FIN3080 Report 123090559

Problem 1

Data collection

As required, the data was downloaded ended up with 2 cvx files: monthly Market Risk Premium Factor(1), Book-to-Market Ratio Factor(1) all with Weighted Average Value of Negotiable Shares from Three factor model and A share monthly Market value of Tradable Shares(2), Return Without Cash Dividend(2), Market Type(2) all during 2000 Dec and 2024 Dec.

Data manipulation

Column renaming and operation:

Rename the columns to deal better in the following codes, and because the problem defines to focus on mainboard stocks listed on Shenzhen Stock Exchange (SZSE) and Shanghai Stock Exchange (SSE), so only choose market type of 1 and 4 in the return csv, choose market type id to be P9706 in the factor csv.

Sort and get 10 portfolios:

After changing date to period type, shift the market value by 1 to get 'last month value', then base on the date(use groupby), short last month value get 10 deciles and mark the decile, each group with equal weights and rebalancing positions monthly. Finally groupby the date and decile marks calculate the average monthly returns as the Y data points in the regression.

Merge and regress:

Merge the factors (risk_premium and BM ratio) and monthly return on date using left merge.

For each group use OLS model to regress 2 factors on the monthly return. Output the alpha, beta, p_value and R_squared.

Results

Group	Alpha	β_Mkt risk	β_BM rate	p_Alpha	p_Mkt risk	P_BM rate	R^2
1	0.024999	1.02118	-1.099825	0.000000	0.000000	0.000000	0.599018
2	0.014611	1.027325	-0.923232	1.2e-05	0.000000	0.000000	0.698891
3	0.011339	1.032951	-0.838866	0.000219	0.000000	0.000000	0.726671
4	0.008417	1.056721	-0.753507	0.00324	0.000000	0.000000	0.754133
5	0.00616	1.038278	-0.726783	0.026519	0.000000	0.000000	0.756383
6	0.005104	1.041816	-0.718278	0.043608	0.000000	0.000000	0.78939
7	0.004436	1.060461	-0.608464	0.054413	0.000000	0.000000	0.818127
8	0.003342	1.054049	-0.551549	0.100061	0.000000	0.000000	0.849079
9	0.003033	1.048308	-0.418702	0.082654	0.000000	0.000000	0.879235
10	0.001923	1.050693	-0.034608	0.065893	0.000000	0.277836	0.950128

Discussion

(1) Alpha

From group 1 tp 10, the alphas are positive and decreasing, with p value gradually increasing, losing significance. All portfolios are highly exposed to systemic risk.
Small-Cap Portfolios: Alpha values are significantly positive (e.g., Group 1: Alpha = 0.025, p = 0), indicating that small-cap firms generate excess returns even after controlling for market risk and BM ratio. This supports the small-cap effect, referring to small-capitalization firms tend to generate higher long-term average returns compared to large-cap firms, because of growth potential, risk compensation(operation risks and liquidity risks)and market neglect.
Large-Cap Portfolios: Alpha diminishes and loses significance (e.g., Group 10: Alpha = 0.0019, p = 0.066), suggesting that large-cap firms exhibit no significant excess returns, likely due to higher market efficiency or fully priced risks.

(2) Impact of Market Risk (β_Mkt risk)
All portfolios show β_Mkt risk close to 1 (1.02–1.06), with p-values of 0, implying market risk is a significant driver of returns across all groups, consistent with CAPM theory.
Mid-sized portfolios (e.g., Group 7,8) are slightly more sensitive to market fluctuations, possibly due to liquidity or sector concentration differences.

(3) Negative Effect of BM Ratio (β_BM rate)
BM ratio coefficients are **negative** and gradually increasing with p value keeping 0 except for group 10(0.278), the negative effect is different from the Fama-French Three-Factor Model's implication. For small-cap portfolios (e.g., Group 1: β_BM rate = -1.10, p = 0), indicating high book-to-market ratios significantly reduce returns for small firms. Potential reasons could be:

Investors may perceive small-cap firms with high BM ratios not as "value opportunities" but as companies with dim growth prospects. For example, a high BM ratio in small firms might reflect outdated business models or industry decline, leading to pessimism about future profitability. In contrast, small-cap firms with low BM ratios may be viewed as high-growth candidates (e.g., tech startups), where investors pay a premium for future potential despite low current book value.

Also, small-cap firms with high BM ratios may face higher financial risks. For instance, a high book value relative to market value could signal unproductive assets (e.g., excess inventory) or heavy debt burdens, raising concerns about solvency. Investors demand higher risk compensation for such firms, reducing demand and suppressing returns.
For large-cap portfolios (Group 10), BM ratio impact is insignificant (β = -0.034, p = 0.278), suggesting limited explanatory power for large firms, whose valuations are more stable.
Suggestion is apply selectively in stock selection, critical factor for small caps but more irrelevant for large caps.

(4) Model Explanatory Power (R^2)

R^2 increases from 0.599 (Group 1) to 0.950 (Group 10), showing the model explains nearly all return variations for large-cap portfolios, as market risk and BM ratio dominate.

Lower R^2 for small-cap portfolios implies their returns may be driven by factors beyond the model, for example the liquidity, momentum and speculative behavior. Fama-French-type models fit large caps well, while small caps require additional tailored factors.