Mispricing and Profitability Premium in the U.S. Stock Market

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Abstract. This paper examines the effect of profitability premium in the U.S. stock market through a variety of profitability measures. The empirical results show that there is a positive profitability premium, which comes mainly from short legs rather than long legs. Firms with high profitability generate significantly higher future stock returns than those with low profitability, and the profitability premium is particularly prominent among firms with large capitalization and high growth. The profitability strategy tends to be a growth strategy for a large stock, and behavioral mispricing fails to explain the phenomenon of the profitability premium in the U.S. stock market.

Keywords: Profitability premium, U.S. stock market, mispricing.

1. Introduction

Legendary investors such as Benjamin Graham and Warren Buffett pay particular attention to profitability when judging the quality of firms and making investment decisions (Frazzini, Kabiller, and Pedersen [1], 2013; Lee [2], 2014). Recent literature has shown clearly that profitability is correlated with higher future returns (Cohen, Gompers and Vuolteenaho [3], 2002; Griffin and Lemmon [4], 2002). However, the strength of the research effect varies across studies (Fama and French [5], 2008, Novy-Marx [6], 2013). Hou, Xue, and Zhang [7] (2015) as well as Fama and French [8] (2015) have included profitability factors in new multi-factor asset pricing models in order to explore asset pricing anomalies.

Wang and Yu [9] (2013), Lam, Wang, and Wei [10] (2016) and others propose explanations for the profitability effect based on behavioral mispricing. They argue that for reasons of behavioral biases investors fail to adequately reflect the valuation information embedded in a firm's profitability. Firms with higher profitability tend to be relatively undervalued in the stock market, while firms with lower profitability are relatively overvalued, which leads to return predictability. In addition, mispricing may not be traded away immediately due to arbitrage constraints that make it expensive and limited (Shleifer and Vishny [11], 1997). However, Ball, Gerakos, Linnainmaa and Nikolaev [12] (2015) doubt whether profitability-related mispricing can persist uncorrected for many years in the U.S. as well as in other relatively efficient stock markets.

This paper re-examines the profitability effect in the U.S. stock market using a variety of empirical profitability measures. In this study, we use OP to proxy a firm's profitability. Following Hou, Xue, and Zhang [7] (2015), we form value-weighted profitability decile portfolios by collating firms' past profitability metrics and observe a positive profitability premium about 6% per year in the U.S. stock market. When we control for other factors, including firm size (Banz [13], 1981) and book-to-market ratio (Fama and French [14], 1993), the positive predictive power of profitability for subsequent stock returns remains significant.

This paper explores whether behavioral mispricing has explanatory strength for the profitability premium through an empirical test, and concludes that most of the profitability premium in the U.S. stock market comes from the short leg because overvaluation is more difficult to correct than undervaluation under short-selling restrictions.

The U.S. stock market is more developed and is an important part of the global capital market with high market efficiency and investment efficiency, and has lower likelihoods of mispricing, so it can provide a strong justification for the competing theories. The research provides positive evidence for the earnings premium effect and development of U.S. stock market.

The rest of the paper is organized as follows. Section 2 discusses the data and computation of profitability measures. Section 3 uses portfolio test and regression analysis to test the predictability of cross-sectional stock return on stock profitability. Section 4 explores the impact of behavioral mispricing explanations on the profitability premium. Section 5 concludes the full paper.

2. Data

In this paper, we obtain U.S. risk-free rate and Fama-French's [14] (1993) three factors from Kenneth R. French: Data Library. Following Allen, Qian, Shan, and Zhu [15] (2015), and Carpenter, Lu, and Whitelaw [16] (2015), our sample includes all U.S. market stocks traded on the New York Stock Exchange, the American Stock Exchange, and the Nasdaq exchange with accounting and returns data to cover different levels of the U.S. stock market.

To ensure the quality of the data, the following sample selection procedure was applied. First, firms with negative book-to-market equity data are excluded, thus removing distressed firms. Second, book equity data must ensure that both T-period and T-1-period are non-missing income data. Finally, the paper requires non-missing data for at least one of the following: cost of goods sold, cost of goods sold, general and administrative costs and expenses, or interest expense in period T-1. Ultimately, the paper obtains approximately 3,300 firm-level observations per month in the samples.

Given that the sample period selected for Jiang, Qi, and Tang's [17] (2018) study of the Chinese stock market profitability premium is from May 2002 to December 2014, this paper selects U.S. stock data for the same period in order to compare with the performance of the Chinese stock market profitability premium. The portfolios are categorized monthly based on quarterly profitability metrics, and the portfolios are formed on each quarter's profitability (OP). Profitability (OP) is measured by dividing the most recent quarter t's revenues minus cost of goods sold, interest expense, and selling, general, and administrative expenses by book equity from the previous quarter t-1.

$$OP_t = \frac{Revenue - COGS - Interest\ expense - SG\&A}{Book\ equity_{t-1}}. \quad (1)$$

Table 1 reports summary statistics of firm characteristics for the full sample. The average OP ratio is 0.38, and the average ME and book-to-market ratio (BM) are 14.77 and 0.62.

Table 1. Summary Statistics

Variables	N	Mean	Min	Median	Max
OP	3300	0.38	-0.54	0.25	4.99
ME	3300	14.77	1.24	14.52	81.35
BM	3300	0.62	0.09	0.53	2.87

3. Empirical Results

3.1. Portfolio Sorts on Profitability

Table 2 reports the performance of the value-weighted decile portfolios over the sample period of May 2002-December 2014, sorted by profitability. To avoid look-ahead bias and ensure that accounting information was publicly available at the time it is used, we allow at least a 1-month lag between stock returns and quarterly accounting variables. Specifically, at the beginning of each month, we form ten portfolios based on the most recently published quarterly earnings and held for one month. Value-weighted returns are computed for the month and the portfolios are rebalanced monthly, where D_1 represents the decile with the lowest profitability, and D_{10} represents the decile in the highest. The "High-Low" profitability spread portfolio is calculated with long the most profitable decile and short the least profitable decile.

Fama-French's [14] (1993) three-factor model is used to calculate abnormal returns for the 10 profitability deciles and to test whether the standard risk factors can explain the positive correlation

between profitability and returns. Fama-French's three factors include the market factor (MKT), size factor (small minus big, SMB), and value factor (high minus low, HML). Factor α and β are computed by regressing the excess returns of the deciles on the corresponding returns of the three factors.

Table 2 shows, first, that the OP-based profitability deciles' average raw returns increase from 0.67% to 0.92% for the lowest and highest deciles, respectively. The average return of the OP spread portfolio is 0.25% per month, which indicates that the long-short trading strategy of buying the highest and selling the lowest OP deciles will have average annual returns of about 3%. The average monthly abnormal return increased from -0.36% to 0.12%, and the alpha of the OP long-short spread portfolio is 0.49% per month, which is an abnormal return of about 5.88% per year.

Second, the OP spread portfolio is negatively correlated with the size and value factors with value betas of -0.58 and -0.23, respectively. This finding explains the increase in the Fama-French abnormal return relative to the raw return of the OP spread portfolio. Thus, we find that the profitability-based strategies belong to the growth strategies in the U.S. stock market, consistent with the findings of Jiang, Qi, and Tang [17] (2018) in the Chinese stock market.

Table 2. Single Sorts on OP in the U.S. stock market

Portfolios	Return	$FF3_{\alpha}$	β_{SMB}	β_{HML}	β_{MKT}
D_1	0.67	-0.362545	0.480497	0.074584	1.307753
D_2	0.65	-0.28862	0.189835	-0.01733	1.255952
D_3	0.67	-0.142764	0.188727	0.075531	1.050824
D_4	0.68	-0.145681	0.141515	0.073025	1.089133
D_5	0.81	0.07323	0.138801	0.153355	1.112693
D_6	0.62	-0.100787	-0.053178	0.110236	0.973092
D_7	0.7	0.002844	-0.101083	0.116657	0.95524
D_8	0.82	0.187442	-0.083343	-0.007773	0.85959
D_9	0.79	0.146656	-0.192832	-0.18921	0.930301
D_{10}	0.92	0.12311	-0.094839	-0.150776	0.967319
High-Low	0.25	0.485655	-0.575336	-0.22536	-0.340434

Further, Table 3 reports the results of Jiang, Qi, and Tang's [17] (2018) study of the profitability premium in the Chinese stock market over the same period, which also rebalances the portfolios monthly using earnings information from quarterly reports. The study reveals that the OP portfolios generate positive raw and abnormal returns in both the U.S. and Chinese markets, and the monthly average of the Fama-French three-factor alpha is 0.49% in the U.S. and 1.91% in the Chinese market. Thus, although the U.S. stock market also provides a positive profitability premium during the same sample period, its economic value is significantly smaller than that of the Chinese stock market, with an average 1.42% per month.

In summary, profitability appears to be a positive predictor of future cross-sectional stock returns in the U.S. stock market, and by comparison, may be an even stronger predictor for the Chinese market, where the raw profitability premium was as high as 15% annualized over 2002-2014, which is as much as five times that of the U.S. stock market.

Finally, this paper finds that the U.S. profitability premium comes mainly from the short legs, exactly opposite of Jiang, Qi, and Tang [17] (2018) who find that the profitability premium in Chinese stocks market comes mainly from the long legs. From the contemporaneous A-share data in Table 3, it can be concluded that the positive abnormal returns observed in the long legs are greater than the absolute value of the negative abnormal returns observed in the short legs, i.e., 0.99% is greater than 0.92%, and thus the profitability premium of the Chinese stock market mainly comes from long legs. Observing the U.S. stock data for the same period in Table 2, this paper finds that huge negative abnormal returns are observed in short legs, with the lowest OP portfolio having a monthly alpha value of -0.36%, while the highest OP portfolio has a monthly alpha value of 0.12% less than the absolute value of -0.36%. It is therefore concluded that the profitability premium in U.S. stocks comes

primarily from the short legs, rather than the long. Most of the profitability premium in U.S. stocks is attributable to negative returns on unprofitable firms, probably due to the presence of short-selling restrictions, and overpricing is more difficult to eliminate than underpricing.

Table 3. Single Sorts on OP in Chinese Stock Market

Portfolios	Return	$FF3_{\alpha}$	β_{SMB}	β_{HML}	β_{MKT}
D_1	0.72	-0.92	0.60	0.22	1.08
D_2	0.83	-0.77	0.51	0.21	1.10
D_3	0.85	-0.72	0.44	0.31	1.07
D_4	1.08	-0.41	0.43	0.14	1.06
D_5	1.22	-0.25	0.37	0.14	1.07
D_6	1.09	-0.30	0.40	0.05	1.00
D_7	1.13	-0.20	0.34	-0.13	1.02
D_8	1.17	-0.03	0.21	-0.20	0.99
D_9	1.58	0.50	0.02	-0.34	1.04
D_{10}	1.74	0.99	-0.21	-0.65	0.92
High-Low	1.02	1.91	-0.81	-0.87	-0.16

3.2. Double Sorts on Profitability and Book-to-Market

Novy-Marx [6] (2013) and Fama and French [8] (2015) have shown that the profitability strategy is part of the overall growth strategy in the U.S. stock market. This section examines the performance of portfolios that are double sorted on profitability and the book-to-market equity ratio (BM) to re-examine the U.S. stock market.

Book-to-market ratios and profitability are independently double sorted and rebalanced every month (Hou, Xue, and Zhang [7], 2015). At the beginning of each month, firms are categorized into five BM groups according to book-to-market equity ratio and five OP groups according to profitability based on each firm's most recently published quarterly accounting information. These portfolios are held for one month and compute the monthly value-weighted abnormal returns of 25 (5 × 5) BM-OP portfolios.

Table 4 documents that the profitability premium is prevalent across firms with all valuation levels, and it is especially pronounced among firms with relatively low BM. Among them, the BM_1 portfolio has an alpha of 0.89%, larger than that of the BM_5 portfolio.

To summarize, the profitability-based strategies belong to the growth strategies in the U.S. stock market, which is consistent with the conclusions drawn previously, and the same applies in the Chinese stock market studied by Jiang, Qi, and Tang [17] (2018).

Table 4. Double Sorts on OP and BM

Portfolios	BM_1	BM_2	BM_3	BM_4	BM_5
OP_1	-0.207432	-0.565875	-0.259271	-0.350122	-0.15608
OP_2	-0.104273	-0.153821	0.07456	-0.047988	-0.210035
OP_3	0.226479	0.07075	0.132911	0.100443	-0.078635
OP_4	0.867291	-0.229722	0.203493	0.253674	-0.012528
OP_5	0.686833	-0.069122	0.491428	0.138509	0.085378
High-Low	0.894265	0.496753	0.750699	0.488631	0.241458

3.3. Double Sorts on Profitability and Size

This subsection examines the performance of portfolios with independent double-sorting of profitability and market capitalization to explore the predictive power of profitability of cross-sectional stock returns.

We perform independent double-sorting of market capitalization and profitability and rebalance portfolios monthly (Hou, Xue, and Zhang [7], 2015). At the beginning of each month, we categorize firms into five size groups based on the size of the market capitalization of all firms within the sample at the end of the previous month, as well as five profitability groups based on OP using the most recently released quarterly accounting information. These portfolios are held for one month and compute the monthly value-weighted returns of these 25 (5 × 5) portfolios.

Table 5 documents the average monthly abnormal returns (FF3α, in percent) for the dual classification of size and profitability by regressing the time series of excess returns on Fama-French [14] (1993) three factors over the sample period. Firms in portfolio with the smallest size are denoted as ME_1, and firms in portfolio with the largest size are denoted as ME_5.

Table 5 shows that the profitability premium is significant for both large and small firms, but relatively low for small-sized firms. This finding is quite different from most mispricing-based asset pricing anomalies, which typically concentrate on a small group of small-sized firms (Fama and French [5], 2008). For example, the high-low spread portfolio generates larger Fama-French three-factor average alpha values each month, and for a portfolio consisting of large firms (ME_5) has an alpha of 0.57%, which is larger than the portfolio consisting of small firms (ME_1) with an alpha of 0.31%.

Table 5. Double Sorts on OP and ME

Portfolios	ME_1	ME_2	ME_3	ME_4	ME_5
OP_1	-0.272575	-0.217981	-0.216924	-0.135334	-0.448054
OP_2	0.109049	-0.083613	0.083309	-0.008677	-0.195006
OP_3	0.091378	0.138863	0.187076	0.091509	-0.027658
OP_4	0.255261	0.291661	0.204275	0.163107	0.058447
OP_5	0.0398	0.327485	0.335872	0.222475	0.125989
High-Low	0.312375	0.545466	0.552796	0.357809	0.574043

Overall, the positive profitability premium is significant for firms with large market capitalization, but relatively weak for firms with small market capitalization. This finding suggests that the profitability strategy tends to be a large-size strategy that is likely driven by risk rather than mispricing, a finding that supports the judgment in subsection 3.2 that behavioral mispricing does not explain the phenomenon of the profitability premium in the U.S. market. There is a positive correlation between size and the profitability premium.

3.4. Triple Sorts on Profitability, Book-to-Market and Size

In this subsection, we independently triple-sort profitability, book-to-market ratio, and market capitalization to further explore the reasons for the profitability premium in the U.S. stock market while controlling for the effects of size and book-to-market ratio.

At the beginning of each month, we sort companies based on market capitalization and BM ratio, independently into two size groups (LME for small and HME for large) and four BM ratio groups (LBM for growth and HBM for value), and four OP groups based on the company's profitability. These portfolios are held for one month and calculate the weighted monthly abnormal returns of these 32 (2 × 4 × 4) ME-BM-OP portfolios.

As shown in Table 6, for HME and LBM firms, the OP-based portfolio has a large monthly average Fama-French three-factor alpha of 0.77%, while for all other portfolios, the alphas are significantly lower than 0.77%. Consistent with previous findings, Table 6 demonstrates that the profitability premium is a significant growth strategy, and that a positive profitability premium is particularly strong among HME (large) and LBM (growth) firms.

Table 6. Triple Sorts on OP, BM and ME

Portfolios	LME				HME			
	LBM	BM_2	BM_3	HBM	LBM	BM_2	BM_3	HBM
OP_1	0.0084	-0.0869	-0.0202	-0.4591	-0.6024	-0.1650	-0.1076	-0.1528
OP_2	-0.1538	0.0445	0.0063	0.0559	-0.0897	0.1128	0.1194	-0.0509
OP_3	0.0480	0.1970	0.2575	0.2609	0.0819	0.1330	0.1119	0.1074
OP_4	0.0398	0.2416	0.3433	-0.5758	0.1677	0.3235	0.3131	0.6140
High-Low	0.0315	0.3285	0.3635	-0.1167	0.7701	0.4884	0.4207	0.7668

4. Explanations based on Behavioral Mispricing

Behavioral mispricing-based explanations for the profitability premium suggest that stocks of profitable firms tend to be relatively underpriced, while unprofitable firms are relatively overpriced, resulting in return predictability. Daniel, Hirshleifer and Subrahmanyam [18] (2001); Barberis and Shleifer [19] (2003); Hirshleifer and Jiang [20] (2010) show that behavioral biases and limitations on arbitrage can lead to systematic mispricing in stock markets. Based on U.S. data, Wang and Yu [9] (2013) and Lam, Wang, and Wei [10] (2016) further show that behavioral biases such as conservatism (Barberis, Shleifer, and Vishny [21], 1998), overconfidence (Daniel, Hirshleifer, and Subrahmanyam [22], 1998), and limited attention (Hong and Stein [23] , 1999) may cause investors to fail to fully reflect the information contained about a firm's profitability and lead to behavioral mispricing.

Summarizing the analysis of the empirical results in the third subsection, it can be concluded that behavioral mispricing cannot explain the relationship between earnings and returns in the U.S. stock market.

5. Summary

In this paper, the indicator OP is used to measure firm profitability to investigate the predictive power of profitability on the cross-sections of stock returns in the U.S. stock market by employing portfolio analysis.

The empirical results prove that there is a positive profitability premium in the U.S. stock market, but its economic value is significantly smaller than that of A-shares; high profitability firms generate significantly higher future stock returns than those with low profitability, and it is particularly prominent among firms with large capitalization and high growth; profitability strategy tends to be the growth strategy of a large cap stock, and the profitability premium in U.S. stocks, which mainly arises from the short leg, is most likely to be driven by risk rather than by mispricing, i.e., behavioral mispricing cannot explain the phenomenon of the profitability premium in the U.S. stock market.

As a result, the profitability premium provides excellent diversification from the size and value premiums and expands the investment opportunities in the U.S. stock market.

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