QMJ Strategy on US stocks

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Introduction

The Quality Minus Junk (QMJ) strategy involves investing in high-quality stocks and shorting low-quality stocks. High-quality stocks are characterized by their high profitability, high growth, and high safety metrics. This report explores the construction of a QMJ portfolio, its performance over time, and its comparison with other well-known strategies (market, size, value, and momentum). The analysis includes performance metrics, rolling statistics, wealth indices, drawdown analysis, strategy alpha, and information ratio.

Data Preparation

Step 1: Data Extraction

We began by extracting annual US financial accounting data from WRDS, focusing on key accounting metrics from Compustat, such as revenues, costs, assets, liabilities etc. and stock returns and market equity from CRSP.

Step 2: Data Cleaning and Calculation

Next, we performed several data-cleaning steps and calculated fundamental metrics:

- **Book Equity (BE)**: Defined as shareholders' equity minus preferred stock. To calculate shareholders' equity, we primarily use stockholders' equity (SEQ). If SEQ is unavailable, we use the sum of common equity (CEQ) and preferred stocks (PSTK). If both SEQ and CEQ are unavailable, we proxy shareholders' equity by subtracting the sum of total liability (LT) and minority interest (MIB) from total assets (AT). We then subtract the preferred stock value (PSTKRV, PSTKL, or PSTK depending on availability) to obtain book equity (BE).
- **Gross Profitability (GPOA)**: Calculated as revenue minus the cost of goods sold (RETV - COGS) divided by total assets (AT). We replaced all infinite values of GPOA where AT is zero with NaN values.
- **Return on Equity (ROE)**: Calculated as net income (IB) divided by book equity (BE). We replaced all infinite values of ROE where BE is zero with NaN values and removed values with negative book equity.
- **Return on Assets (ROA)**: Defined as net income (IB) divided by total assets (AT). We replaced all infinite values of ROA where AT is zero with NaN values.
- **Cash Flow Over Assets (CFOA)**: Calculated as net income (IB) plus depreciation (DP) minus changes in working capital (ΔWC) and capital expenditures (CAPX), all divided by total assets (AT). We replaced all infinite values of CFOA where AT is zero with NaN values.
- **Gross Margin (GMAR)**: Defined as revenue minus the cost of goods sold (RETV - COGS) divided by total sales (SALE). We replaced all infinite values of GMAR where sales is zero with NaN values.

- **Accruals (ACC)**: Calculated as depreciation (DP) minus changes in working capital (ΔWC), all divided by total assets (AT). We replaced all infinite values of ACC where AT is zero with NaN values.
- **Working Capital (WC)**: Defined as current assets (ACT) minus current liabilities (LCT), minus cash and short-term instruments (CHE), plus short-term debt (DLC) and income taxes payable (TXP).
- **5y Growth in GOPA, ROE, ROA, CFOA, and GMAR**
- **Leverage (*LEV*):** is minus total debt (the sum of long term debt, short term debt, minority interest and preferred stock) over total assets. We replaced all infinite values of LEV where AT is zero with NaN values.
- **Altman's Z-Score:** is a weighted average of working capital, retained earnings, earnings before interest and taxes, market equity and sales, all over total assets. We replaced all infinite values of Altman z-score where AT is zero with NaN values.
- **EVOL:** is the standard deviation of annual *ROE* over the past 5 years.

Step 3: Profitability, Growth, and Safety Factors

We ranked each stock cross-sectionally on a yearly rebalancing date (June 30th each year) based on each of the abovementioned accounting metrics values of last fiscal year and calculated z-scores of those ranks cross-sectionally for each rebalancing date. We filled NaN rank z-score values due to missing data as 0 for all metrics.

- **Profitability Factor:** Averaged rank z-scores of GPOA, ROE, ROA, CFOA, GMAR to create a profitability factor rank z-score.
- **Growth Factor:** Averaged rank z-scores of 5y growth in GPOA, ROE, ROA, CFOA, GMAR to create a growth factor rank z-score.
- **Safety Factor:** Averaged rank z-scores of financial stability metrics like leverage, Altman Z-score, and EVOL to create a safety factor rank z-score.

- **Quality Factor:** Averaged profitability, growth, and safety factor rank z-scores to create final quality factor rank z-score.

Portfolio Construction

Step 4: Merging Data

We merged LinkTable data with CRSP data to ensure alignment between Compustat accounting data and CRSP stock returns data.

Step 5: Creating the QMJ Portfolio

We constructed the QMJ portfolios by sorting stocks into deciles based on their quality factor rank z-scores on June 30th each year based on NYSE breakpoints and calculated the value-weighted returns for each decile for the next 12 months before updating in June next year as an annual rebalancing exercise. We also calculated the monthly value-weighted returns for a long-short quality portfolio (QMJ01-QMJ10).

Because we are creating deciles based on rank z-scores, the first decile portfolio (QMJ01) would be high quality long portfolio and QMJ10 would be low quality short portfolio.

Step 6: Performance Metrics

We calculated several performance metrics for each decile and long-short portfolio, as well as for fama-french 4 factor strategies (market, smb, hml, and umd) including:

- **Annualized Returns:** The annualized returns over since Jan-1973.
- **Volatility:** The annualized standard deviation of returns since Jan-1973
- **Skewness:** A measure of the asymmetry of returns.
- **Sharpe Ratio:** The annualized risk-adjusted return since Jan-1973

- **Max drawdown:** The maximum drawdown strategy experienced since its inception.

Results

Performance Metrics Table:

	mktrf	smb	hml	umd	QMJ01-QMJ10
Annualized Excess Return	7.13	1.73	3.58	7.00	9.16
Annualized Volatility	16.06	10.60	10.83	15.22	16.75
Skewness	-0.50	0.46	0.07	-1.33	1.66
Annualized Sharpe Ratio	0.44	0.16	0.33	0.46	0.55
Maximum Drawdowns	-0.54	-0.55	-0.58	-0.58	-0.40

Annual Alpha: 7%, T-stat: 3.5, Annual IR: 0.52

We calculated the monthly alpha of the long-short QMJ strategy by regressing QMJ01-QMJ10 monthly excess returns against traditional four fama-french factors: market excess returns, size(smb), value(hml), and momentum(umd). We annualized the monthly alpha and also calculated the t-stat of alpha of the strategy. The QMJ long-short strategy generated an annual alpha of 7% with a t-statistic of 3.5. The t-statistic of >2 also indicates the robustness of the alpha. A t-statistic above 2 generally suggests that the results are statistically significant, meaning there is a less than 5% probability that the observed alpha is due to random chance. Thus, with a t-statistic of 3.5, the annual alpha of 7% is considered statistically significant, confirming that the QMJ strategy outperforms the traditional fama-french 4 factor portfolio consistently. We also calculated the information ratio of the QMJ long-short strategy by dividing annualized alpha by annualized residual standard deviation of regression, and we get annualized IR of 0.52 which is considered very good, thus indicating the superior performance of QMJ strategy. An annual alpha of 7% with t-stat of 3.5 for QMJ long-short strategy indicates a higher risk premium investors demand for investing in high quality stocks vs low quality stocks. The alpha for QMJ is not due to mispricing which can be arbitraged away.

Interpretation:

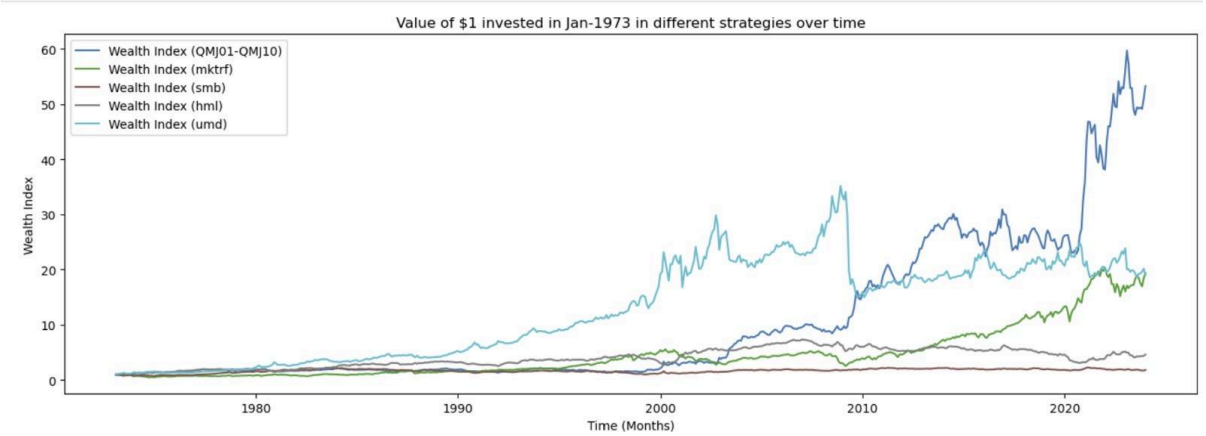
- Annualized Excess Return: The QMJ01 decile (top-quality stocks) had the highest annualized excess return at 22.80%, while the QMJ10 decile (low-quality stocks) had a return of 13.64%.
- Volatility: Volatility was higher for QMJ01 at 23.41% compared to QMJ10 at 17.36%.
- Skewness: Skewness varied across deciles, indicating different asymmetry in returns.
- Sharpe Ratio: QMJ01 had a high Sharpe ratio of 0.97, showing good risk-adjusted returns.

- Alpha: Annualized alpha of 7% with 3.5 t-stat for QMJ long-short strategy.

- Information ratio: Annualized IR of 0.52 for QMJ long-short strategy, which is quite impressive.

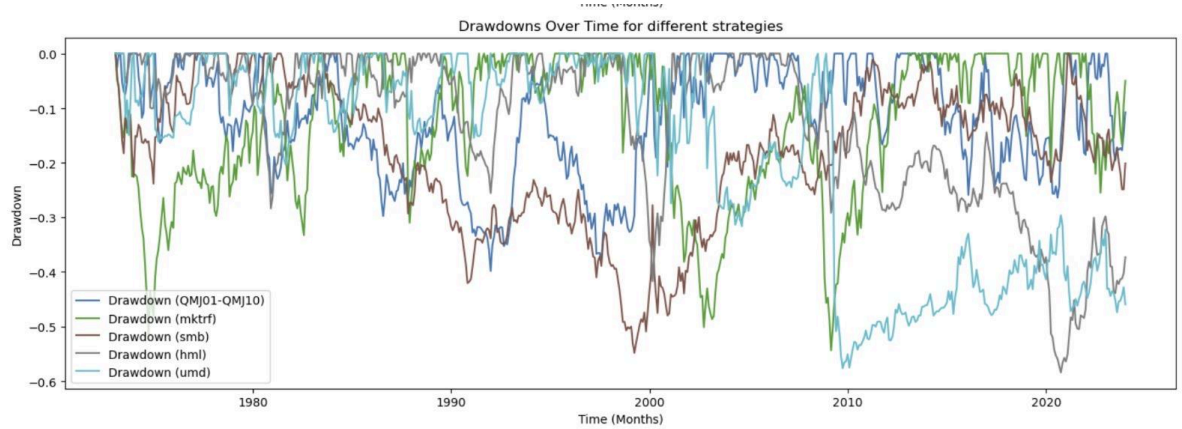
Graphs:

1. Wealth Index Over Time (Cumulative returns)



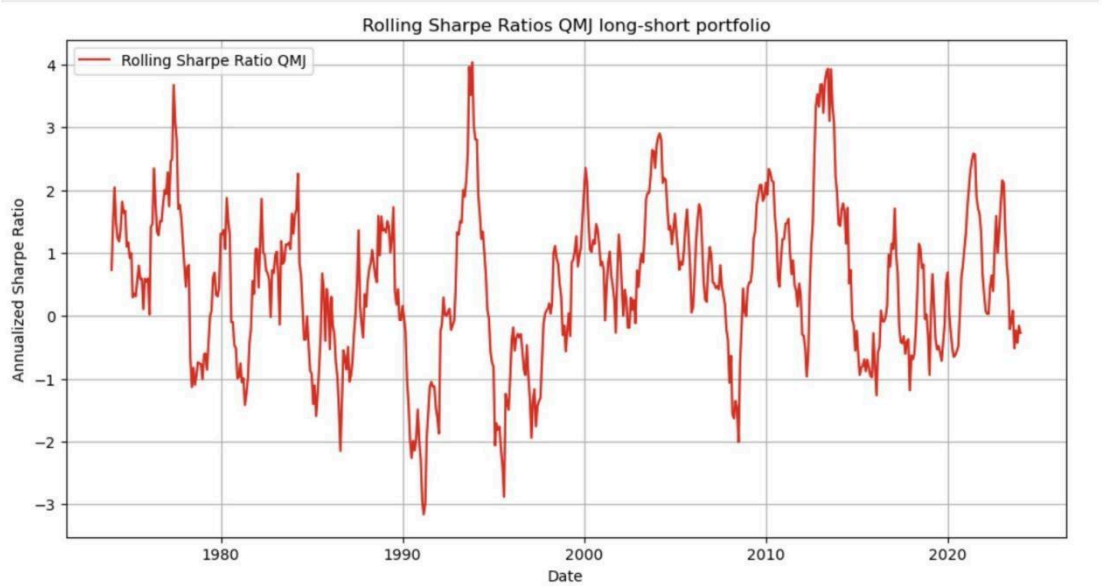
This graph shows the value of $1 invested in January 1973 across different strategies over time. The QMJ strategy outperforms the other strategies, indicating superior growth vs other strategies.

2. Drawdowns Over Time



The drawdown graph indicates losses investors have from previous peak value over time. The QMJ strategy's max drawdown is around 40%, which is significantly better than other factor strategies' max drawdown which range from 54% to 60%, this indicates much higher capital preservation of QMJ strategy vs other fama-french factor strategies.shows significant drawdowns during market downturns but recovers well, highlighting its resilience.

3. Rolling Sharpe Ratios



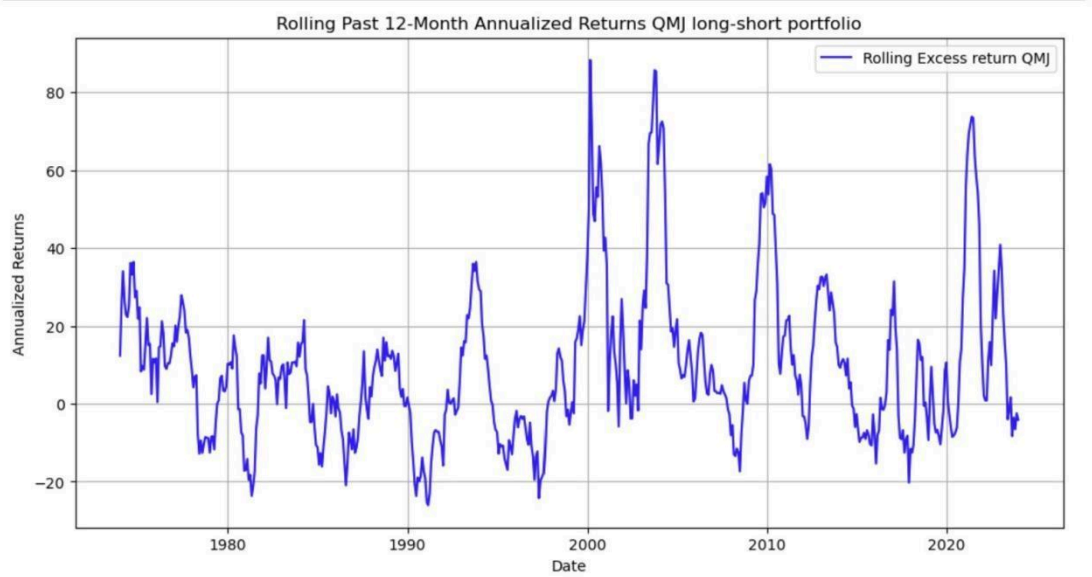
This graph depicts the rolling Sharpe ratios, showing the changing risk-adjusted returns. Higher Sharpe ratios during certain periods indicate better performance relative to risk.

4. Performance Comparison (QMJ decile portfolios)

	QMJ01	QMJ02	QMJ03	QMJ04	QMJ05	QMJ06	QMJ07	QMJ08	QMJ09	QMJ10	QMJ01-QMJ10
Annualized Excess Return	22.80	16.48	14.13	13.19	13.42	11.65	12.60	14.17	12.94	13.64	9.15
Annualized Volatility	23.41	18.04	16.97	17.63	17.56	18.31	17.44	17.06	16.61	17.36	16.75
Skewness	0.89	0.70	0.05	-0.08	NaN	NaN	-0.17	-0.17	-0.32	-0.18	1.66
Annualized Sharpe Ratio	0.97	0.91	0.83	0.75	0.76	0.64	0.72	0.83	0.78	0.79	0.55

The comparison of annualized excess return, volatility, skewness, and Sharpe ratio across different deciles shows that the QMJ01 decile (high quality stocks) performs the best in risk-adjusted returns with annualized excess return of 22.8% and sharpe ratio of 0.97. The long-short QMJ portfolio has annualized excess returns of 9.15% with a sharpe ratio of 0.55

5. Rolling Past 12-Month Annualized Returns



This graph illustrates the variability in annualized returns over time, highlighting periods of high performance and market downturns.
Additional Insights:

Impact of Market Conditions: The QMJ strategy's performance varied across different market conditions, with notable high returns during bull markets and resilience during downturns. This suggests that the strategy is adaptable and can perform well in various economic environments.

Risk Management: While the strategy yielded high returns, it also experienced significant drawdowns, emphasizing the importance of risk management. Investors should consider diversification and other risk mitigation techniques when implementing the QMJ strategy.

Long-term Growth: The wealth index demonstrates substantial long-term growth, reinforcing the strategy's potential for building wealth over extended periods. Investors with a long-term horizon can benefit significantly from the QMJ strategy.

Rolling Analysis: Rolling analysis provides a dynamic view of the strategy's performance, revealing trends and shifts in risk-adjusted returns over time. This helps investors make informed decisions based on recent performance patterns.

Comparison with Other Strategies

QMJ: The QMJ strategy had an annualized excess return of 9.16% with a Sharpe ratio of 0.55, with max-drawdown of 40%, indicating QMJ is the best strategy vs tradition four fama-french factor strategies (market, size, value, and momentum).

Market (Mktrf): The market strategy had an annualized excess return of 7.13% with a Sharpe ratio of 0.44, max-drawdown of 54%, indicating lower risk-adjusted returns compared to the QMJ strategy.

Size (SMB): The size strategy yielded a lower annualized excess return of 1.73% and a Sharpe ratio of 0.16, max-drawdown of 55%, highlighting its lower performance.

Value (HML): The value strategy had an annualized excess return of 3.58% with a Sharpe ratio of 0.33, max-drawdown of 58%, performing better than the size strategy but still below the QMJ strategy.

Momentum (UMD): The momentum strategy had an annualized excess return of 7% with a Sharpe ratio of 0.46, max-drawdown of 58%, performing better than the other strategies but still below the QMJ strategy.

Costs and Risks

We have not included the portfolio turnover analysis and impact of transaction costs on QMJ strategy’s returns and sharpe ratio, which could be a potential risk to QMJ strategy’s returns over a long period of time, especially in the case when portfolio turnover is significant. Another, potential improvements or areas of further research could be to study impact of different rebalancing frequency (quarterly for instance) on portfolio returns or different composition of long-short portfolio (top and bottom 1 percentile of stocks vs top and bottom decile we are using currently).

Conclusion

The QMJ strategy demonstrates strong performance with a significant annual alpha and Sharpe ratio. The rolling analysis highlights periods of high returns and the strategy's resilience during market downturns. The wealth index shows substantial growth over the long term, while the drawdown analysis indicates manageable risks. The consistent outperformance of the QMJ strategy is evidenced by its significant annual alpha of 7%, confirmed by a t-statistic of 3.5.The strategy has annualized information ratio of 0.52, which is considered pretty good in asset management standards. This suggests that the outperformance is statistically significant and not due to random chance. The high Sharpe ratio, particularly for the top decile (QMJ01), indicates that the strategy provides high returns for high quality stocks. The drawdown analysis shows that the strategy can withstand market downturns, recovering well from periods of loss. Additionally, the strategy benefits from diversification across quality metrics, which helps to mitigate individual metric risks and enhance overall portfolio stability.

Overall, the QMJ strategy is a robust approach for achieving superior returns by focusing on high-quality stocks. The comprehensive evaluation confirms the strategy's effectiveness over a long-term investment horizon, aligning with the findings from academic literature. This detailed analysis underscores the value of incorporating quality metrics into investment decision-making, making the QMJ strategy a valuable tool for investors seeking consistent and significant outperformance.