.28***	1.08***	0.34	0.30	0.47	0.52	0.30
	[2.66]	[2.67]	[3.11]	[3.46]	[2.86]	[0.53]	[0.47]	[0.72]	[0.80]	[0.45]
2	0.29	0.72**	0.82***	1.04***	0.84***	−0.02	0.37	0.31	0.47	0.23
	[0.95]	[2.46]	[2.61]	[3.25]	[2.66]	[−0.03]	[0.59]	[0.48]	[0.69]	[0.36]
3	0.22	0.52*	0.44*	0.38	0.60**	0.05	0.28	0.18	0.04	0.12
	[0.79]	[1.89]	[1.73]	[1.46]	[2.10]	[0.08]	[0.42]	[0.27]	[0.06]	[0.18]
4	−0.09	0.12	0.13	0.27	0.22	−0.00	0.15	0.02	0.13	0.07
	[−0.34]	[0.47]	[0.55]	[1.14]	[1.04]	[−0.00]	[0.23]	[0.03]	[0.18]	[0.10]
Big	−0.38	−0.49**	−0.19	0.04	−0.10	0.41	0.04	0.20	0.38	0.23
	[−1.43]	[−2.52]	[−1.04]	[0.23]	[−0.46]	[0.63]	[0.06]	[0.29]	[0.59]	[0.37]
	$R_t^p = \alpha_p + \beta_p^{SMB} SMB_t + \epsilon_t^p$					$R_t^p = \alpha_p + \beta_p^{HML} HML_t + \epsilon_t^p$				
Small	0.41	0.41	0.58	0.74	0.59	1.54**	1.46**	1.60**	1.63**	1.38*
	[0.65]	[0.63]	[0.89]	[1.13]	[0.85]	[2.08]	[1.98]	[2.17]	[2.24]	[1.86]
2	0.02	0.43	0.46	0.71	0.50	0.84	1.23*	1.23*	1.40*	1.15
	[0.03]	[0.68]	[0.72]	[1.02]	[0.75]	[1.19]	[1.80]	[1.77]	[1.92]	[1.65]
3	0.06	0.38	0.32	0.23	0.45	0.76	1.00	0.88	0.78	0.87
	[0.10]	[0.57]	[0.48]	[0.34]	[0.64]	[1.16]	[1.46]	[1.29]	[1.13]	[1.25]
4	−0.01	0.20	0.17	0.35	0.35	0.48	0.64	0.58	0.64	0.55
	[−0.02]	[0.31]	[0.24]	[0.50]	[0.50]	[0.74]	[0.97]	[0.84]	[0.94]	[0.81]
Big	0.31	0.12	0.37	0.67	0.59	0.31	0.01	0.25	0.33	0.09
	[0.47]	[0.19]	[0.53]	[1.00]	[0.89]	[0.48]	[0.02]	[0.38]	[0.52]	[0.15]
	$R_t^p = \alpha_p + \beta_p^M(R_{M,t} - R_{f,t}) + \beta_p^{SMB} SMB_t + \epsilon_t^p$					$R_t^p = \alpha_p + \beta_p^M(R_{M,t} - R_{f,t}) + \beta_p^{HML} HML_t + \epsilon_t^p$				
Small	−0.00	−0.02	0.15	0.31*	0.14	1.12***	1.04***	1.17***	1.21***	0.95**
	[−0.02]	[−0.14]	[0.91]	[1.68]	[0.65]	[2.84]	[2.79]	[3.20]	[3.27]	[2.57]
2	−0.41**	0.01	0.04	0.25	0.06	0.41	0.82***	0.82**	0.96***	0.73**
	[−1.99]	[0.08]	[0.21]	[1.34]	[0.31]	[1.39]	[2.84]	[2.58]	[3.04]	[2.36]
3	−0.34	−0.05	−0.12	−0.22	−0.01	0.36	0.58**	0.46*	0.35	0.44*
	[−1.58]	[−0.26]	[−0.65]	[−1.28]	[−0.07]	[1.35]	[2.12]	[1.79]	[1.35]	[1.66]
4	−0.42*	−0.22	−0.28	−0.11	−0.11	0.08	0.23	0.15	0.21	0.12
	[−1.68]	[−0.97]	[−1.51]	[−0.52]	[−0.61]	[0.32]	[0.96]	[0.64]	[0.92]	[0.57]
Big	−0.11	−0.31	−0.09	0.23	0.16	−0.10	−0.40**	−0.18	−0.07	−0.30
	[−0.42]	[−1.64]	[−0.50]	[1.25]	[0.73]	[−0.54]	[−2.16]	[−0.96]	[−0.44]	[−1.64]

The excess returns on 25 stock portfolios formed on size and book-to-market ratios are regressed in six different models. The estimated intercepts α_p and the associated t-values for each portfolio are reported. *, ** and *** correspond to statistical significance at 10%, 5% and 1%, respectively.

We also perform the Gibbons, Ross and Shanken F-tests to formally test whether the intercepts for the 25 stock portfolios are jointly zero in different models. Table 8 reports the F-statistics and the associated probability levels. The three stock-market factors, $R_M - R_f$, SMB, and HML, produce the smallest F-statistic 0.93 with a bootstrap probability of 0.40. Thus, we can not reject the hypothesis that the intercepts for the 25 portfolios are all zero in a three-factor model. However, it is worth noting that F-tests can not reject the joint-zero intercepts hypothesis for any of the models. The F-statistic for the CAPM model is the largest, 1.33 with a bootstrap probability of 0.85. Thus, even though 11 out of 25 portfolios have significant intercepts under the CAPM model, the F-test couldn't reject the hypothesis that the intercepts are jointly zero. This is largely due to the fact that large Chinese stocks don't earn significant excess returns in general. In fact, only eight portfolios in the bottom two size quintiles can produce significant excess returns. Given the lack of statistical power of F-tests in the Chinese stock market, we rely more on the magnitude of the F-statistics to judge the performance of different factors models. Within the three one-factor models, SMB generates the lowest F-test statistic 1.01. Within the three two-factor models, the combination of SMB and HML generates the lowest F-test statistic of 0.93. Thus, by all metrics, SMB is the most important factor in explaining cross-sectional returns in China's stock market.

Table 8: F-statistics and Matching Probability Levels of Bootstrap and F-distributions

Panel A: China's stock market, July 1997 to December 2013							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F−statistics	0.93	1.00	1.23	0.93	1.33	1.01	1.25
Probability level							
Bootstrap	0.403	0.501	0.751	0.382	0.823	0.475	0.750
F−distribution	0.435	0.532	0.783	0.434	0.850	0.547	0.800
Panel B: U.S. stock market, July 1997 to December 2013							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F−statistics	2.44	2.59	2.52	2.09	2.63	2.22	2.23
Probability level							
Bootstrap	0.996	0.998	0.995	0.986	0.998	0.992	0.989
F−distribution	1.000	1.000	1.000	0.997	1.000	0.998	0.999

Seven different factor models are tested: (1) $R_t^p = \alpha_p + \beta_p^M R_t^M + \beta_p^{SMB} SMB_t + \beta_p^{HML} HML_t + \epsilon_t^p$; (2) $R_t^p = \alpha_p + \beta_p^M R_t^M + \beta_p^{SMB} SMB_t + \epsilon_t^p$; (3) $R_t^p = \alpha_p + \beta_p^M R_t^M + \beta_p^{HML} HML_t + \epsilon_t^p$; (4) $R_t^p = \alpha_p + \beta_p^{SMB} SMB_t + \beta_p^{HML} HML_t + \epsilon_t^p$; (5) $R_t^p = \alpha_p + \beta_p^M R_t^M + \epsilon_t^p$; (6) $R_t^p = \alpha_p + \beta_p^{SMB} SMB_t + \epsilon_t^p$ and (7) $R_t^p = \alpha_p + \beta_p^{HML} HML_t + \epsilon_t^p$. Panel A reports the F-test results on the hypothesis that the intercepts, αs, are jointly zero across the 25 size-B/M sorted portfolios in the Chinese stock market, from July 1997 to December 2013. Panel B reports the F-test results for the U.S. market, from July 1997 to December 2013.

5.2 Fama-Macbeth Regressions

For asset pricing tests in this section, we follow the standard cross-sectional regression approach of Fama and MacBeth (1973). In the first-stage of the Fama-Macbeth regressions, we estimate individual stocks' exposures to the market, SMB and HML factors. To reduce noises in the estimation, we follow the literature and use a portfolio-based approach. At the end of June each year, we divided all non-financial stocks into three equal-sized portfolios by individual stocks' sizes and three equal-sized portfolios by their book-to-market ratios. We then form nine double-sorted portfolios by intersecting the three size-sorted portfolios with the three B/M-sorted portfolios. For each of the nine portfolios, we further divide each portfolio into three portfolios using the pre-ranking CAPM βs of individual stocks, estimated with the previous five years (with at least two years) of monthly returns. For each of the 27 portfolios, the post-ranking betas are estimated by:

$$R_t^p - R_{f,t} = \alpha_p + \beta_p^M (R_{M,t} - R_{f,t}) + \beta_p^{SMB} SMB_t + \beta_p^{HML} HML_t + \epsilon_t^p, \quad p = 1, 2, \ldots, 27. \tag{2}$$

where R_i^p is the equal-weighted return for portfolio p in month t and this regression is run over the entire sample period from July 1997 to December 2013. We then use each portfolio's full-sample post-ranking betas as the estimates for the individual stocks' betas on market, SMB and HML.

In the second stage of the Fama-Macbeth regressions, we run a cross-sectional regression at each month t:

$$R_t^i - R_{f,t} = \gamma_{0,t} + \gamma_t^M \beta_i^M + \gamma_t^{SMB} \beta_i^{SMB} + \gamma_t^{HML} \beta_i^{HML} + \epsilon_t^i, \tag{3}$$

where $R_t^i - R_{f,t}$ is the excess returns of stock i at month t, β_i^M, β_i^{SMB} and β_i^{HML} are our estimates of stock i's betas on market, SMB and HML, respectively. Figure 4 plots the estimated factor premiums, γ_t^M, γ_t^{SMB} and γ_t^{HML}, and the associated 95% confidence interval of each month.

In a standard Fama-Macbeth regression, the factor premiums are estimated as the time-series average of γ_t^M, γ_t^{SMB} and γ_t^{HML}. That is:

$$\begin{aligned} \gamma^{M,EW} &= \sum_{t=1}^{N} \frac{1}{N} \gamma_t^M, \\ \gamma^{SMB,EW} &= \sum_{t=1}^{N} \frac{1}{N} \gamma_t^{SMB}, \\ \gamma^{HML,EW} &= \sum_{t=1}^{N} \frac{1}{N} \gamma_t^{HML}, \end{aligned} \tag{4}$$

where N is the total number of months for the full sample period. In other words, the factor

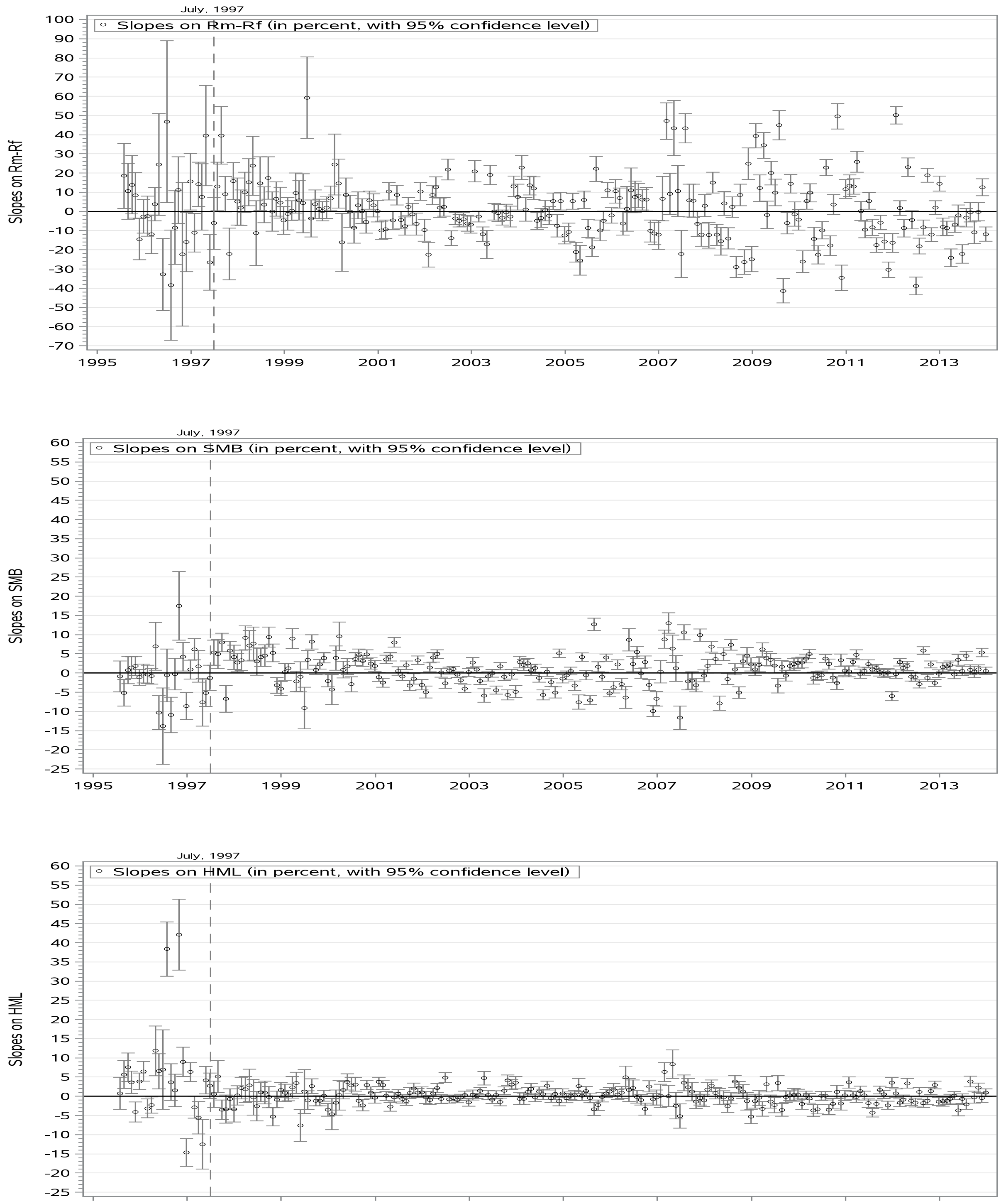


Figure 4: Month-by-Month slopes on $R_M - R_f$, SMB and HML in cross-sectional Fama-Macbeth regressions: July 1995 - December 2013

premiums are calculated as the equal-weighted averages of the estimated premiums of each month.

In our sample of Chinese stocks, the earlier period contains much fewer number of stocks. As a result, the estimated premiums for months in the earlier sample period have much larger standard errors than those in the later period. The larger standard errors for the estimated factor premiums in the earlier period are also shown in the time-series plot of Figure 4. To address the potential bias caused by the noisy premium estimates in the earlier period, we also estimate the factor premiums using the value-weighted averages of γ_t^M, γ_t^{SMB} and γ_t^{HML}:

$$\begin{aligned}
\gamma^{M,VW} &= \sum_{t=1}^{N} \frac{n_t}{n_1 + n_2 + \ldots + n_N} \gamma_t^M, \\
\gamma^{SMB,VW} &= \sum_{t=1}^{N} \frac{n_t}{n_1 + n_2 + \ldots + n_N} \gamma_t^{SMB}, \\
\gamma^{HML,VW} &= \sum_{t=1}^{N} \frac{n_t}{n_1 + n_2 + \ldots + n_N} \gamma_t^{HML},
\end{aligned} \tag{5}$$

where n_t is the number of stocks at month t. As the Chinese stock market shows tremendously growth in terms of number of stocks, the factor premiums gives less weights on the γ_t^M, γ_t^{SMB} and γ_t^{HML} in the earlier sample period which have less precision than those in the later sample period.

Table 9 reports the estimated factor premiums of market, SMB and HML. The Panel A of Table 9 reports the equal-weighted time-series averages of factor premiums using Equation (4) and the Panel B of Table 9 reports the value-weighted time-series averages of factor premiums using Equation (5). Consistent with our earlier findings, only SMB shows significant risk premiums in the Fama-Macbeth regression tests. The estimated premium of SMB is 0.98% per month using equal-weighted time-series averages and 0.84% per month using value-weighted time-series averages. Both are strongly statistically positive with t-values above 3. The magnitude of the estimated factor premium is close to the time-series average of the return of SMB during the sample period, which is 0.85% per month. In contrast, HML doesn't have significant risk premium. The estimated premium is 0.33% per month with t-value 1.56 using equal-weighted time-series averages, and 0.22% per month with t-value 0.99 using value-weighted time-series averages. Similarly, the market factor, $R_M - R_f$, also doesn't carry significant risk premium.

Table 9: Estimated Risk Premiums by Fama-Macbeth Cross-Sectional Regressions (July 1997 - December 2013)

	Panel A: Standard Fama-Macbeth resutls				Panel B: Weighted Fama-Macbeth results			
Models	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	1.17	0.13	0.33	2.08**	1.70	0.87	1.05	2.50**
	[1.31]	[0.15]	[0.39]	[2.28]	[1.57]	[0.78]	[0.95]	[2.18]
R_M-R_f	−0.66	1.01	0.16	−0.89	−1.13	0.24	−0.50	−1.35
	[−0.60]	[0.92]	[0.15]	[−0.83]	[−0.91]	[0.20]	[−0.39]	[−1.09]
SMB	0.98***		1.01***		0.84***		0.86***	
	[3.22]		[3.31]		[3.19]		[3.31]	
HML	0.33			0.71***	0.22			0.56***
	[1.56]			[3.16]	[0.99]			[2.59]
N	198	198	198	198	198	198	198	198
R^2	4.84	1.07	4.07	2.00	4.51	1.17	3.82	1.96

This table shows the estimated risk premiums using the Fama-Macbeth cross-sectional regressions. Individual stocks' betas are estimated as the full-sample betas of 27 triple-sorted portfolios by size, book-to-market ratio and CAPM beta. We then run cross-sectional month-by-month regressions of individual stocks' returns on their exposures to SMB, HML and $R_M - R_f$. In Panel A, the estimated factor premiums are the simple time-series averages of the monthly slopes. In Panel B, the estimated factor premiums are value-weighted time-series averages of the monthly slopes, where the weights are the number of stocks at each month. The sample period is from July 1997 to December 2013.

In Table 10, we test the robustness of the factor premiums by controlling various accounting variables. The results remain robust. SMB remains to be the only factor which has significant risk premium, while the market and HML factor don't. The magnitude of the estimated SMB premium is in a narrow range from 0.82% to 1.08% per month under different regression models and weighting schemes. Moreover, none of the accounting variables that we tested carries significant risk premiums.

5.3 Pooled Time-series Cross-section Regressions

In addition to the Fama-Macbeth regressions, we also tried pooled regressions by stacking the cross-section data across all time together. In the second-stage of Fama-Macbeth regressions, we run cross-sectional regressions using Equation (3) at each month t and then use the time-series averages of the slopes as the estimated factor premiums. In the pooled regressions, we instead use one OLS regression to estimate the Equation (3) across the sample of stock returns of all firms over the entire sample period from July 1997 to December 2013. Given that

Table 10: Fama-Macbeth Regressions with Accounting Variables Controls (July 1997 - December 2013)

Models	Intercept	$R_M - R_f$	SMB	HML	Floating	A/BE	A/ME	E/P dummy	E(+)/P	D/P	N	R^2
					Panel A: Standard Fama-Macbeth regressions							
1	1.17	−0.66	0.98***	0.33							198	4.84
	[1.31]	[−0.60]	[3.22]	[1.56]								
2	1.21	−0.91	1.06***	0.33	0.46						198	5.43
	[1.31]	[−0.83]	[3.11]	[1.55]	[0.96]							
3	1.16	−0.59	0.99***	0.20		0.14					198	5.20
	[1.29]	[−0.54]	[3.23]	[1.07]		[1.22]						
4	1.28	−0.46	1.02***			0.31**	−0.25				198	5.57
	[1.43]	[−0.44]	[3.46]			[2.22]	[−1.49]					
5	0.78	−0.39	1.08***	0.24				−0.08	0.04		198	6.69
	[0.82]	[−0.36]	[4.30]	[1.17]				[−0.42]	[0.86]			
6	0.94	−0.49	1.02***	0.29						0.06	198	5.20
	[1.05]	[−0.46]	[3.47]	[1.36]						[1.50]		
					Panel B: Weighted Fama-Macbeth regressions							
1	1.70	−1.13	0.84***	0.22							198	4.51
	[1.57]	[−0.91]	[3.19]	[0.99]								
2	1.70	−1.15	0.85***	0.24	−0.03						198	4.98
	[1.50]	[−0.93]	[3.08]	[1.05]	[−0.08]							
3	1.70	−1.10	0.82***	0.18		0.07					198	4.86
	[1.55]	[−0.87]	[3.20]	[0.88]		[0.55]						
4	1.76	−0.95	0.86***			0.21*	−0.23				198	5.15
	[1.63]	[−0.80]	[3.50]			[1.69]	[−1.37]					
5	1.20	−0.79	0.96***	0.14				−0.17	0.04		198	6.14
	[1.07]	[−0.63]	[4.39]	[0.69]				[−0.81]	[1.14]			
6	1.44	−0.95	0.88***	0.17						0.07*	198	4.84
	[1.34]	[−0.77]	[3.47]	[0.79]						[1.85]		

This table shows the estimated risk premiums using the Fama-Macbeth cross-sectional regressions. Individual stocks' betas are estimated as the full-sample betas of 27 triple-sorted portfolios by size, book-to-market ratio and CAPM beta. We then run cross-sectional month-by-month regressions of individual stocks' returns on their exposures to SMB, HML and $R_M - R_f$,and accounting variables as controlling variables. In Panel A, the estimated factor premiums are the simple time-series averages of the monthly slopes. In Panel B, the estimated factor premiums are value-weighted time-series averages of the monthly slopes, where the weights are the number of stocks at each month. The sample period is from July 1997 to December 2013.

the error terms are likely to be cross-sectional correlated at a given month, we clustered the standard-errors at the month level. The pooled regression and the Fama-Macbeth regressions are indeed two similar approaches. Cochrane (2005) has shown that under certain technical conditions, the two approaches will have identical numerical results. Nevertheless, given that the Chinese stock market had few stocks and was more volatile in the early period, we think it is helpful to report the pooled time-series cross-section regression results as a robustness check.

Table 11 reports the estimated premiums and the adjusted t-statistics for the pooled regressions. The results are similar to the ones using the Fama-Macbeth approach. SMB has a robust positive risk premium of 0.78% per month, while the other two factors, market and HML, don't have significant premiums and are thus not priced on average in the Chinese market. In addition, the size factor significantly improves the R^2 of the pooled regressions. The R^2 for the pooled regression with only the market factor is less than 0.01%. Adding HML together with the market factor improves the R^2 only marginally. In contrast, when the size factor SMB is included, the R^2 increases to 0.07%, confirming the strong explanatory power of SMB in explaining the cross-section returns.

Table 11: Estimated Risk Premiums by Pooled Regressions (July 1997 - December 2013)

Models	(1)	(2)	(3)	(4)
Intercept	1.77*	1.16	1.13	2.38**
	[1.79]	[1.05]	[1.03]	[2.35]
R_M-R_f	−1.16	−0.02	−0.56	−1.22
	[−0.98]	[−0.02]	[−0.47]	[−1.04]
SMB	0.78***		0.82***	
	[2.75]		[2.92]	
HML	0.20			0.41
	[0.80]			[1.60]
N	185316	185316	185316	185316
R^2	0.07	0.00	0.06	0.01

Individual stocks' exposures to SMB, HML and $R_M - R_f$ are first estimated as the full-sample betas of 27 triple-sorted portfolios by size, book-to-market ratio and CAPM beta. Next, the equation, $R_t^i - R_{f,t} = \gamma_{0,t} + \gamma_t^M \beta_i^M + \gamma_t^{SMB} \beta_i^{SMB} + \gamma_t^{HML} \beta_i^{HML} + \epsilon_t^i$, is estimated in one single OLS regression by pooling individual stock returns across all months together. T-statistics are estimated based on standard errors clustered by month. The sample period is from July 1997 to December 2013.

6 Robustness

6.1 Sample Period from July 1995 to December 2013

Our main results can be summarized as 1) strong size effect - smaller firms, on average, have higher returns than bigger firms; and 2) no value effect - value and growth firms don't have significant different returns. Our findings contradict some of the existing literature on the Chinese stock market, including Chen, Kim, Yao, and Yu (2010), Nusret Cakici and Topyan (2011) and Carpenter, Lu, and Whitelaw (2014), where they find strong size and value effect.

The disagreement stems mainly from different choices of sample periods. We use the returns of Chinese firms listed on the Shanghai and Shenzhen exchanges from July 1997 to December 2013 for the asset pricing tests; Chen, Kim, Yao, and Yu (2010) use data from July 1995 to June 2007; Nusret Cakici and Topyan (2011) use data from January 1994 to March 2011; Carpenter, Lu, and Whitelaw (2014) use data from July 1995 to December 2012. In fact, the major difference lies in whether the period predates July 1997. We test the robustness of our results by expanding our sample period to cover 222 months from July 1995 to December 2013, which is longer than all samples used in the existing literature of which we are aware.

The Panel A and Panel B of Table 12 report the Fama-Macbeth regression results based on the sample from July 1995 to December 2013. Panel A reports the equal-weighted average premiums and Panel B reports the value-weighted average premiums. In both panels, SMB remains to be the only factor that carries a significant factor premium with t-value above 2.60. The estimated premium for HML remains to be not statistically significant at the 5% confidence level. However, the t-values are close to marginal significant. The t-value of HML factor premium is 1.69 for the equal-weighting scheme in Panel A and 1.22 for the value-weighting scheme in Panel B.

In the pooled regression tests, Table 13 shows that the HML premium is estimated to be 0.32% with t-value 1.76 which is marginally significant.

Figure 4 plots the estimated slopes of the Fama-Macbeth regressions, γ^{SMB} and γ^{HML}, month-by-month from July 1995 to December 2013. It is clear that the estimated slopes are much noisier from 1995 to 1997, when compared with later periods. After July 1997, all of the estimated slopes on HML are within the range from -10% to $+10\%$. In contrast, the estimated slopes during the 24 months from July 1995 to June 1997 appear to be much noisier. There are five months when the slopes are outside of the $[-10\%, 10\%]$ band during the 24 months from July 1995 to June 1997. On two months, July 1996 and October 1996, the estimated slopes are even above 35%. Given that there are only 222 months from July 1995 to December 2013, the extreme values of the estimated slopes in the first two years might have a heavy impact on the factor premiums.

To address this concern, we test the robustness of the estimated premiums by excluding the two months, July 1996 and October 1996, from our extended sample from July 1995

Table 12: Estimated Risk Premiums by Fama-Macbeth Cross-Sectional Regressions (July 1995 - December 2013)

	Monthly observations from July 1995 to December 2013							
	Panel A: Standard Fama-Macbeth regressions				Panel B: Weighted Fama-Macbeth regressions			
Models	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	−0.41	−3.07**	−2.01	−0.51	0.46	−1.04	0.12	0.33
	[−0.43]	[−2.15]	[−1.37]	[−0.53]	[0.46]	[−1.09]	[0.12]	[0.33]
R_M-R_f	1.32	4.34***	2.90*	1.84	0.17	2.14**	0.51	0.81
	[1.22]	[2.83]	[1.78]	[1.62]	[0.13]	[2.16]	[0.46]	[0.64]
SMB	0.83***		0.86***		0.87***		0.86***	
	[2.68]		[2.96]		[3.35]		[3.57]	
HML	0.65*			0.87**	0.22			0.45***
	[1.69]			[2.30]	[1.22]			[2.63]
N	222	222	222	222	222	222	222	222
R^2	5.35	1.41	4.21	2.45	4.20	1.02	3.45	1.67

	Monthly observations from July 1995 to December 2013 Excluding July 1996 and Octor 1996							
	Panel C: Standard Fama-Macbeth regressions				Panel D: Weighted Fama-Macbeth regressions			
Models	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	−0.87	−1.93*	−0.88	−0.98	0.34	−0.73	0.42	0.21
	[−0.98]	[−1.94]	[−0.85]	[−1.08]	[0.34]	[−0.80]	[0.42]	[0.21]
R_M-R_f	1.61	3.05***	1.65	2.12*	0.24	1.80*	0.18	0.88
	[1.44]	[3.01]	[1.47]	[1.83]	[0.19]	[1.88]	[0.17]	[0.69]
SMB	0.76**		0.73**		0.85***		0.83***	
	[2.37]		[2.47]		[3.25]		[3.38]	
HML	0.29			0.51***	0.12			0.35**
	[1.39]			[2.58]	[0.79]			[2.34]
N	220	220	220	220	220	220	220	220
R^2	5.12	1.31	4.11	2.20	4.13	0.99	3.43	1.61

This table shows the estimated risk premiums using the Fama-Macbeth cross-sectional regressions. Individual stocks' exposures to SMB, HML and $R_M - R_f$ are estimated as the full-sample betas of 27 triple-sorted portfolios by size, book-to-market ratio and CAPM beta. We then run cross-sectional month-by-month regressions of individual stocks' returns on their betas. In Panel A and Panel C, the estimated factor premiums are the simple time-series averages of the monthly slopes. In Panel B and Panel D, the estimated factor premiums are value-weighted time-series averages of the monthly slopes, where the weights are the number of stocks at each month. The sample period for Panel A and Panel B is 222 months from July 1995 to December 2013, and the sample period for Panel B and Panel D is 220 months from July 1995 to December 2013 but excluding July 1996 and October 1996.

to December 2013. Panel C and Panel D of Table 12 shows that the t-values of the factor premiums associated with HML drop significantly after the two months are excluded from the sample. The t-value of the estimated premium of HML drops to 1.39 when using equal-weighted averages and 0.79 when using value-weighted averages. Similarly, in the pooled

Table 13: Estimated Risk Premiums by Pooled Regressions (July 1995 - December 2013)

	Panel A: July 1995 - December 2013				Panel B: July 1995 - December 2013 Excluding July 1996 and October 1996			
Models	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	−0.66	−1.48	−0.73	−0.67	−0.86	−1.24	−0.49	−0.87
	[−0.52]	[−1.49]	[−0.70]	[−0.53]	[−0.68]	[−1.26]	[−0.48]	[−0.69]
R_M-R_f	1.29	2.57**	1.35	1.78	1.43	2.29**	1.08	1.93
	[0.82]	[2.28]	[1.16]	[1.12]	[0.91]	[2.06]	[0.94]	[1.21]
SMB	0.87***		0.87***		0.86***		0.85***	
	[3.14]		[3.35]		[3.12]		[3.26]	
HML	0.32*			0.45**	0.23			0.35**
	[1.76]			[2.51]	[1.33]			[2.13]
N	189009	189009	189009	189009	188557	188557	188557	188557
R^2	0.07	0.02	0.07	0.02	0.07	0.02	0.07	0.02

Individual stocks' betas are first estimated as the full-sample betas of 27 triple-sorted portfolios by size, book-to-market ratio and CAPM beta. Next, the equation, $R_t^i - R_{f,t} = \gamma_{0,t} + \gamma_t^M \beta_i^M + \gamma_t^{SMB} \beta_i^{SMB} + \gamma_t^{HML} \beta_i^{HML} + \epsilon_t^i$, is estimated in one single OLS regression by pooling individual stock returns across all months together. T-statistics are estimated based on standard errors clustered by month. The sample period for Panel A is from July 1995 to December 2013, and the sample period for Panel B is from July 1995 to December 2013 but excluding July 1996 and October 1996.

regression tests, the premium of HML decreases to 0.23 with t-value 1.33, and is no longer statistically significant. By comparison, the estimated premiums of SMB remain robust and statistically significant even after the two months are removed from the sample. In other words, the previous documented significant value premium is likely caused by a few extreme values in the early period of the Chinese stock market.

6.2 Alternative Splits to Construct SMB and HML

For the construction of SMB and HML, we follow Fama and French (1993) to sort firms into three groups on B/M and only two groups on size. The split itself is arbitrary. In fact, the main motivation of Fama and French (1993) is the observation that B/M has a stronger role in average stock returns in the U.S. market. On the other hand, our previous discussion shows that, in the Chinese market, size can help explain average returns while B/M can not. Thus, we tried two alternative splits for the construction of SMB and HML factor. The first split is to independently sort firms into two groups on size (Small and Big) and two groups on B/M (Low and High) at the end of June of each year. The intersections generate four portfolios: Small-Low, Small-High, Big-Low and Big-High. The monthly returns of the four portfolios are the value-weighted average of individual stock returns, in which the weights are floating A-share market capitalizations at the portfolio formation time. SMB is the difference between the simple average of the returns on the two small-stock portfolios (Small-Low and Small-High) and the two big-stock portfolio (Big-Low and Big-High).

The second split is similar, except that we sort firms into three groups on size (Small, Medium and Big) and two groups on B/M (Low and High). The three size portfolios represent the bottom 30%, middle 40% and top 30% of stocks ranked on the basis of size. The intersections generate six portfolios: Small-Low, Small-High, Medium-Low, Medium-High, Big-Low and Big-High. SMB is the difference between the simple average of the returns on the two small-stock portfolios (Small-Low and Small-High) and the two big-stock portfolio (Big-Low and Big-High).

Table 14 summarizes the Fama-Macbeth results for the above 2-by-2 and 3-by-2 splits. The results confirm the robust positive premium of the size factor. The average premiums for SMB are of similar magnitude as our main results, and remain positively significant. The average premiums for HML are still positive, but non-significant. Our main conclusions are thus robust to different splits in the construction of size and value factors.

6.3 Alternative Definition of Size

Due to the "split-share structure", Chinese-listed firms often have both floating shares and non-floating shares. In the main part of this paper, we define a firm's size as the floating A-share market capitalization because regular investors can only publicly trade floating A shares. However, some papers do use the total market capitalization to define size. To compare our results with them on an equal footing, we test the robustness of our main results for different measures of size.

Definition of size affects the construction of $R_M - R_f$, SMB and HML factors in two dimensions. First, it determines individual stocks' ranking when we form two size portfolios: Small and Big. Second, the relative weights for individual stocks within a portfolio, e.g. market, Small-Low, Small-Medium, Small-High, Big-Low, Big-Medium and Big-High, are determined by their size. Hence, we have in total six combinations: rank by floating capitalization and

Table 14: Alternative Splits to Construct SMB and HML

Panel A: Two size-sorted portfolios and two B/M sorted portfolios								
	$R_M - R_f$		SMB		HML		N	R^2
1	−0.50	[−0.39]	0.87***	[3.31]			198	3.82
2	−1.49	[−1.20]			0.44***	[2.72]	198	1.97
3	−1.18	[−0.95]	0.84***	[3.16]	0.18	[1.06]	198	4.51
Panel B: Three size-sorted portfolios and two B/M sorted portfolios								
	$R_M - R_f$		SMB		HML		N	R^2
1	−0.46	[−0.36]	1.13***	[3.33]			198	3.83
2	−1.44	[−1.16]			0.40***	[2.65]	198	1.97
3	−1.14	[−0.91]	1.10***	[3.20]	0.16	[1.03]	198	4.52

Value-weighted Fama-Macbeth regression results are reported for different splits to construct SMB and HML factors. The weights are the number of observations at each month, and the sample period is from July 1997 to December 2013. In panel A, stocks are sorted on the basis of size into two groups (Small and Big) and two groups on B/M ratios (Low and High) at the end of June of each year from 1997 to 2013. The intersections generate four portfolios: Small-Low, Small-High, Big-Low and Big-High. SMB is the difference between the simple average of the returns on the two small-stock portfolios (Small-Low and Small-High) and the two big-stock portfolios (Big-Low and Big-High). In panel B, stocks are sorted into three groups on size (Small, Medium and Big) and two groups on B/M (Low and High). The three size groups represent the bottom 30%, middle 40% and top 30% of stocks ranked on the basis of size. The intersections generate six portfolios: Small-Low, Small-High, Medium-Low, Medium-High, Big-Low and Big-High. SMB is the difference between the simple average of the returns on the two small-stock portfolios (Small-Low and Small-High) and the two big-stock portfolio (Big-Low and Big-High).

weight by floating capitalization, rank by floating and weight by total, rank by floating and weight equally, rank by total and weight by floating, rank by total and weight by total and rank by total and weight equally.

The Fama-Macbeth results for the above six cases are summarized in Table 15. Different ranking and weighting schemes produce similar $R_M - R_f$, SMB and HML factors. The time-series average and t-values for the returns on the three factors show very small differences. Not surprisingly, the estimated risk premiums in the Fama-Macbeth regressions are also close. SMB has a robust positive premium and $R_M - R_f$ and HML don't.

7 Conclusions

We find stock returns are strongly related to firms' size in the Chinese market. On average, small stocks outperform large stocks. The average returns on stocks in the smallest size

Table 15: Alternative Definition of Size

	Sorted by floating cap			Sorted by total cap		
Weighted by	Floating	Total	Equal	Floating	Total	Equal
Panel A: Summary statistics of Fama-French 3 factors						
R_M-R_f	0.60	0.47	1.12	0.60	0.47	1.12
	[0.97]	[0.80]	[1.66]	[0.97]	[0.80]	[1.66]
SMB	0.85***	0.85***	0.76***	0.85***	0.86***	0.81***
	[3.09]	[3.08]	[3.63]	[3.08]	[3.09]	[3.94]
HML	0.34	0.36	0.33*	0.29	0.30	0.28
	[1.61]	[1.68]	[1.75]	[1.40]	[1.43]	[1.47]
Panel B: Fama-Macbeth regression results on the loadings of 3 factors						
Intercept	1.70	1.72	1.74	1.70	1.92*	2.10*
	[1.57]	[1.59]	[1.57]	[1.54]	[1.70]	[1.82]
R_M-R_f	−1.13	−1.15	−1.17	−1.31	−0.84	−1.00
	[−0.91]	[−0.93]	[−0.92]	[−1.03]	[−0.62]	[−0.74]
SMB	0.84***	0.85***	0.68***	0.87***	0.84***	0.67***
	[3.19]	[3.17]	[3.47]	[3.25]	[3.10]	[3.52]
HML	0.22	0.23	0.15	0.14	0.16	0.10
	[0.99]	[1.01]	[0.78]	[0.65]	[0.71]	[0.51]
N	198	198	198	198	198	198
R^2	4.51	4.51	4.52	4.50	4.51	4.52

Definition of size affects the construction of $R_M - R_f$, SMB and HML factors in two dimensions: individual stocks' rank in size and their relative weights in a portfolio. Six different methods are examined: rank by floating capitalization and weight by floating capitalization, rank by floating and weight by total, rank by floating and weight equally, rank by total and weight by floating, rank by total and weight by total and rank by total and weight equally. Panel A reports the time-series summary statistics of $R_M - R_f$, SMB and HML for each method. Panel B reports the risk premiums estimated by value-weighted Fama-Macbeth regressions. The weights are the number of observations at each month, and the sample period is from July 1997 to December 2013.

decile is 1.63% higher than those in the largest size decile. Following the classic Fama-French methodology, we construct a zero-cost portfolio, small-minus-big (SMB), to mimic the strong size effect in the cross-section returns. SMB earns an average monthly returns of 0.85%, not only economically large but also statistically significant. In contrast, stocks' average returns don't exhibit clear relation with their book-to-market ratios. The factor mimicking portfolio for the book-to-market ratios, high-minus-low (HML), generates an average monthly returns of 0.34%, positive but not statistically significant. The market factor, $R_M - R_f$, also doesn't have significant premium. Moreover, SMB consistently beats the market and HML factors in both time-series regressions and Fama-Macbeth cross-sectional tests. Among the three factors, SMB is the most important one in terms of capturing cross-sectional variations in Chinese stock returns.

Our results contradict some previous literature which documented strong size and value effect. The differences stem mainly from choices of sample periods. Our results are based on a relative stable period from July 1997 to December 2013, while other papers usually include earlier years from 1995 to 1996. In the robustness check, we find that the previous documented value effect is not robust and is largely caused by a few extreme months before 1997.

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