

## Chinese Stock Market P/B ratio analysis: Mainboard as sample

### Introduction

The P/B ratio is a financial metric that compares a company's market price per share with its book value per share. The book value, also known as the net asset value, is the value of a company's total assets minus its liabilities. In essence, the P/B ratio is a valuation tool that helps investors determine whether a stock is overvalued or undervalued by comparing its market price to its intrinsic value. A low P/B ratio may indicate that the stock is undervalued, while a high P/B ratio may suggest overvaluation.

Investors can take advantage of the P/B ratio by incorporating it into their investment strategies. It is particularly useful in value investing, which focuses on identifying and purchasing undervalued stocks with the expectation that their true value will eventually be recognized by the market. By comparing the P/B ratios of different companies within an industry or sector, investors can gain insights into potential investment opportunities, identifying stocks that are trading at a discount to their intrinsic value.

The relationship between P/B ratio and Return on Equity (ROE) is crucial in evaluating a company's financial health and growth prospects. ROE is a measure of profitability, calculated as the net income divided by shareholders' equity. A higher ROE indicates that a company is generating more profit per dollar of equity, which is often seen as an indicator of efficient capital management. When analyzing stocks, investors should consider both P/B ratio and ROE, as a low P/B ratio combined with a high ROE may indicate a stock with strong fundamentals that are trading at an attractive price.

Volatility, on the other hand, refers to the degree of fluctuation in a stock's price over time. While the P/B ratio is not directly related to volatility, it can be a useful indicator of market sentiment and potential risk. Stocks with low P/B ratios and high ROEs may be perceived as less risky investments, as their undervalued status suggests that there is limited downside potential. Conversely, stocks with high P/B ratios may experience greater price fluctuations due to market perceptions of overvaluation.

### Method

#### 2.1 Decomposition from definition

This equation illustrates the relationship between P/B ratio, P/E ratio, and ROE. In essence, the P/B ratio is equal to the product of the P/E ratio and ROE. This relationship highlights the interconnectedness of these financial metrics and their importance in evaluating a company's performance, valuation, and potential for growth.

$$\frac{P}{B} = \frac{\text{Market Value}}{\text{Bookvalue}} = \frac{\text{Earning}}{\text{Bookvalue}} \times \frac{\text{Market Value}}{\text{Bookvalue}} = ROE \times \frac{P}{E}$$

#### 2.2 Cumulative return calculation

Cumulative return is a financial metric used to measure the total percentage change in the value of an investment over a specific period. It represents the aggregate growth or decline in the investment's value, taking into account all gains, losses, and reinvested dividends or interest.

To calculate the cumulative return, you can use the following formula:

$$\text{Cumulative Return} = \frac{\text{Ending Value}}{\text{Beginning Value}} - 1$$

In this formula, the Ending Value represents the final value of the investment at the end of the specified period, while the Beginning Value is the initial value of the investment at the start of

the period. To make calculation in Stata more intuitively:

$$R_{cumulative,n} = \prod_{i=1}^n (1 + r_i) - 1$$

## Result

### 3.1 Overview

We first construct P/B ratio using the formula:  $\frac{P}{B} = \frac{\text{Market Value}}{\text{Asset} - \text{Liability}}$

We directly derive firms' asset and liability from the Balance Sheet of listed firms (main board firms). Since the Balance Sheet is released every end of the quarter, and market value is also calculated at end of every month, we use the Balance Sheet released month for corresponding P/B calculation and next two month calculation. For example, a 2010Q4 Balance Sheet is released at the end of September, then we use it for calculating P/B ratio of 2010 Dec., 2011 Jan., 2011 Feb. with monthly market value. P/B ratio actually  $\frac{\text{Market Value}_{2011 \text{ Jan}}}{\text{Bookvalue}_{2010 \text{ Dec}}}$  for 2011 Jan.

This is a summarize of constructed P/B

Variable	Obs	Mean	Std. Dev.	Min	Max
stock_pb	379,520	1.411291	781.0409	-290408.2	28169.81

### 3.2 Regression P/B ratio on ROE and volatility

Before we start to do linear regression, we first took a look at the data sample.

Variable	Obs	Mean	Std. Dev.	Min	Max
stock_pb	4,566	5.270082	11.47685	-369.0152	347.0784
vola_q	4,566	.8164298	.0354192	.6503645	1.139384
roe_ttm	4,566	.1130027	.6760961	-9.911979	21.89803

Form table 1, we can see that in 2010Q4, the mean P/B ratio is 5.27 and the standard

deviation is 11.47. It's a relatively low standard deviation. However, the maximum and minimum value of P/B significantly deviate from the mean P/B, it means few certain firms are under misjudgment. We conclude the misjudgment into two types:

- (1) Negative P/B ratio: When we use the firm with negative P/B ratio into analysis, we miss the goal of making investment portfolio. Companies with negative P/B ratios frequently experiencing financial distress, which can include declining revenues, mounting debt, or significant losses. These financial difficulties can lead to bankruptcy or insolvency, which poses a high risk for investors, as they may lose their entire investment if the company fails.
- (2) Extremely high P/B ratio: A significantly high P/B ratio of a firm may introduce challenges in the analysis and regression process due to overvaluation and lack of comparability. It may indicate that a firm is overvalued, suggesting that its market price is significantly higher than its intrinsic value. In such cases, the stock's price may not accurately reflect the company's fundamentals and may be driven by external factors, such as market sentiment or speculation. Also, it may not provide a meaningful comparison of their relative value.

#### 3.2.1 Overall regression

These are the overall monthly and the quarterly regression without taking any

Source	SS	df	MS	Number of obs	=	1,528
Model	2525.67547	2	1262.83774	F(2, 1525)	=	15.02
Residual	128195.894	1,525	84.0628811	Prob > F	=	0.0000
				R-squared	=	0.0193
				Adj R-squared	=	0.0180
Total	130721.569	1,527	85.6067905	Root MSE	=	9.1686

ew_stock_pb	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
vola_q	33.95289	6.631374	5.12	0.000	20.94531 46.96047
roe_ttm	.6754905	.3476342	1.94	0.052	-.0064012 1.357382
_cons	-22.52068	5.41946	-4.16	0.000	-33.15106 -11.8903

Source	SS	df	MS	Number of obs	=	4,566
Model	7622.77936	2	3811.38968	F(2, 4563)	=	29.29
Residual	593669.811	4,563	130.105152	Prob > F	=	0.0000
				R-squared	=	0.0127
				Adj R-squared	=	0.0122
Total	601292.59	4,565	131.717982	Root MSE	=	11.406

stock_pb	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
vola_q	34.07963	4.766398	7.15	0.000	24.73519 43.42408
roe_ttm	.6773897	.2497009	2.71	0.007	.1878551 1.166924
_cons	-22.63009	3.895113	-5.81	0.000	-30.2664 -14.99379

ROE increase, this is from the definition of P/B ratio. 2. The P/B ratio and volatility are positively correlated, stocks with low P/B ratios are often viewed as less risky investments because their undervalued nature implies a reduced potential for downside. On the other hand, stocks with elevated P/B ratios could be subject to increased price volatility as a result of market sentiment that considers them overvalued.

### 3.2.2 Regression without negative P/B ratio

Source	SS	df	MS	Number of obs	=	1,524
Model	1824.10795	2	912.053973	F(2, 1521)	=	20.26
Residual	68481.7595	1,521	45.024168	Prob > F	=	0.0000
				R-squared	=	0.0259
Total	70305.8675	1,523	46.1627495	Adj R-squared	=	0.0247
				Root MSE	=	6.71

ew_stock_pb	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
vola_q	27.89411	4.857405	5.74	0.000	18.36619 37.42203
roe_ttm	-1.994888	.705021	-2.83	0.005	-3.377804 -.6119713
_cons	-17.05796	3.969602	-4.30	0.000	-24.84444 -9.271492

Source	SS	df	MS	Number of obs	=	4,558
Model	4415.92793	2	2207.96397	F(2, 4555)	=	35.27
Residual	285183.478	4,555	62.6088866	Prob > F	=	0.0000
				R-squared	=	0.0152
Total	289599.406	4,557	63.5504512	Adj R-squared	=	0.0148
				Root MSE	=	7.9126

stock_pb	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
vola_q	27.21305	3.308271	8.23	0.000	20.72724 33.69887
roe_ttm	-.4832242	.2788526	-1.73	0.083	-1.02991 .063462
_cons	-16.64518	2.703695	-6.16	0.000	-21.94574 -11.34463

smaller coefficient compared to the quarterly regression. This suggests that, with all other factors held constant, refining the data leads to a decrease in the coefficient of ROE.

Consequently, we hypothesize that the presence of specific data points might be responsible for these issues. Further analysis and adjustments are necessary to account for the impact of such data points and to ensure a more accurate understanding of the relationship between P/B ratio, ROE, and their effects on stock performance.

### 3.2.3 Regression without extreme high P/B ratio

Source	SS	df	MS	Number of obs	=	1,522
Model	2073.61013	2	1036.80507	F(2, 1519)	=	43.69
Residual	36049.8133	1,519	23.732596	Prob > F	=	0.0000
				R-squared	=	0.0544
Total	38123.4234	1,521	25.0647097	Adj R-squared	=	0.0531
				Root MSE	=	4.8716

ew_stock_pb	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
vola_q	31.4197	3.528885	8.90	0.000	24.49769 38.3417
roe_ttm	1.431784	.5225635	2.74	0.006	.406762 2.456807
_cons	-20.47657	2.884211	-7.10	0.000	-26.13403 -14.81911

special treatment around the 2010Q4 period. The revised regression table shares similarities with the initial one but exhibits higher  $R^2$  values and increased t-values. This improvement is

manually selection of P/B ratio. From the table, we can see that the overall regression perfectly demonstrates the relationship between P/B ratio with ROE and volatility: 1. Holding other things constant, P/B ratio increase when

We begin with our first adjustment by excluding all stocks with negative P/B ratios. Both the monthly and quarterly regression tables demonstrate that the P/B ratio and ROE exhibit negative coefficients, which contradicts our initial expectations. This discrepancy may be attributed to the influence of stocks with extremely high P/B ratios.

Additionally, we observe that the monthly regression yields a

We proceed to eliminate firms with extremely high P/B ratios from our analysis. This results in the removal of only five observations, specifically affecting three stocks: 000831, 600083, and 600715.

These stocks were all subject to

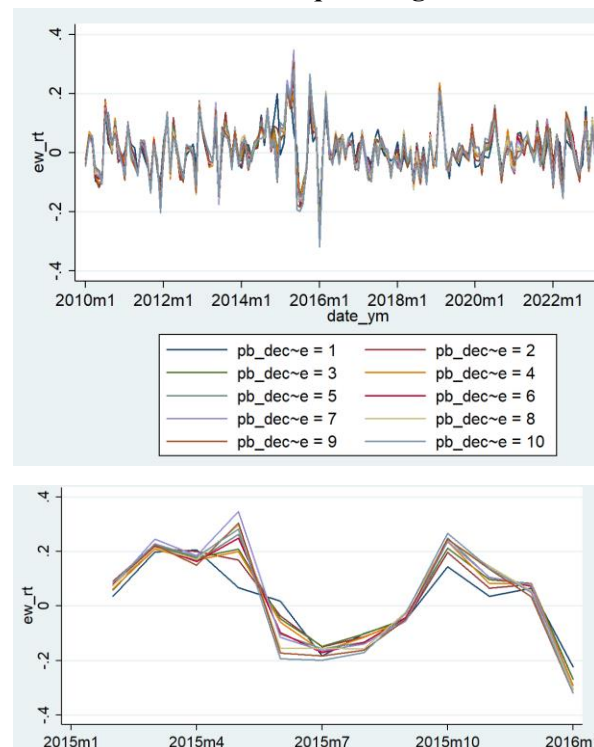
encouraging, as it indicates that our linear regression model better

explains the dataset and provides more significant results concerning the relationship between P/B ratio and ROE. Furthermore, it supports the notion that higher P/B ratios

contribute to increased risk due to greater volatility. This refined analysis offers valuable insights for investors seeking to understand the connection between P/B ratios, ROE, and risk in their investment decision-making process.

### 3.3 Time-series of P/B portfolios

#### 3.3.1 Time-series with equal weighted return



most significant losses during market downturns. This observation aligns with the assumption that higher P/B ratios are associated with increased volatility. In conclusion, while the relationship between P/B ratio and stock returns may not be as straightforward as initially expected, the assumption of greater volatility for portfolios with higher P/B ratios remains consistent with the data.

#### 3.3.2 Time-series with cumulative return

Since the ordinary time-series is difficult to justice whether the portfolio receive a positive return, we did the cumulative return time series. In this graph we can see that from 2016 Jan., the ten portfolios are separated significantly. The leading highest cumulative return are generated by portfolio 1 and portfolio 3, thus the almost lowest P/B

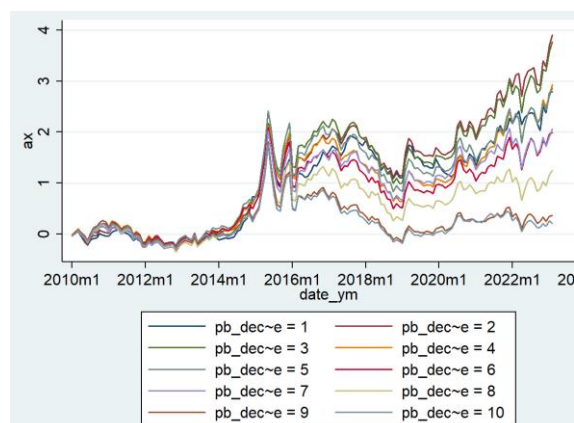
Source	SS	df	MS	Number of obs	=	4,553
Model	5941.95438	2	2970.97719	F(2, 4550)	=	120.68
Residual	112014.544	4,550	24.618581	Prob > F	=	0.0000
Total	117956.498	4,552	25.9131147	R-squared	=	0.0504
				Adj R-squared	=	0.0500
				Root MSE	=	4.9617

stock_pb	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
vola_q	31.16484	2.075917	15.01	0.000	27.09503 35.23465
roe_ttm	.6928366	.1754795	3.95	0.000	.3488116 1.036862
_cons	-20.18171	1.696659	-11.89	0.000	-23.50799 -16.85544

The provided graph presents an overview of the P/B ratio for 10 portfolios spanning from January 2010 to December 2022. Examining the time-series data, it becomes evident that the portfolio with the highest P/B ratio does not consistently yield higher stock returns, as one might anticipate. In fact, only a few peaks can be observed, such as in October 2015 and May 2015. Interestingly, Portfolio 2, which has a lower P/B ratio and is expected to generate lower returns, appears to produce higher stock returns around 2020.

Another important observation is that although the high P/B ratio portfolio does not consistently outperform in terms of stock returns, it tends to experience the



ratio portfolios. The highest P/B portfolios, on the contrary, generated the lowest cumulative return. From this result we make a conclusion that low P/B portfolios can generate high returns for several reasons, while high P/B portfolios may underperform. Historically, stocks with low valuations (such as low P/B ratios) have tended to revert to their historical average valuation over time, providing opportunities for gains. Conversely, high P/B ratio stocks may experience reversion to the mean in the form of price declines. From volatility prospect, high P/B stocks may carry greater risk due to their overvaluation and potential for price declines.

## Discussion

Stocks with higher P/B ratios frequently display relatively high ROE, suggesting a strong connection between these two financial metrics. High ROE indicates a company is effectively utilizing its equity capital to generate substantial profits, which can contribute to its increased market valuation. As a result, companies with high ROE often exhibit higher P/B ratios, reflecting the market's recognition of their superior financial performance and growth prospects.

Nonetheless, it is crucial to recognize that stocks with high P/B ratios may not always present optimal investment opportunities. One primary concern associated with high P/B ratio stocks is the potential overvaluation, as the market may have already incorporated the company's robust performance and future growth potential into its current price. This leaves limited scope for further price appreciation; investors may not realize the anticipated returns.

Moreover, stocks with high P/B ratios are generally more susceptible to market fluctuations, and they may bear increased downside risks owing to their lofty valuations. This heightened exposure to market conditions can result in greater volatility and potential losses, especially during times of market instability or economic contractions. Given these considerations, it is imperative for investors to exercise prudence when evaluating high P/B ratio stocks as prospective investments. For instance, during P/B analysis, it is advisable to exclude stocks with negative P/B ratios and exceedingly high P/E ratios, as these stocks are subject to special treatment and lack sufficient information for a comprehensive assessment.

In conclusion, while high P/B ratio stocks may display attractive characteristics, such as high ROE, investors should exercise prudence and conduct thorough research before committing to these stocks. This approach ensures that the potential overvaluation and associated risks are taken into account, ultimately leading to more informed and balanced investment decisions.

## Limitation

This study acknowledges three analytical limitations. Firstly, the book value may not accurately represent a company's true asset value, particularly for firms with significant intangible assets. Consequently, the P/B ratio could be less informative or misleading in such cases.

Secondly, the analysis insufficiently explains why low P/B stocks may have higher value. While undervaluation is considered, it may not be the primary reason for a profit-making stock's low price. Further data is needed to identify the driving factors behind P/B ratios.

Lastly, industry classification was not addressed. The P/B ratio may not capture a company's growth potential, especially for high-growth firms with substantial intangible assets. The ratio alone cannot determine if a high P/B ratio is justified by strong growth prospects or competitive advantages.