Problem 1

Monthly P/B ratios (i.e. PB_Ratios) = *Monthly stock closing price* / *Net Assets per Share* (i.e. Net_Assets_PS)

ROE = *Net Income / Net Asset*

Stock Volatility here is estimated by log return of the latest 250 trading days.

In this problem, taking Monthly P/B ratios as the dependent variable and others as independent variables, we do ordinary least square regression analysis among these three variables. This cross-sectional regression focuses on the data of the end of 2010.

Regression Model: P/Bi = α + β1ROEi + β2Stock Volatilityi + εi.

Following are the regression results:

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. reg PB_Ratios ROE volatility
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Source	SS	df	MS	Number of obs	=	1,388
				F(2, 1385)	=	105.94
Model	795.02135	2	397.510675	Prob > F	=	0.0000
Residual	5196.81273	1,385	3.75221136	R-squared	=	0.1327
				Adj R-squared	=	0.1314
Total	5991.83408	1,387	4.31999574	Root MSE	=	1.9371

PB_Ratios	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ROE	1.753048	.453351	3.87	0.000	.8637196	2.642377
volatility	8.720593	.6292928	13.86	0.000	7.486123	9.955063
_cons	.1419682	.2885971	0.49	0.623	-.4241664	.7081028

Figure 1 Regression results.

Regression Model: P/Bi = 0.142 + 1.753*ROEi + 8.721*Stock Volatilityi

Findings and discussion:

We have 1388 observations.

a. Explain the regression coefficient.

According to the regression results, estimated β1=1.753 with a standard error of 0.45, estimated β2=8.721 with a standard error of 0.629, and estimated constant α = 0.142 with a standard error of 0.289. Both ROE and Stock Volatility have positive correlations with Monthly P/B ratios, meaning that if other variables are constant, a single increase in either of them will give rise to Monthly P/B ratios, while the unit increase in Stock Volatility may cause a more significant increment in Monthly P/B ratios. Since their p-values are almost 0, the results are statistically significant.

b. Check the fitness of regression model.

The R^2 is around 0.13, which denotes that about 13% of the total variation can be explained by this regression as a significant degree of fit regarding the stock market.

Problem 2

In this problem, we group stocks in the market monthly into ten classes, from low to high, based on their last-month P/B ratios from January 2010 to December 2023. For example, each month, stocks with P/B ratios more minor than the 10th percentile will be attributed to class 1 in this month but independent from their last or next month's index. Next, we manually create ten portfolios using data from these ten classes. After calculating the monthly returns of these ten portfolios, we draw the bar chart below:

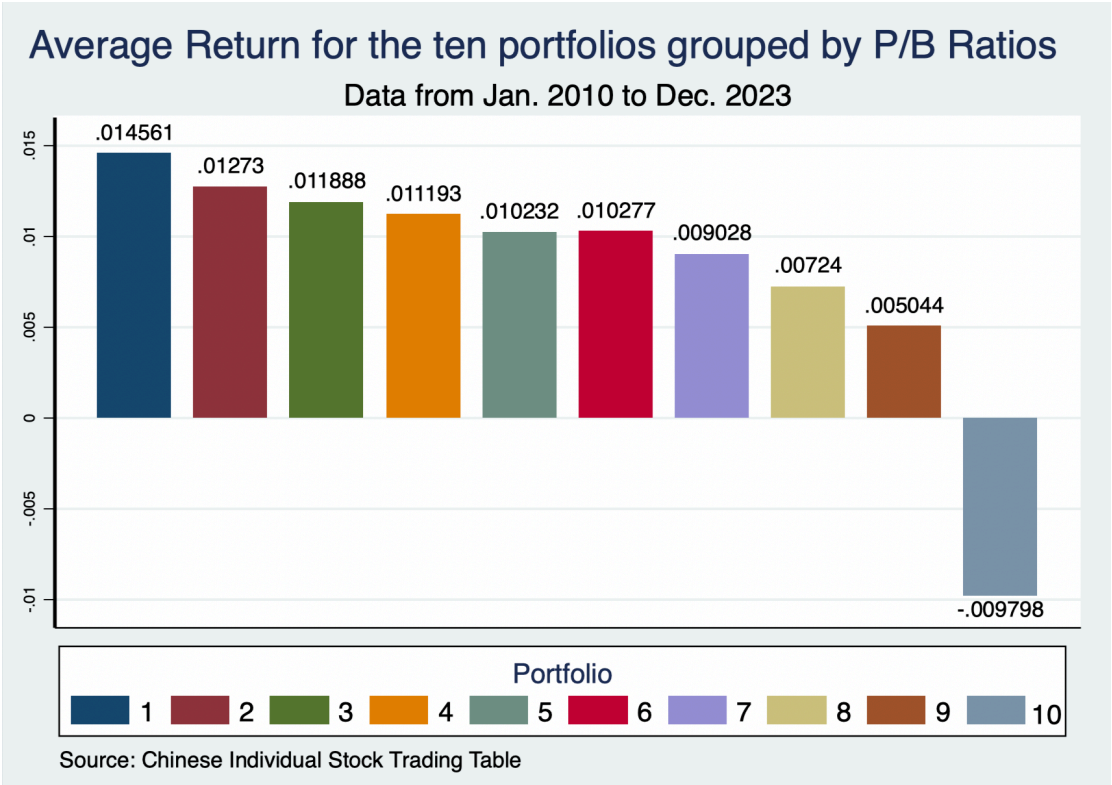

Figure 2 Average return of the ten portfolios.

Findings and discussion:

We can find that except for Portfolio10, which constantly owns the highest P/B ratios in the market, all portfolios get a positive average return, indicating the remarkable growth of the whole market over the past 13 years. On top of that, we can also find portfolios with smaller indexes always have higher average returns, showcasing the negative correlation

between P/B ratios and stock returns. That makes sense since companies with low P/B ratios usually mean comparable undervaluation in their value and consequently could be treated as symbols of investment opportunity.