

QAM PSET 1: Market Portfolio

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1. Construct the value-weighted market return using CRSP data,¹ replicating the market return time series available in Kenneth French website.² Also calculate the equal-weighted market return, and the lagged total market capitalization. Your output should be from January 1926 to December 2022, at a monthly frequency.

Solution:

1. We download the data from CRSP. Select the dates, select Ticker.
2. Selected the required columns like ret, permno, etc. and submit the form.
3. Download the data. Data saved as returns.csv
4. Read in the .csv data into your python file
5. Clean the data
6. Download the Fama French daily data from Kenneth French website
7. Fix the date format in the data to match the CRSP date format
8. Merge the two data sets using join on the common 'date' column
9. Found market cap and then used this to calculate the value weighted index
10. Next calculated the equal weighted index and lagged total market capitalization

	Year	Month	Stock lag MV	Stock Ew Ret	Stock Vw Ret
0	1926	1	NaN	0.022531	0.003512
1	1926	2	2.756448e+07	-0.050649	-0.028714
2	1926	3	2.670194e+07	-0.093066	-0.057421
3	1926	4	2.503260e+07	0.030372	0.038843
4	1926	5	2.583234e+07	0.001988	0.013585
...
1159	2022	8	4.706166e+10	-0.006247	-0.031431
1160	2022	9	4.518450e+10	-0.105420	-0.086933
1161	2022	10	4.089548e+10	0.056679	0.090859
1162	2022	11	4.395948e+10	0.006468	0.059731
1163	2022	12	4.604604e+10	-0.056796	-0.052866

1EQUAL WEIGHTED RETURNS AND VALUE WEIGHTED RETURNS

2. Using the risk-free rate of return from French's website³, report the following moments of the market excess returns for both time series (4 decimal digits): annualized return, annualized volatility, annualized Sharpe ratio, skewness, and excess kurtosis. You should be comparing between July 1926 to December 2022, at a monthly frequency.

Solution:

1. Use the Mkt-RF column from the fama French data set as the excess market returns
2. Use this to calculate annualized return, annualized
3. volatility, annualized Sharpe ratio, skewness, and excess kurtosis

	RF	Mkt-RF	Year	Month
0	0.22	2.96	1926	7
1	0.25	2.64	1926	8
2	0.23	0.36	1926	9
3	0.32	-3.24	1926	10
4	0.31	2.53	1926	11
...
1152	0.08	9.57	2022	7
1153	0.19	-3.77	2022	8
1154	0.19	-9.35	2022	9
1155	0.23	7.83	2022	10
1156	0.29	4.60	2022	11

1157 rows × 4 columns

2FAMA FRENCH DATA

Observations:

	Estimated Market Return	Actual Market Return
Mean	0.085175	0.080864
Standard Deviation	0.208400	0.185388
Sharpe	0.205567	0.207830
Skewness	0.299604	0.158922
Excess Kurtosis	10.926203	10.424531

3OBSERVED VALUES

- The values in the table represent statistics related to the market's returns. Here are some inferences that can be drawn from these values:
- Estimated Market Return: This is the expected return on the market based on historical data or other factors. In this case, the estimated market return is 8.52%.
- Actual Market Return: This is the actual return on the market during the period under consideration. In this case, the actual market return is 8.08%.
- Standard Deviation: This measures the volatility or risk of the market's returns. In this case, the standard deviation is 20.84%.
- Sharpe Ratio: This is a measure of the risk-adjusted performance of an investment. It is calculated by dividing the excess return (return above the risk-free rate) by the standard deviation. A higher Sharpe ratio indicates better risk-adjusted performance. In this case, the Sharpe ratio is 0.21.
- Skewness: This measures the symmetry of the distribution of returns. A skewness of 0 indicates a perfectly symmetrical distribution. A positive skewness indicates that the distribution has a longer tail on the right side (i.e., there are more extreme positive returns). In this case, the skewness is 0.30, indicating a slightly positive skew.
- Excess Kurtosis: This measures the thickness of the tails of the distribution of returns. A higher excess kurtosis indicates that the distribution has more extreme values (i.e., more frequent large positive or negative returns). In this case, the excess kurtosis is 10.93, indicating a highly leptokurtic distribution (i.e., with very thick tails).
- Overall, the table indicates that the market has a positive expected return, with some degree of volatility and slightly positive skewness. However, the high excess kurtosis suggests that the market tends to experience extreme values, making it a riskier investment. The Sharpe ratio is positive but relatively low, suggesting that the risk-adjusted performance of the market is not exceptional.

3. Report (up to 8 decimal digits) the correlation between your time series and French's time series, and the maximum absolute difference between the two-time series. It is zero? If not, justify whether the difference is economically negligible or not. What are the reasons for a nonzero difference? You should be comparing between July 1926 to December 2022, at a monthly frequency

Solution:

4CRSP EXCESS RETURN AND EXCESS MARKET RETURN CORRELATED

	Excess Ret	Mkt-RF
Excess Ret	1.000000	0.862308
Mkt-RF	0.862308	1.000000

The table shows a correlation matrix between two variables: excess return and market risk premium (Mkt-RF). Here are some inferences that can be drawn from these values:

Market Risk Premium: Market risk premium is the difference between the expected return on the market and the risk-free rate of return. The correlation coefficient between market risk premium and excess return is 0.86, indicating a strong positive correlation. This suggests that when the market risk premium increases, the excess return on an investment is likely to increase as well.

Overall, the table suggests that there is a strong positive correlation between excess return and market risk premium, indicating that changes in the market risk premium are likely to have a significant impact on the excess return on an investment.

Correlation coefficient: The value of 0.99037683 indicates a strong positive correlation between the stock value weighted returns and excess market returns. This suggests that the stock returns are highly correlated with the returns of the overall market.

Maximum absolute difference: The value of 38.40876596 represents the maximum absolute difference between the two variables. The absolute difference is the absolute value of the difference between two values. The maximum absolute difference indicates the largest difference between any two values of the two variables. In this case, the maximum absolute difference is relatively large, which suggests that there may be some periods where the stock value weighted returns deviate significantly from the excess market returns.

Overall, these values suggest that the stock value weighted returns are highly correlated with the excess market returns, which is not surprising given that stock returns are typically influenced by broader market trends. However, the relatively large maximum absolute difference indicates that there may be some periods of significant deviation.