Profitability and the Cross-Section of Stock Returns

Dongshuo Jia

University of Manchester, M13 9PL, England

EMAIL: Henryjia512@gmail.com

Abstract. The purpose of this essay is to determine that whether the profitability of firms is effective on abnormal returns. After using Fama and French 3-factor model, Capital asset pricing model and Fama and French 5-factor model to analyst the cross-section of the stock returns, I found that profitable firms do generate more abnormal returns than less profitable firms.

Keywords: Cross-section of the stock returns, Capital asset pricing model, Fama-French 3 factors model, Fama-French 5 factors model

1 Introduction

The focus of asset pricing research is to perceive the cross-section of stock market returns. The cross-sectional return phenomenon means that the prices of a group of stocks with certain characteristics will move together, and eventually, after a period of time, the average return rate of one group of stocks will be significantly higher than that of another group of stocks. The factors which make one stock differ from another has been attracting researchers for decades.

Linter (1965), Mossin (1966), and Sharpe (1964) [3] introduced capital asset pricing model (CAPM) paradigm which focused on risk and return trade-offs. Over the years, it has deviated from standard capital asset pricing, and several anomalies have been discovered. The most prominent anomalies are the size and value effect (Fama, 1993, 1996) [4]. Thus, Fama and French 3-factor model was introduced by including size factor and value factor.

Cooper, Gulen, and Schill (2008) is proposed, which performs relatively well in the following aspects in predicting average stock return. Besides, The nexus of anomalies-stock returns-asset pricing models: The international evidence, Rahul Roy, Santhakumar Shijin, [J]. Borsa Istanbul Review 19-1 (2019) 1-14 [1] suggested that the value, momentum and profitability premiums differ from the firm size and premiums increased from bigger to smaller stocks.

F. Cao et al. (eds.), *Proceedings of the 2023 5th International Conference on Economic Management and Cultural Industry (ICEMCI 2023)*, Advances in Economics, Business and Management Research 276,
https://doi.org/10.2991/978-94-6463-368-9_100

The purpose of this paper is to investigate whether investment strategy based on profitability can earn abnormal returns. Although Fama and French 5-factor [7] has included the profitability factor, whether abnormal return earn by such profitability strategy can be explained by Fama and French 5-factors [7] remain an open question. In this paper, samples will be constructed from multiple entry points, trying to analyze the model's impact on risk monitoring and abnormal returns.

2 Data and Variable

To build our sample, we follow The other side of value: The gross profitability premium, Robert Novy-Marx, [J]. Journal of financial Economics 108 (2013) 1-28 [2]. In the data extraction,we use stock returns of each month from the Center for Research in security (CRSP), and accounting data revealed by Compustat. Our study focuses on all common stocks traded on AMEX, NYSE and NASDAQ. Summarize all data and organize it as appropriate. We then matched the companies on the CRSP with their lagged annual accounting information on Compustat, and the matching period was observed as often as possible, at least six months. For instance, if the firms' fiscal year end is December, we assume that this information is public until the end of June next year. The 6-month is a minimum gap between fiscal year end and the date of return, and the gap could be larger in reality. This is also the reason why the research in this paper takes a matching period of at least 6 months. We obtain the market value of equity, from July 1968 to June 2019. The monthly factors of market risk (MKT), size (SMB), value (HML), operating profitability (RMW) and risk-free rate (CMA) are collected from Kenneth French's online data Library. The profitability of an enterprise is the ability of the enterprise to appreciate its assets or capital. Among them, the amount of profit is an important factor affecting the size of profitability. The amount of profit reflects the scale or level of the enterprise's current or past profit, but we can not judge the profitability of the enterprise by the amount of profit alone, because the amount of profit can only reflect the overall level or scale of the enterprise's profit, can not reflect the formation process of profit in essence. The profitability of a firm is equal to sales minus cost of sales, divided by total assets of the firm. Besides, all financial firms are excluded. Because financial enterprises, including a lot of insurance, loans and other businesses, the financial industry's financial report structure and figures are relatively special. Therefore, according to the purpose of empirical research, it is often necessary to exclude, so as not to affect the research results.

3 Methodology

In this study, we rank all stocks with effective prices, and return the information to the quintile based on profitability, then we sort all stocks into 5 portfolios, and the portfolios will be held from July for the following 12 months. During this time, critical data will be examined. The portfolio is rebalanced every year and we track value-weighted portfolio returns throughout the sample period. Long-short portfolio holding stocks in quintile 5 stock (highest profitability) and short the stock in quintile 1 (minimum

profitability), representing a zero cost profitability investment strategy. By rebalancing to reduce the interference of factors, to achieve as much as possible, the long-short portfolio holding quintile stocks (highest profitability) and short quintile stocks (lowest profitability) significant changes are achieved through investment policy adjustment. We use the time series change of long-short portfolio returns during the sample period to calculate the significance level. Another measure of portfolio performance is to use risk-adjusted returns instead of raw returns. Risk-adjusted return is very important in risk management. Risk-adjusted return realizes the comprehensive consideration of return and risk, and avoids the excessive risk caused by only considering return, which is prone to the impact of market fluctuations. However, at the same time, the risk adjustment of return will also produce additional costs and affect the return. We use various asset pricing models to estimate risk-adjusted returns including the CAPM model [3], the Fama and French (1993) three-factor model (FF3) [4], and the Fama and French five-factor model (FF5) [7], the formulas of those asset pricing models are follow below:

$$r_{i,t} - r_{f,t} = \alpha_{i,CAPM} + \beta_{i,market}(R_{m,t} - r_{f,t}) + \varepsilon_{i,t} \quad \text{CAPM}$$

$$r_{i,t} - r_{f,t} = \alpha_{i,FF3} + \beta_{i,market}(R_{m,t} - r_{f,t}) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + \mathcal{E}_{i,t} \quad \text{FF3}$$

$$r_{i,t} - r_{f,t} = \alpha_{i,FF5} + \beta_{i,market}(R_{m,t} - r_{f,t}) + \beta_{i,SMB}SMB_t + \beta_{i,HML}HML_t + \beta_{i,RMW}RMW_t + \beta_{i,CMA}CMA_t + \mathcal{E}_{i,t} \quad \text{FF5}$$

In which: $r_{i,t}$ is the portfolio return at time t; $R_{m,t}$ is the market portfolio return at time t; $r_{f,t}$ is the risk-free interest rate at time t; SMB_t, HML_t, RMW_t and CMA_t are size factor, value factor, profitability and investment factor at time t, respectively. Alphas estimated from the asset pricing models [3] capture the risk-adjusted returns.

4 Empirical Results

Table 1. Excess return

Excess return	r^e	t-value
Portfolio		
Low	0.40	2.23
2	0.47	2.48
3	0.60	3.17
4	0.55	2.73
High	0.63	3.39
High-low	0.23	1.97

Table 2. Alphas using CAPM

CAPM Portfolio	α	MKT
Low	-0.07	0.91
	-0.99	58.67
2	-0.03	0.98
	-0.46	63.63
3	0.89	0.99
	0.13	73.81
4	0.0081	1.04
	0.13	73.81
High	0.14	0.95
	2.01	60.49
High-Low	0.21	0.041
	1.78	1.57

Table 3. Alphas using Fama French 3-factors

3-factors Portfolio	α	MKT	SMB	HML
Low	-0.16	0.94	0.017	0.23
	-2.42	60.83	0.75	9.60
2	-0.11	1.01	-0.032	0.20
	-1.62	64.95	-1.39	8.25
3	0.074	0.99	0.022	0.036
	1.25	71.84	1.11	1.74
4	0.10	1.00	-0.0077	-0.24
	1.77	72.80	-0.39	-11.47
High	0.25	0.92	-0.077	-0.26
	3.89	60.43	-3.52	-11.44
High-Low	0.41	-0.025	-0.094	-0.49
	3.87	-1.02	-2.60	-12.90

Table 4. Alphas using Fama French 5-factors

5-factors Portfolio	α	MKT	SMB	HML	RMW	CMA
Low	-1.02	0.93	-0.42	0.19	-0.23	0.90
	-1.57	59.52	-1.84	6.31	-7.50	1.93
2	-0.15	1.04	-0.031	0.11	0.017	0.18
	-2.26	62.69	-1.30	3.59	0.52	3.70
3	0.025	1.01	0.027	-0.04	0.032	0.17
	0.412	69.51	1.28	-1.44	1.12	3.99
4	0.096	1.00	-0.0008	-0.24	0.028	-0.0065
	1.58	68.32	-0.036	-8.33	0.97	-0.15
High	0.18	0.93	-0.015	-0.24	0.25	-0.05
	2.82	60.87	-0.67	-8.38	8.41	-1.11
High-low	0.28	-0.0058	0.027	-0.44	0.48	-0.14
	2.77	-0.24	0.76	-9.30	10.05	-1.93

Table 1 shows the results of portfolio sort based on gross profitability. The average excess returns are generally increasing with profitability, with a test-statistic of 1.97. The average excess returns from the lowest profitability portfolio is 0.40% per month with a test-statistic of 2.23, and it is the lowest among the other portfolios. The average excess returns from the highest profitability portfolio is 0.63% per month with a test-statistic of 3.39. From the significant spread above, we detect that more profitable firms are more likely to receive higher excess returns.

Table 2 reports the abnormal return α of univariate sorted portfolios based on profitability measure using the CAPM model. The abnormal return of the low profitability portfolio is -0.07% per month (t=-0.99). The abnormal return of the high profitability portfolio is 0.14% per month (t=2.01), which is substantially higher than the other portfolios, and the spread is therefore 0.21%. It follows an increasing pattern as the profitability of a firm increase. In this case, the abnormal return is still significant when the CAPM model is being used, we then use the Fama-French 3-factors model to analyze.

Table 3 reports the abnormal return α univariate sorted portfolios based on profitability measure using the Fama-French 3-factors model. The abnormal return of the low profitability portfolio is -0.16% per month (t=-2.42). The abnormal return of the high profitability portfolio is 0.25% per month (t=3.89), which is the highest among all 5 portfolios, and the spread is 0.41%. When using the Fama-French 3-factors model to load, abnormal return is still significant, which leads we to use the Fama-French 5-factors model.

Table 4 reports the abnormal return α univariate sorted portfolios based on profitability measure using the Fama-French 5-factors model. The abnormal return of the low profitability portfolio is -1.02% (t=-1.57). The abnormal return of the high profitability portfolio is 0.18% per month (t=2.82), which is the highest among all 5 portfolios, and the spread is 1.20%. We observe that the abnormal return is still significant when using the Fama-French 5-factors model.

5 Conclusion

This paper investigates whether investment strategy based on profitability can earn abnormal returns. The abnormal return here refers to the additional return of an investment strategy based on profitability, as opposed to the abnormal return value obtained by subtracting the normal return from the expected market return.The results show that profitable firms generate significantly higher returns than unprofitable firms. The return from long-short profitability sorted portfolio cannot be explain by the CAPM model, Fama-French 3-factor model [4], and Fama-French 5-factor model [7].

Intuitively, since the Fama-French 5-factor model [7] include the profitability factor which is constructed based on long-short profitability sorted portfolio, we should not observe abnormal return when the Fama-French 5 factor model [7] is used to adjust for the risk. However, the abnormal return of High-Low profitability portfolio is still significant. This indicates that the Fama-French 5 Factor model [7] cannot capture the risk associated with our profitability investment strategy. It can be inferred from the

above that since the Fama-French five-factor model includes the profitability factor, timely adjustment of the risk model will not result in abnormal return value. The difference in returns exists because of risks that cannot be captured and detected by the Fama-French five-factor model.

References

1. The nexus of anomalies-stock returns-asset pricing models: The international evidence, Rahul Roy, Santhakumar Shijin, [J]. Borsa Istanbul Review 19-1 (2019) 1-14.
2. The other side of value: The gross profitability premium, Robert Novy-Marx, [J]. Journal of financial Economics 108 (2013) 1-28.
3. Linter (1965), Mossin (1966), and Sharpe (1964), capital asset pricing model.
4. Fama (1993, 1996), Fama-French 3 factors model.
5. Cooper, Gulen, and Schill (2008), Asset growth and the Cross-Section of Stock Returns.
6. Sun, Wei, and Xie (2014), On the Explanations for the Gross Profitability Effect: Insights from International Equity Markets.
7. Fama and French, (2015, 2016) 5 factors model. Fama and French (2015,2016) added profitability and investment factors through the Fama and French 3-factor model [5].