Apply Five-factor Asset Pricing Model in Chinese Market

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Abstract: In 2014, Fama and French changed their three-factor model (FF, 1993) to five- factor model and claimed that it performs better after testing NYSE, AMEX, and NASDAQ stocks. However, whether five-factor model is also effective in Chinese is not certain, because Chinese stock market is quite different from the US market. For example, in Chinese stock market, shares are divided into two categories, tradable shares and non-tradable shares. Moreover, non-tradable shares are dominant with nearly 75% in a Chinese public firm. This paper aims to test whether five-factor is efficient in Chinese market using data from CSMAR.

1. Introduction

Since William Sharpe put forward the Capital Asset Pricing Model (CAPM), it has been widely used to simplify the process of analyzing portfolios [1]. However, one necessary assumption of CAPM is that the market is complete, which means there are sufficient buyers and sellers, and no one could affect asset prices largely and independently. Fama and French (FF,1992) expanded CAPM by adding extra two factors, size and value to the market risk factor [2]. Three-factor model takes the fact that value and small-cap stocks usually outperform markets. The model was adjusted for this outperforming tendency, which make it a better tool for evaluating investment performance. Many scholars also tried to improve three-factor model and built a more mature one which can be applied in Chinese market [3].

2. Data Analysis

2.1 The Playing Field

Our empirical tests examine whether the five-factor model and models that include subsets of its factors explain average returns on portfolios formed to produce large spreads in Size, B/M, profitability, and investment. The first step is to examine the Size, B/M, profitability, and investment patterns in average returns we seek to explain.

Average monthly percent excess returns for portfolios formed on Size and B/M, Size and OP, Size and Inv; January 2008–December 2017, 120 months.

At the end of each June, stocks are allocated to five Size groups (Small to Big) using SSE market cap break- points. Stocks are allocated independently to five B/M groups (Low to High), again using SSE breakpoints. The intersections of the two sorts produce 25 value-weight Size-B/M portfolios. In the sort for June of year t, B is book equity at the end of the fiscal year ending in year t-1 and M is market cap at the end of December of year t-1, adjusted for changes in shares outstanding between the measurement of B and the end of December. The Size-OP and Size-Inv portfolios are formed in the same way, except that the second sort variable is operating profitability or investment. Operating profitability, OP, in the sort for June of year t is measured with accounting data for the fiscal year ending in year t-1 and is revenues minus cost of goods sold, minus selling, general, and administrative expenses, minus interest expense all divided by book equity. Investment, Inv, is the change in total

assets from the fiscal year ending in year t-2 to the fiscal year ending in t-1, divided by t-2 total assets. The figure shows averages of monthly returns in excess of the one- month Treasury bill rate.

	Low	2	3	4	High
Panel A: Size-B/M portfolios					
Small	0.23	0.79	0.82	0.99	1.12
2	0.44	0.69	0.90	0.91	0.99
3	0.48	0.75	0.77	0.85	1.05
4	0.58	0.55	0.68	0.81	0.84
Big	0.42	0.47	0.45	0.52	0.59
Panel B: Size-OP portfolios					
Small	0.58	0.88	0.90	0.94	0.88
2	0.58	0.78	0.84	0.89	0.98
3	0.53	0.77	0.79	0.85	0.94
4	0.58	0.65	0.68	0.72	0.85
Big	0.38	0.33	0.44	0.49	0.52
Panel C: Size-Inv portfolios					
Small	1.24	1.25	1.35	0.98	0.23
2	1.00	1.08	1.12	1.17	0.96
3	0.72	0.97	0.67	0.50	0.28
4	0.36	0.59	0.60	0.49	0.34
Big	0.34	0.30	0.35	0.19	0.26

Figure 1. 5x5 sorts

Panel A of Figure1 shows average monthly excess returns for 25 value-weight (VW) portfolios from independent sorts of stocks into five Size groups and five B/M groups, called them 5x5 Size-B/M sorts. In each B/M column of Panel A of Figure 1, we can see that the average return usually falls from small stocks to large stocks, which we call size effect. For example, for the microcap portfolios in the first row, average excess return rises from 0.23% per month for the lowest B/M portfolio (extreme growth stocks) to 1.12% per month for the highest B/M portfolio (extreme value stocks). In contrast, for the biggest stocks (megacaps) average excess return rises only from 0.42% per month to 0.59%. Small cap stocks have better growth elasticity, and people generally have higher expectations for growth-oriented small-cap companies, People's speculation in small size and high growth stock has boosted the prices. Panel B of Figure1 shows average excess returns for 25 VW portfolios from independent sorts of stocks into Size and profitability quintiles. The patterns in the average returns of the 25 Size-OP portfolios in Figure1 are like those observed for the Size-B/M portfolios. Holding operating profitability roughly constant, average return typically falls as Size increases. The decline in average return with increasing Size is monotonic in the three middle quintiles of OP, but for the extreme low and high OP quintiles, the action with respect to Size is almost entirely due to lower average returns for megacaps.

Panel C of Figure1 shows average excess returns for 25 Size-Inv portfolios. In every Size quintile, the average return on the portfolio in the lowest investment quintile is much higher than the return on the portfolio in the highest Inv quintile. There is a size effect in the lowest four quintiles of Inv; that is, portfolios of small stocks have higher average returns than big stocks. In the highest Inv quintile, the size effect is not remarkable, and the microcap portfolio in the highest Inv group has the lowest average excess return in the matrix, 0.23% per month.

The five-factor regressions will show that the stocks in this portfolio are like the microcaps in the lowest B/M quintile of Panel A of Table 1; their stock returns behave like those of firms that invest a lot despite low profitability. The low average returns of these portfolios are lethal for the five-factor model. According to the division of a single dimension based on Figure1, we get the combined effect of single factor and company size, in order to get more details, we use different portfolio structure(2x4x4) to explore the influence of the combination of three factors.

Figure 2 shows average excess returns for the 32 Size- B/M-OP portfolios, the 32 Size-B/M-Inv portfolios, and the 32 Size-OP-Inv portfolios. For small stocks, there are strong value, profitability, and investment effects in average returns. Controlling for OP or Inv, average returns of small stock

portfolios increase with B/M; controlling for B/M or Inv, average returns also increase with OP; and controlling for B/M or OP, higher Inv is associated with lower average returns. For big stocks, the pattern is roughly the same but relatively weak.

In the tests of the five-factor model presented later, two portfolios in Figure 2 display the lethal combination of RMW and CMA slopes noted in the discussion of the Size-B/M and Size-Inv portfolios of Figure 1. In the BM-OP sorts, the portfolio of small stocks in the lowest B/M and OP quartiles has an extremely low average excess return, 0.04% per month. In the Size-OP-Inv sorts, the portfolio of small stocks in the lowest OP and highest Inv quartiles also has an low average excess return 0.03% per month. In this case, the five-factor slopes simply confirm that the small stocks in this portfolio invest a lot despite low profitability.

Averages of monthly percent excess returns for value-weight (VW) portfolios formed on (i) Size, B/M, and OP, (ii)

Size, B/M, and Inv, (iii) Size, OP, and Inv; January 2008–December 2017, 120 months. At the end of June each year t, stocks are allocated to two Size groups (Small and Big) using the SSE median market cap as breakpoint. Stocks in each Size group are allocated independently to four B/M groups (Low B/M to High B/M for fiscal year t-1), four OP groups (Low OP to High OP for fiscal year t-1), and four Inv groups (Low Inv to High Inv for fiscal year t-1) using SSE breakpoints specific to the Size group. The figure shows averages of monthly returns in excess of the one-month Treasury bill rate on the 32 portfolios formed from each of the three sorts.

	Small				Big			
Panel A: Portfolios formed on Size, B/M, and OP								
B/M	Low	2	3	High	Low	2	3	High
Low *OP*	0.04	0.73	0.85	0.94	0.25	0.27	0.38	0.59
2	0.63	0.76	0.89	1.08	0.40	0.51	0.53	0.68
3	0.67	0.88	1.07	1.29	0.41	0.58	0.67	0.90
High *OP*	0.79	0.99	1.16	1.55	0.54	0.65	0.80	0.72
Panel B: Portfolios formed on Size, B/M and Inv								
B/M	Low	2	3	High	Low	2	3	High
Low *Inv*	0.52	0.65	0.74	0.88	0.19	0.22	0.33	0.45
2	0.55	0.73	0.81	0.95	0.28	0.33	0.55	0.64
3	0.58	0.81	0.95	0.94	0.40	0.45	0.73	0.80
High *Inv*	0.60	0.88	1.03	1.21	0.53	0.64	0.88	0.99
Panel C: Portfolios formed on Size, OP, and Inv								
OP	Low	2	3	High	Low	2	3	High
Low *Inv*	0.57	0.71	0.80	0.93	0.20	0.24	0.42	0.55
2	0.60	0.78	0.87	1.02	0.29	0.37	0.59	0.73
3	0.66	0.86	1.01	1.11	0.44	0.52	0.82	0.89
High *Inv*	0.03	0.93	1.11	1.02	0.58	0.73	0.97	0.87

Figure 2. 2x4x4 sorts

The portfolios in Figures1 and 2 do not cleanly disentangle the value, profitability, and investment effects in average returns predicted by the valuation, but we shall see that they expose variation in average returns sufficient to provide strong challenges in asset pricing tests.

After initially explaining five factors, we need to find the parameters of each factor corresponding to the real market.

2.2 Factor Definitions

To examine whether the specifics of factor construction are important in tests of asset pricing models, we use three sets of factors to capture the patterns in average returns in Figures 1 and 2. The three approaches are described formally and in detail in Figure3. Here we provide a brief summary.

We use independent sorts to assign stocks to two Size groups, and two or three B/M, operating profitability(OP), and investment(Inv) groups. The VW portfolios defined by the intersections of the groups are the building blocks for the factors. We label these portfolios with two or four letters. The first always describes the Size group, small(S) or big(B). In the 2x3 sorts and 2x2 sorts, the second describes the B/M group, high(H), neutral(N), or low(L), the OP group, robust(R), neutral(N), or weak(W), or the Inv group, conservative(C), neutral(N), or aggressive(A). In the 2x2x2x2 sorts, the

second character is B/M group, the third is OP group, and the fourth is Inv group. The factors are SMB(small minus big), HML(high minus low B/M), RMW(robust minus weak OP), and CMA(conservative minus aggressive Inv).

Sort	Breakpoints	Factors and their components
2x3 sorts on *Size* and *B/M*, or *Size* and *OP*, or *Size* and *Inv*	*Size*: SSE median	$SMB_{B/M}=(SH+SN+SL)/3-(BH+BN+BL)/3$ $SMB_{OP}=(SR+SN+SW)/3-(BR+BN+BW)/3$ $SMB_{Inv}=(SC+SN+SA)/3-(BC+BN+BA)/3$ $SMB=(SMB_{B/M}+SMB_{OP}+SMB_{Inv})/3$
	B/M: 30th and 70th SSE percentiles	$HML=(SH+BH)/2-(SL+BL)/2=[(SH-SL)+(BH-BL)]/2$
	OP: 30th and 70th SSE percentiles	$RMW=(SR+BR)/2-(SW+BW)/2=[(SR-SW)+(BR-BW)]/2$
	Inv: 30th and 70th SSE percentiles	$CMA=(SC+BC)/2-(SA+BA)/2=[(SC-SA)+(BC-BA)]/2$
2x2 sorts on *Size* and *B/M*, or *Size* and *OP*, or *Size* and *Inv*	*Size*: SSE median	$SMB=(SH+SL+SR+SW+SC+SA)/6-(BH+BL+BR+BW+BC+BA)/6$
	B/M: SSE median	$HML=(SH+BH)/2-(SL+BL)/2=[(SH-SL)+(BH-BL)]/2$
	OP: SSE median	$RMW=(SR+BR)/2-(SW+BW)/2=[(SR-SW)+(BR-BW)]/2$
	Inv: SSE median	$CMA=(SC+BC)/2-(SA+BA)/2=[(SC-SA)+(BC-BA)]/2$
2x2x2x2 sorts on *Size*, *B/M*, *OP*, and *Inv*	*Size*: SSE median	$SMB=(SHRC+SHRA+SHWC+SHWA+SLRC+SLRA+SLWC+SLWA)/8$ $-(BHRC+BHRA+BHWC+BHWA+BLRC+BLRA+BLWC+BLWA)/8$
	B/M: SSE median	$HML=(SHRC+SHRA+SHWC+SHWA+BHRC+BHRA+BHWC+BHWA)/8$ $-(SLRC+SLRA+SLWC+SLWA+BLRC+BLRA+BLWC+BLWA)/8$
	OP: SSE median	$RMW=(SHRC+SHRA+SLRC+SLRA+BHRC+BHRA+BLRC+BLRA)/8$ $-(SHWC+SHWA+SLWC+SLWA+BHWC+BHWA+BLWC+BLWA)/8$
	Inv: SSE median	$CMA=(SHRC+SHWC+SLRC+SLWC+BHRC+BHWC+BLRC+BLWC)/8$ $-(SHRA+SHWA+SLRA+SLWA+BHRA+BHWA+BLRA+BLWA)/8$

Figure 3. 2x3 sorts

Firstly, break the size at median point and describe the size group, big(B), small(S). Secondly, divide the B/M group into high(H), neutral(N), or low(L), the OP group into robust(R), neutral(N), or weak(W), and the Inv group into conservative(C), neutral(N), or aggressive(A). The breakpoints of B/M, OP and Inv are the 30th and 70th percentiles for stocks. The size factor SMB is defined as the average of $SMB_{B/M}$, SMB_{OP}, and SMB_{Inv}. It is the same to define that SMB is the aver-age of the returns on the nine small stock portfolios of the three 2x3 sorts minus the average of the returns on the nine big stock portfolios.

The profitability factor RMW is the average of the two robust OP portfolio returns minus the average of the two weak OP portfolio returns. Equivalently, it is the average of small and big value factors constructed with portfolios of only small stocks and portfolios of only big stocks.

The value and investment factors, HML and CMA, are formed in the same way as RMW except the second sort is either on operating value (high minus low) or investment (conservative minus aggressive). Like RMW, HML and CMA can be interpreted as averages of value and investment factors for small and big stocks.

2.3 Regression Details

To evaluate model performance, we next examine regression details, specifically, intercepts and pertinent slopes. We not only find the exposures of portfolios to the Size, B/M, OP, and Inv factors, but also we want other factors to have slopes that reflect the fact that, at least in this sample, the four-factor model that drops HML captures average returns as well as the five-factor model.

2.3.1 25 Size-B/M portfolios

Regression for 25 value-weight Size-B/M portfolios: January 2008-December 2017, 120 months. At the end of June each year, stocks are allocated to five Size groups (Small to Big) using SSE market cap breakpoints. Stocks are allocated independently to five B/M groups (Low B/M to High B/M), again using SSE breakpoints. The intersections of the two sorts produce 25 Size-B/M portfolios. The LHS variables in each set of 25 regressions are the monthly excess returns on the 25 Size-B/M portfolios. The RHS variables are the excess market return, $R_M - R_F$, the Size factor, SMB, the value factor, HML, the profitability factor, RMW, and the investment factor, CMA, constructed using independent 2x3 sorts on Size and each of B/M, OP, and Inv.

The five-factor slopes provide information about stocks in the troublesome microcap portfolio in the lowest B/M quintile. The portfolio's HML slope (-0.04, t=-0.54), and its CMA slope (0.12, t=0.80)

are not similar to those of other extreme growth portfolios. The RMW and CMA slopes say the portfolio is dominated by microcaps whose returns behave like those of unprofitable firms that grow rapidly. There is a similar but the unexplained average similar negative intercept in the results to come whenever the LHS assets include a portfolio of large stocks with strong negative RMW and CMA slopes.

However, no reason to expect that univariate characteristics line up with multivariate regression slopes, which estimate marginal effects holding constant other explanatory variables. Moreover, the characteristics are measured with lags relative to returns. Since pricing should be forward looking, an interesting question for future research is whether RMW, CMA, and HML slopes line up better with future values of the corresponding characteristics than with past values.

2.3.2 25 Size-OP portfolios

Regression for 25 value-weight Size-OP portfolios; January 2008-December 2017, 120 months. At the end of each June, stocks are allocated to five Size groups (Small to Big) using SSE market cap breakpoints. Stocks are allocated independently to five OP (profitability) groups (Low OP to High OP), again using SSE breakpoints. The intersections of the two sorts produce 25 Size-OP portfolios. The LHS variables in each set of 25 regressions are the monthly excess returns on the 25 Size-OP portfolios. The RHS variables are the excess market return, R_M-R_F, the size factor, SMB, the value factor, HML, the profitability factor, RMW, and the investment factor, CMA, constructed using independent 2x3 sorts on Size and each of B/M, OP, and Inv.

The tests on the 25 Size-OP portfolios tell us that for small and big stocks, low profitability is not a five-factor asset pricing problem. For example, the five-factor intercept for the microcap portfolio in the lowest profitability quintile is 0.33% per month (t=2.88). This portfolio has strong negative exposure to RMW (-0.39, t=-4.49) but modest exposure to CMA (-0.04, t=-0.44). This is in contrast to the Size-B/M sorts, in which the big problem is microcaps with extreme negative exposures to RMW and CMA. In short, portfolios formed on Size and OP are less of a challenge for the five-factor model than portfolios formed on Size and B/M in large part because the Size-OP portfolios do not isolate small stocks whose returns behave like those of firms that invest a lot despite low profitability.

For US stock market, the Size-OP portfolios are a problem for the FF three- factor model. However, it can be applied in China.

2.3.3 25 Size-Inv portfolios

Regressions for 25 value-weight Size-Inv portfolios; January 2008–December 2017, 120 months. At the end of June each year, stocks are allocated to five Size groups (Small to Big) using SSE market cap breakpoints. Stocks are allocated independently to five Inv (investment) groups (Low Inv to High Inv), again using SSE breakpoints. The intersections of the two sorts produce 25 Size-Inv portfolios. The LHS variables are the monthly excess returns on the 25 Size-Inv portfolios. The RHS variables are the excess market return, R_M-R_F, the Size factor, SMB, the value factor, HML or its orthogonal version, HMLO, the profitability factor, RMW, and the investment factor, CMA, constructed using independent 2x3 sorts on Size and each of B/M, OP, and Inv.

The slopes of SMB have a decreasing trend as size of portfolios become larger and larger. Especially for big size and conservative portfolio, the slope of SMB becomes relatively small (-0.34%, t=-3.09). For slope of CMA, as the portfolios' investment strategy become more and more aggressive, the values of slope become smaller and smaller or even negative which indicate the CMA factor has negative effect on explaining the aggressive portfolios.

In three factors model, the intercept for the portfolio of stocks in the smallest size and highest Inv quartiles is 0.48% per month (t=2.07), the intercept is 0.34% (t=1.46) in the five-factor model. Two more factors: CMA and RMW, improve the troublesome statistics. This phenomenon shows the shortages in three-factor model. And five-factor model is more reasonable.

2.3.4 32 Size-OP-Inv portfolios

For small and big stocks, RMW slopes are positive for high profitability quartiles and negative for low OP quartiles, and CMA slopes are positive for low investment quartiles and negative for high Inv quartiles. The correspondence between characteristics and regression slopes facilitates inferences about the nature of the stocks in troublesome portfolios.

The biggest problem for the five-factor model is the portfolio of small stocks in the lowest profitability and highest investment quartiles. Its intercept, 0.3% per month (t=1.20) easily rejects the model as a description of expected returns on the 32 Size-OP-Inv portfolios. Low profitability per se is not a problem for the five-factor model in the results for small stocks. Two of the other three portfolios in the lowest OP quartile produce positive intercepts and one is 2.21 standard errors from zero. There is again suggestive evidence that for small stocks, high investment alone is associated with five-factor problems. The other three small stock portfolios in the highest Inv quartile also produce negative five-factor intercepts and two are more than two standard errors below zero.

Regressions for 32 value-weight Size-OP-Inv portfolios; January 2008–December 2017, 120 months. At the end of June each year, stocks are allocated to two Size groups (Small and Big) using the SSE median as the market cap breakpoint. Small and big stocks are allocated independently to four OP groups (Low OP to High OP) and four Inv groups (Low Inv to High Inv), using SSE OP and Inv breakpoints for the small or big Size group. The intersections of the three sorts produce 32 Size-OP-Inv portfolios. The LHS variables in the 32 regressions are the excess returns on the 32 Size-OP-Inv portfolios. The RHS variables are the excess market return, R_M-R_F, the Size factor, SMB, the B/M factor, HML or its orthogonal version HMLO, the profitability factor, RMW, and the investment factor, CMA, constructed using 2x3 sorts on Size and B/M, OP, or Inv.

If one looks to big stocks for confirmation of the five- factor problems observed for small stocks, none is found. The portfolio of big stocks in the lowest OP and highest Inv quartiles (the lethal combination for small stocks) pro- duces a small positive five-factor intercept, 0.18% per month (t=0.89). Moreover, the intercepts for the four big stock portfolios in the highest Inv quartile split evenly between positive and negative, and the troublesome one is positive (0.89 per month, t=1.13,for the big stock portfolio in the highest OP and Inv quartiles). Thus, if the market overprices small stocks that invest a lot, the problem does not carry over to big stocks. Indeed, the asset pricing problem for big stocks is the high average return of highly profitable firms that invest a lot.

The FF three-factor model's problems in the tests on the 32 Size-OP-Inv portfolios are more severe. For example, portfolios of small or big stocks that combine high OP and low Inv produce strong positive intercepts in the three-factor model, but in the five-factor model the high average returns of these portfolios are absorbed by strong positive RMW and CMA slopes. The lethal combination that dooms the five-factor model is even more deadly in the three-factor model. The three- factor intercept for the portfolio of small stocks in the lowest OP and highest Inv quartiles is -0.02 month (t=0.1), but negative RMW and CMA slopes shrink the intercept to 0.3% (t=1.2) in the five-factor model. The Size-OP-Inv sorts provide the most direct evidence that strong profitability and investment tilts are problems for the three-factor model.

3. Conclusion

There are patterns in average returns related to Size, B/M, profitability, and investment.

Judged on regression intercepts, the three sets of factors we use — (i) separate 2x3 sorts on Size and B/M, OP, or Inv, (ii) separate 2x2 sorts, and (iii) 2x2x2x2 sorts that jointly control for Size, B/M, OP, and Inv provide similar descriptions of average returns on the LHS portfolios examined. Armed with the evidence presented here, which version of the factors would we choose if starting fresh? We might prefer the factors from the 2x2 Size-B/M, Size-OP, and Size-Inv sorts over those from the 2x3 sorts (the original approach). Since the 2x2 versions of HML, RMW, and CMA use all stocks and the 2x3 versions exclude 40%, the 2x2 factors are better diversified. In the tests of the five-factor

model here and in Fama and French (2014), however, the performance of the two sets of factors is similar for the LHS portfolios we examine, so the choice between them seems inconsequential.

The joint controls of the 2x2x2x2 sorts are attractive for isolating estimates of factor premiums. But given that multivariate regression slopes measure marginal effects, it's not clear that the factors from the 2x2x2x2 sorts better isolate exposures to variation in returns related to Size, B/M, profitability, and investment. And inevitable uncertainty about the eventual list of factors lessens the attraction of the 2x2x2x2 factors. Controlling for more factors is problematic. If we add momentum, for example, correlations among the five variables are likely to result in poor diversification of some of the portfolios used to construct factors. If one shortens the list of factors (for example, dropping HML), one should reconstruct the factors since controlling for unused characteristics is potentially harmful.

In the end, precedent, flexibility in accommodating more or fewer factors, and the fact that they perform as well as the 2x2 and 2x2x2x2 factors in our tests of asset pricing models lead us back to the factors from the 2x3 sorts. If parsimony is an issue, our results suggest that HML is a redundant factor in the sense that its high average return is fully captured by its exposures to R_M-R_F, SMB, and especially RMW and CMA. Thus, in applications where the sole interest is abnormal returns (measured by regression intercepts), our tests suggest that a four- factor model that drops HML performs as well as the five-factor model. But if one is also interested in portfolio tilts toward Size, value, profitability, and investment premiums, the five-factor model is the choice. As a concession to the evidence that suggests HML is redundant, however, one might substitute HMLO for HML in the five-factor model.

One of our more interesting results is that portfolios of small stocks with negative exposures to RMW and CMA are the biggest asset pricing problem in four of the six sets of LHS portfolios examined here. For these portfolios, we say their returns behave like those of the stocks of firms that invest a lot despite low profitability, but there are hints that for small stocks, high investment alone might be the prime problem. In this sort, negative RMW and CMA slopes line up nicely with low OP and high Inv, and we conclude that the lethal portfolios contain small stocks of firms that invest a lot despite low profitability. As a lure for potential readers of FF (2014) we can report that small stock portfolios with similar properties play a big role in our tests of the five-factor model on prominent anomaly variables, specifically, accruals, net share issues, and volatility. Behavioral stories for the low average returns of small stocks that invest a lot despite low profitability face a serious challenge: The unexplained average returns of big stocks that invest a lot despite low profitability are positive.

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