FINA 4359

Replication Study on Idiosyncratic Momentum Strategy

This article attempts to replicate *"Eureka, a version of Momentum that Works in Japan"* by Denis Chaves (2012). Chaves proposed a new form of momentum signal created by the cumulative idiosyncratic return which seems to be superior to traditional momentum signal.

This article founds that idiosyncratic momentum is superior to traditional momentum only for in-sample data. After the Chaves' article is published, the strategy is no-longer able to produce significant alpha.

This article also attempts to extend the strategy by using Fama-French five-factor model to produce idiosyncratic momentum. However, it was discovered that this method is inferiors to the idiosyncratic momentum produced by Chaves.

Data

All data are taken from the course server. Data includes monthly returns and market capitalizations of individual U.S. companies, risk-free rate, and U.S. risk factors for the four-factor and five-factor model.

Only common stock (shrcd 10, 11) in NYSE, AMEX and NASDAQ (hexcd 1, 2, 3) are included.

Moreover, only stocks with a full previous year of data are used since momentum requires 11 valid observations. Previous month stock price and market capitalization also need to be valid.

Building Signal

The follow steps as use to build the idiosyncratic momentum strategy. These steps are as similar to Chaves' as possible.

1. Find idiosyncratic return $\epsilon_{i,t}$

Rolling CAPM regression are estimated with 3 years of data. The idiosyncratic returns $\epsilon_{i,t}$ are ensured to be greater than -1 to prevent the definition of $IMOM_{i,t}$ from breaking down.

$$r_{i,t} - r_t^f = \alpha + \beta\left(r_t^M - r_t^f\right) + \epsilon_{i,t}^*$$

$$\epsilon_{i,t} = \max\left(\epsilon_{i,t}^*, -0.99\right)$$

2. Create idiosyncratic momentum $IMOM_{i,t}$

The idiosyncratic momentum $IMOM_{i,t}$ is the cumulative idiosyncratic return of the past months. The previous month is ignored to avoid reversal effect.

$$IMOM_{i,t} = \prod_{j=2}^{12}\left(1 + \epsilon_{i,t-j}\right) - 1$$

3. Create idiosyncratic momentum factor $IUMD_t$

Following the author, stocks are splits into 6 portfolios using 1 breakpoint on size at 50th percentile and 2 breakpoints on IMOM at 30th and 70th percentile. The idiosyncratic momentum factor $IUMD_t$ is created by the averaging the return differential between the extreme portfolios in each size group

$$IUMD_t = \frac{1}{2}(r_t^{SH} - r_t^{SL}) + \frac{1}{2}(r_t^{BH} - r_t^{BL})$$

In-Sample Results

The performance of the strategy is summarize using both in-sample and out-of-sample data (next section). In-sample data span from Jan-1965 to Sept-2011.

The following tables attempts to reproduce the result from the original paper.

Table 1: WML Portfolios

This table reports excess returns (annualized, percent) and t-stats (in parentheses) for the five sorted portfolios and the long–short portfolio (WML).

The returns for the WML portfolio and 5th quintile portfolios are significant with a quite large t-value. It also shows a monotonically increase pattern of returns. However, the returns and t-value are not as high as reported by Chaves.

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Table 2: WML Portfolios Factor Regressions

This table reports alphas (annualized, percent), coefficients, and t-stats (in parentheses) for regression of the long-short portfolio (WML). Result is extended to 5-factor benchmarking.

The alphas are significant for CAPM, 3-factor, 4-factor and 5-factor model. Similar to table 1, the t-value is not as high as reported by Chaves.

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Table 3: WML Portfolios in Size Groups

This table reports, for all three size groups, average excess returns (annualized, percent) and t-stats (in parentheses) for the five sorted portfolios and the long–short portfolio (WML). It also shows the CAPM, 3-factor, 4-factor, and 5-factor alpha (annualized, percent) and t-stats (in parentheses).

Stocks are split into micro caps, small caps, and large caps using breakpoints at the 20th and 50th percentiles of market capitalization among NYSE stocks, following the same definition of the author.

The results are mostly similar to the original paper even when extended to 5-factor benchmarking. Portfolio based on IMOM generally have higher alphas compare to the corresponding MOM portfolios (except for five-factor alpha for equal weight large-cap portfolio).

However, both large-cap IMOM equal-weighted and value-weighted portfolio fails to generate a significant four-factor alpha. This may be due to a high correlation between IMOM signal and the UMD factor.

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Table 5: Excess Returns and Factor Loadings

This table reports average excess returns of five quintile portfolios sorted on either MOM (Panel A) or IMOM (Panel B) and their regression coefficients on UMD and IUMD factors. The column WML (winners minus losers) reports the spread between quantiles 5 and 1, and the column. Slope reports the spread in excess returns divided by the spread in coefficients.

Results are generally similar to the original paper.

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Table 6: Spanning Tests

This table reports alphas (annualized, percent), coefficients, t-statistics (in parentheses), and R-squared of regressions of factors on factors.

The author claims that IUMD can substitute UMD in the four-factor model due to positive alphas for IUMD and negative alphas for UMD. Similar trends can still be observed when controled by new factor introduced by the five-factor model. However, the inferred result may not be statically significant as the t-value for UMD alphas are smaller than the original paper.

Dependent Variable	Alpha	IUMD	UMD	MKT	SMB	HML	RMW	CMA	R-squared
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Table 7: UMD Extreme Months

This table shows losses of Carhart's [1997] momentum factor (UMD) and the corresponding returns of the market in the previous year, the market in the same month, and the risk factor based on idiosyncratic momentum (IUMD) in the same month.

Note that there is a minor difference in the UMD factor between author's data and the data used for replication. However, the inferred result generally still holds. Returns from IUMD are usually less negative than UMD.

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Figure 1: Average returns

This chart shows the average returns (annualized, percent) and t-stats for the value-weighted long–short portfolio (WML) formed on idiosyncratic momentum (IMOM) and traditional momentum (MOM) up to 12 months after formation.

Results are similar to the original paper. IMOM portfolio generates higher and more significant returns than MOM portfolio.

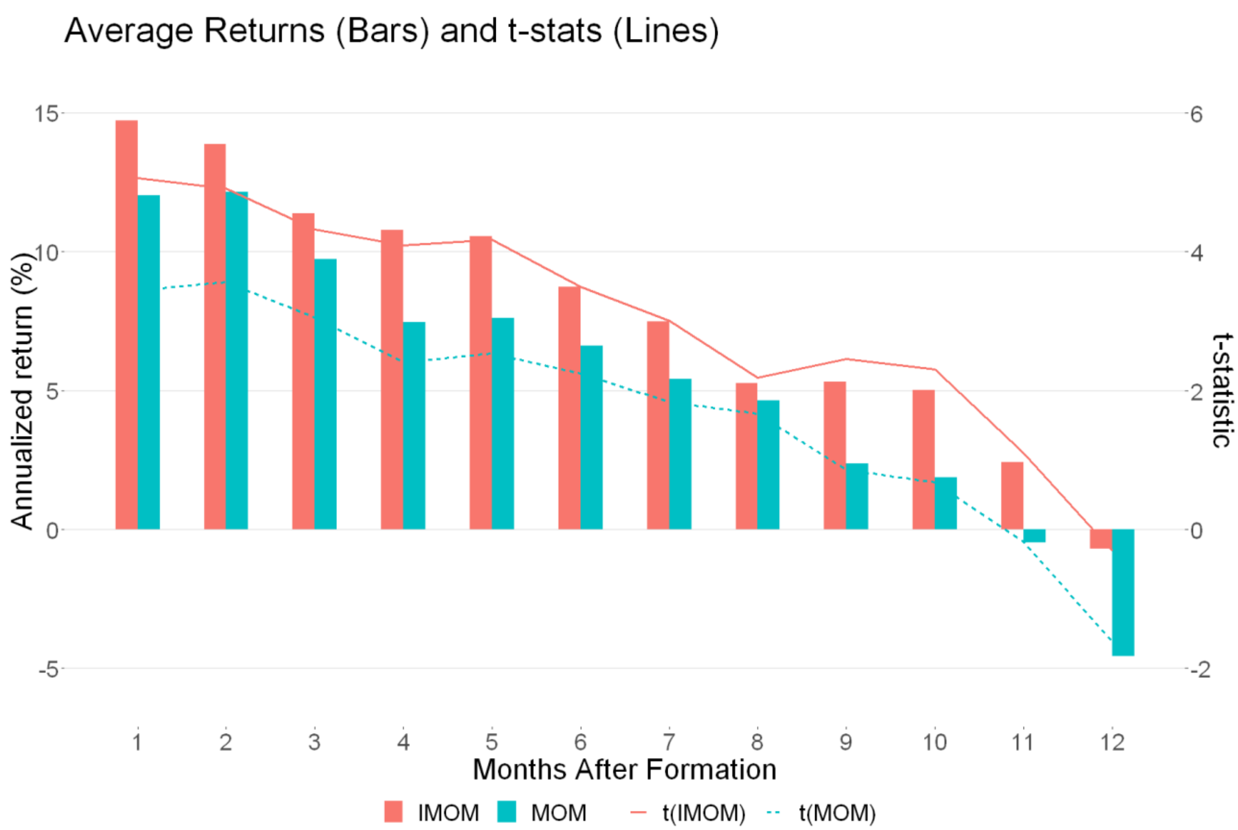


Figure 2: Four factor alphas

This chart shows four-factor alphas (annualized, percent) and t-stats for the value-weighted long–short portfolio (WML) formed on idiosyncratic momentum (IMOM) and traditional momentum (MOM) up to 12 months after formation.

Note that the 4-factor alpha for the 1st month is much lower than the original paper. This is likely due to a higher correlation between IMOM portfolio and UMD factor than the original paper.

However, the inferred result still holds as IMOM portfolio generates higher and most significant alphas than MOM portfolio.

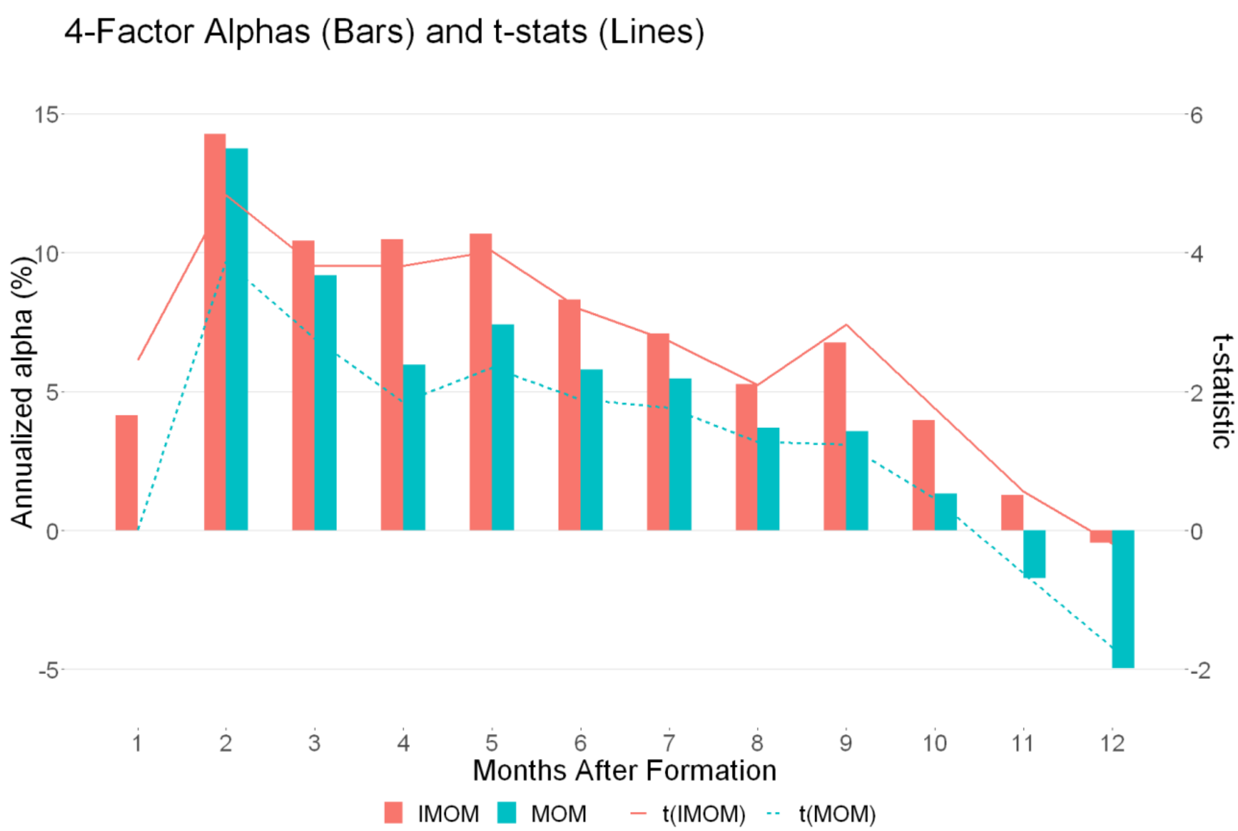


Figure 2.1: Five-factor alphas

This chart extends the figure 2 to five-factor alphas (annualized, percent) and corresponding t-stats for the value-weighted long–short portfolio (WML) formed on idiosyncratic momentum (IMOM) and traditional momentum (MOM) up to 12 months after formation.

Even when extend to the five-factor model, the result still holds. IMOM portfolio still generates higher and most significant alphas than MOM portfolio. This confirms IMOM achieve superior performance than MOM between 1965 and 2011.

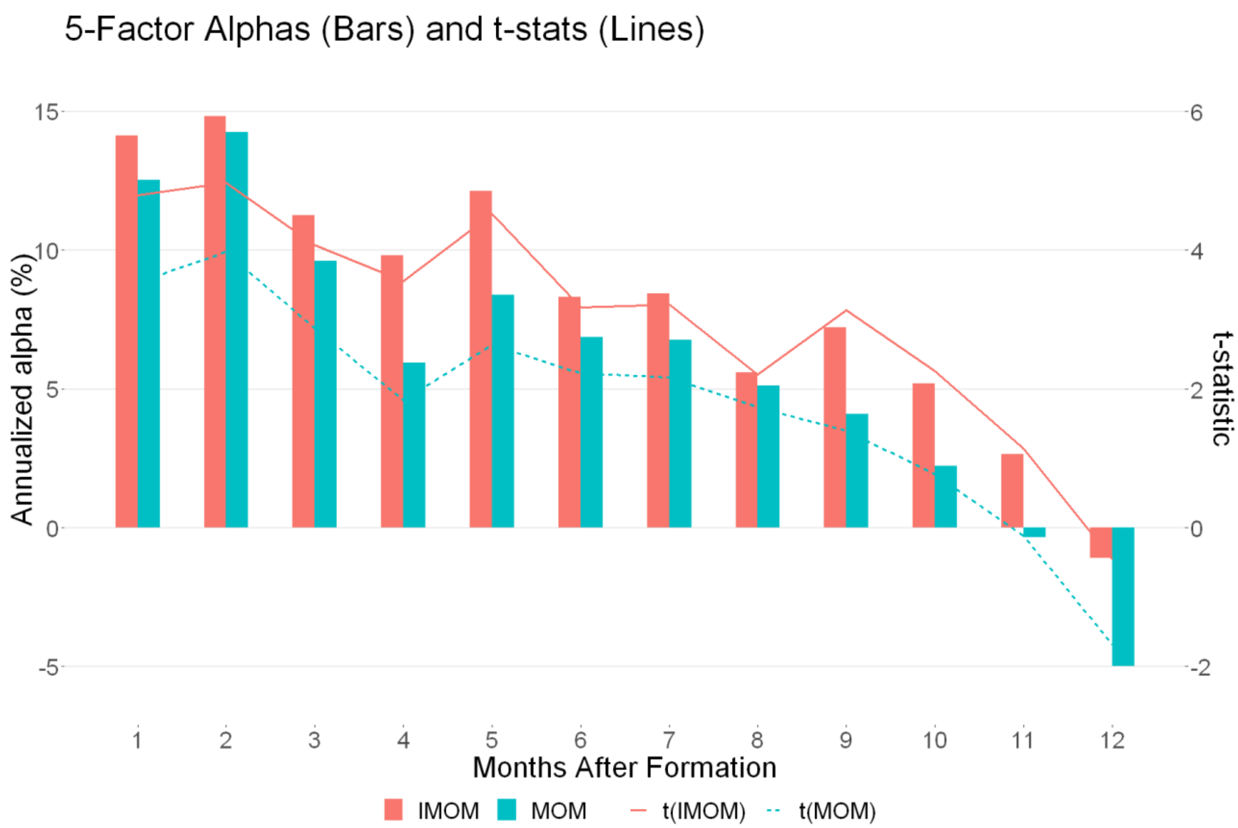
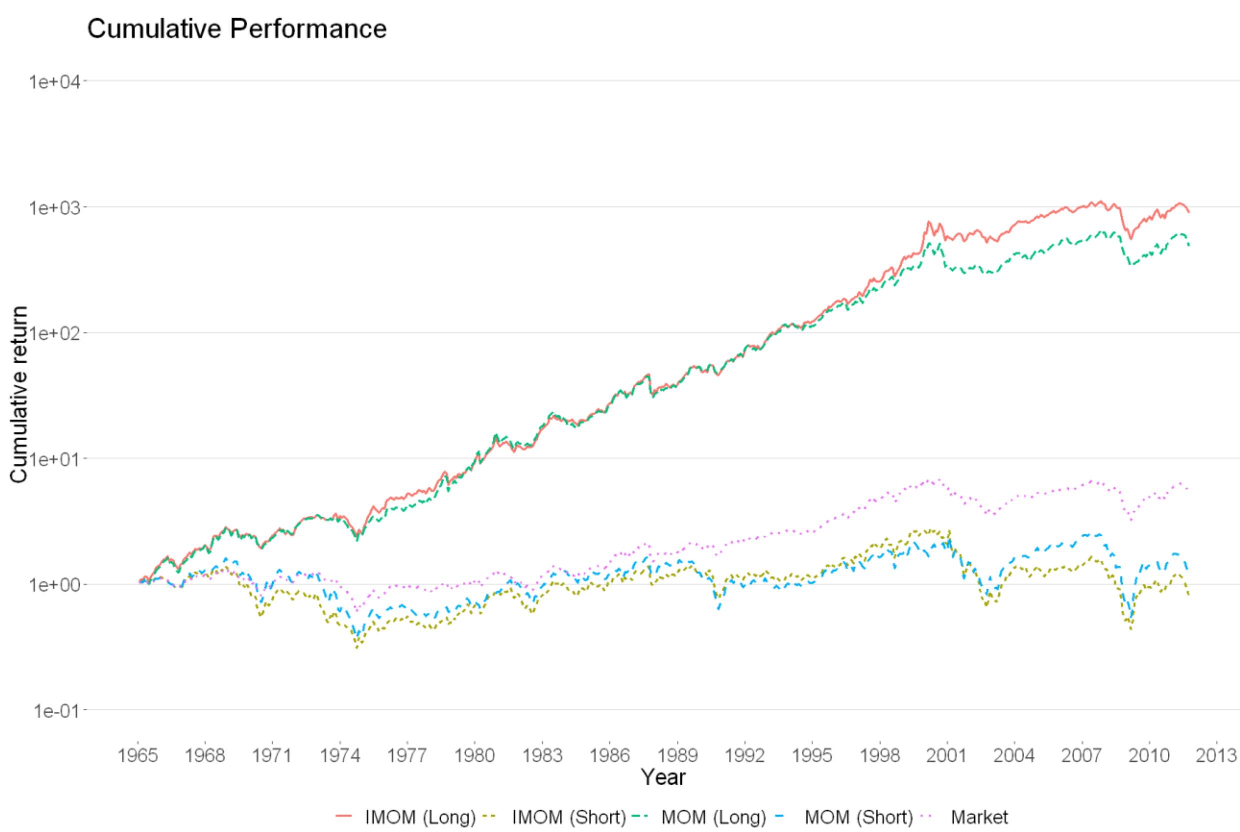


Figure 3: Cumulative Performance

This chart shows the cumulative performance of $1 invested in January 1965 in each of five portfolios: market, long and short legs of value-weighted long–short portfolio (WML) based on IMOM and MOM.

Note that value weighted WML portfolio is used instead of UMD and IUMD factor because it places less emphasis on small cap stock. Performance would be more similar to an investable portfolio on this strategy.

The result is similar to the original paper. IMOM long portfolio generally outperform the MOM long portfolio, while IMOM short portfolio generally underperform the MOM short portfolio. Moreover, this also confirms with the original paper that the most return form IMOM are from the long portfolio.



Out-of-Sample Result

This section attempts to reproduce the evidence for out-of-sample data. Out-of-sample data span from Jan-2012 to Dec-2019, which is after the paper was published.

However, in the following tables, it can be observed that this strategy no longer produces superior performance compared to traditional momentum signals.

Table 1a: WML Portfolios

This table reports excess returns (annualized, percent) and t-stats (in parentheses) for the five sorted portfolios and the long–short portfolio (WML).

The long–short portfolio (WML) no longer produces a significant return. The portfolios no longer show a monotonic increasing pattern.

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Table 2a: WML Portfolios Factor Regressions

This table reports alphas (annualized, percent), coefficients, and t-stats (in parentheses) for regression of the long-short portfolio (WML).

The alphas are insignificant for CAPM, 3-factor, 4-factor and 5-factor model for both equal-weighted and value-weighted portfolios.

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Table 3a: WML Portfolios in Size Groups

This table repeat table 3 with out-of-sample data.

The alphas produce by IMOM portfolio are insignificant and generally less than that of MOM portfolio. This shows that IMOM portfolios is no-longer superior to MOM portfolios.

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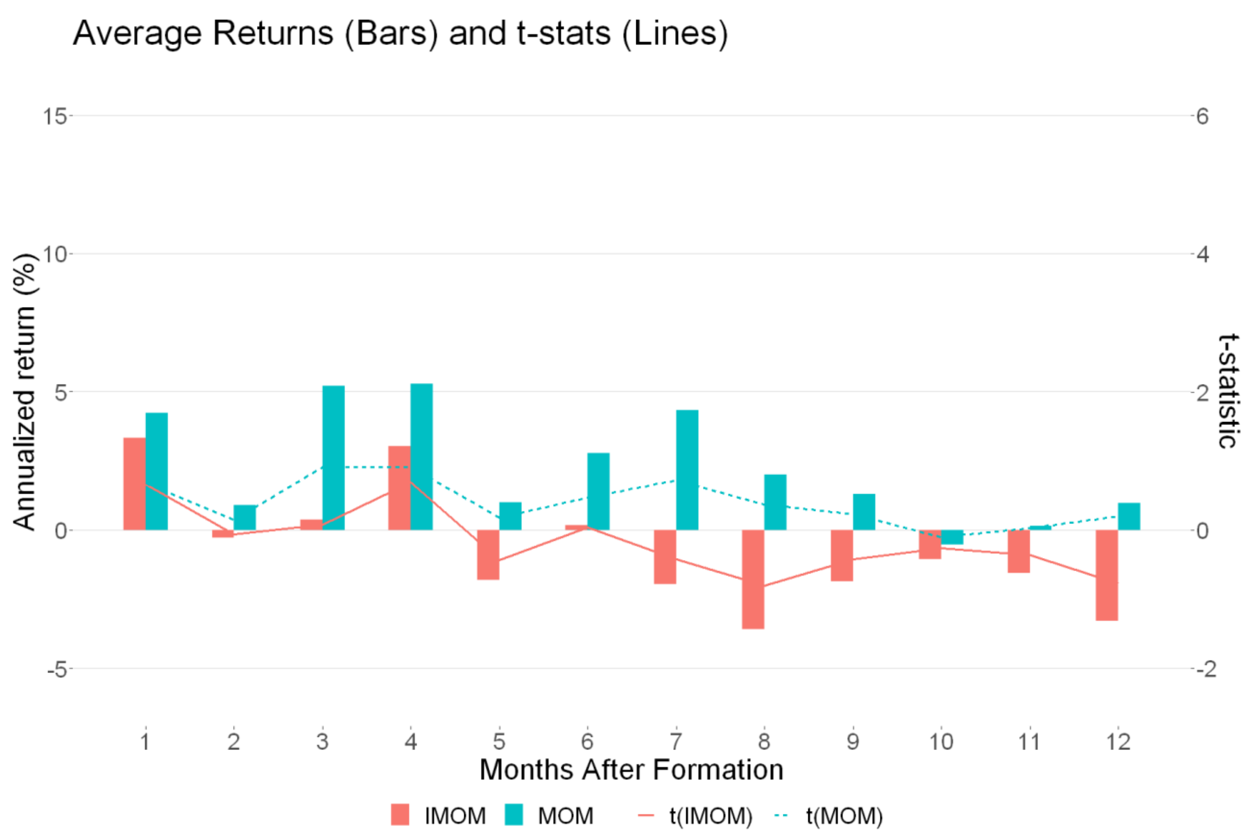
Figure 1a: Average returns

This chart shows the average returns (annualized, percent) and t-stats for the value-weighted long–short portfolio (WML) formed on idiosyncratic momentum (IMOM) and traditional momentum (MOM) up to 12 months after formation.

Similar to above, IMOM returns is consistently lower than that of MOM.



Extension to Five-Factor Idiosyncratic Momentum

This section attempts to extend the strategy to use Fama-French five-factor model to produce the idiosyncratic return instead of CAPM. The five-factor idiosyncratic return $\epsilon_{i,t}^{5f}$ is defined as below.

$$r_{i,t} - r_t^f = \alpha + \beta_{mkt}\left(r_t^M - r_t^f\right) + \beta_{smb} r_t^{SMB} + \beta_{hml} r_t^{HML} + \beta_{rmw} r_t^{RMW} + \beta_{cma} r_t^{CMA} + \epsilon_{i,t}^{**}$$

$$\epsilon_{i,t}^{5f} = \max\left(\epsilon_{i,t}^{**}, -0.99\right)$$

Similarly, the five-factor idiosyncratic momentum $5F\_IMOM_{i,t}$ is the cumulative five-factor idiosyncratic return of the past months.

$$5F\_IMOM_{i,t} = \prod_{j=2}^{12}\left(1 + \epsilon_{i,t-j}^{5f}\right) - 1$$

The following table summarize the performance the strategy using both in-sample data and out-of-sample data. 5F_IMOM is found to be inferior to IMOM for in-sample data, while 5F_IMOM does not generate significant alpha for out-of-sample data.

Table 8.1: Five-factor IMOM Summary (In-sample)

This table reports excess returns (annualized, percent) and t-stats (in parentheses) for the five sorted portfolios and the long–short portfolio (WML). In-sample data.

It can be observed that the long-short portfolio (WML) can generate significant return and there exist a monotonically increasing pattern. Five-factor idiosyncratic momentum seems to be a valid strategy. However, the return is much smaller and less significant than that of the original IMOM strategy. 5F_IMOM is not able to improve performance.

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Table 8.2: Five-factor IMOM Factor Regressions (In-sample)

This table reports alphas (annualized, percent), coefficients, and t-stats (in parentheses) for regression of the long-short portfolio (WML). In-sample data.

Similarly, 5F_IMOM alphas is less significant than IMOM alphas. It can be observed on the 3rd and 7th row that 5F_IMOM is much highly correlated with traditional momentum (UMD). The regression on these 2 rows produce higher R squared and t-value for UMD factor, compare to similar regression with IMOM. Similar increase in correlation can also be observed for RMW and CMA factor.

The large correlation with other factor in 5F_IMOM may be the cause for it to underperform compare to IMOM.

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Figure 4.1: Five-factor IMOM P/L Curve (In-sample)

This chart shows the cumulative performance of value-weighted and equal-weighted WML 5-factor-IMOM portfolios. In-sample data.

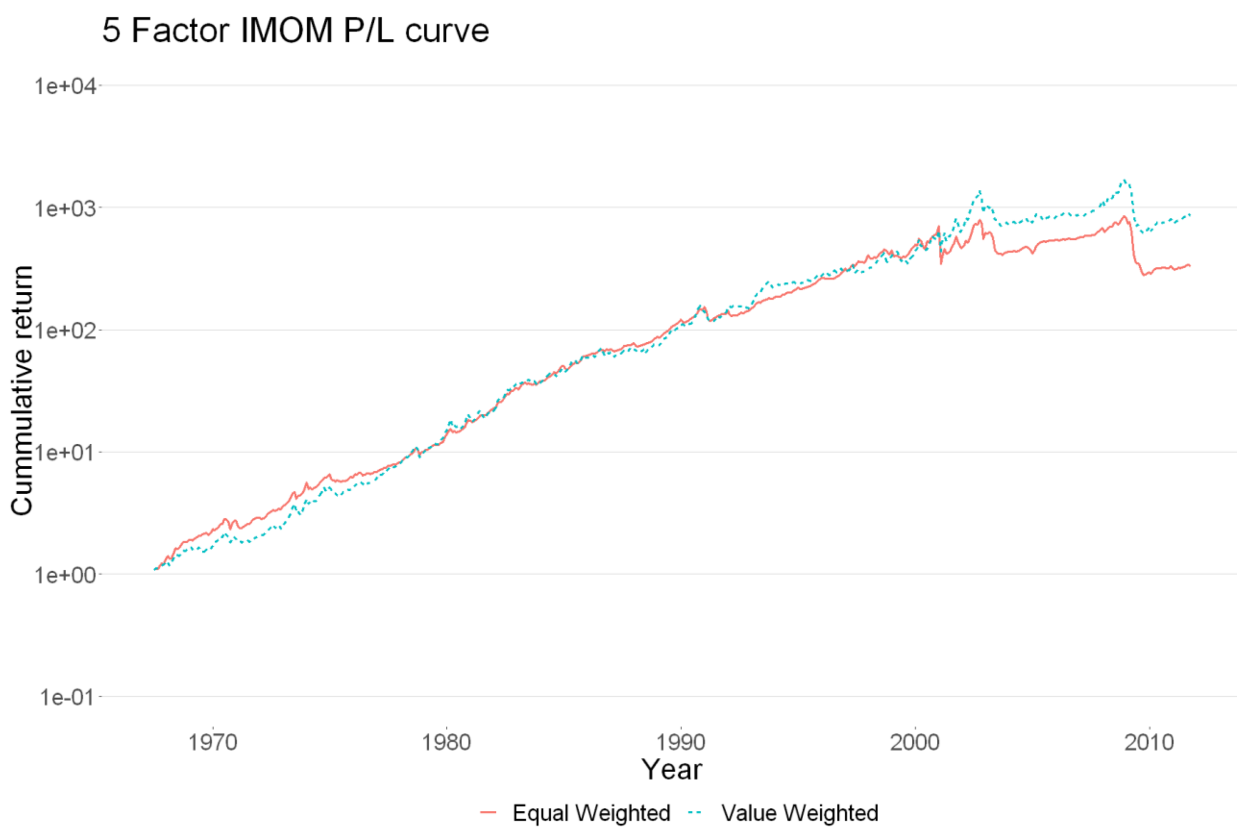

Figure 4.2: Five-factor IMOM Cumulative performance (In-sample)

This chart shows the cumulative performance of $1 invested in January 1965 in each of five portfolios: market, long and short legs of value-weighted long–short portfolio (WML) based on 5-factor-IMOM and IMOM. In-sample data.

It can be observed that 5F_IMOM long portfolio do not outperform IMOM long portfolio, while IMOM short portfolio generally underperform 5F_IMOM short portfolio. Therefore, 5F_IMOM is inferior to IMOM.

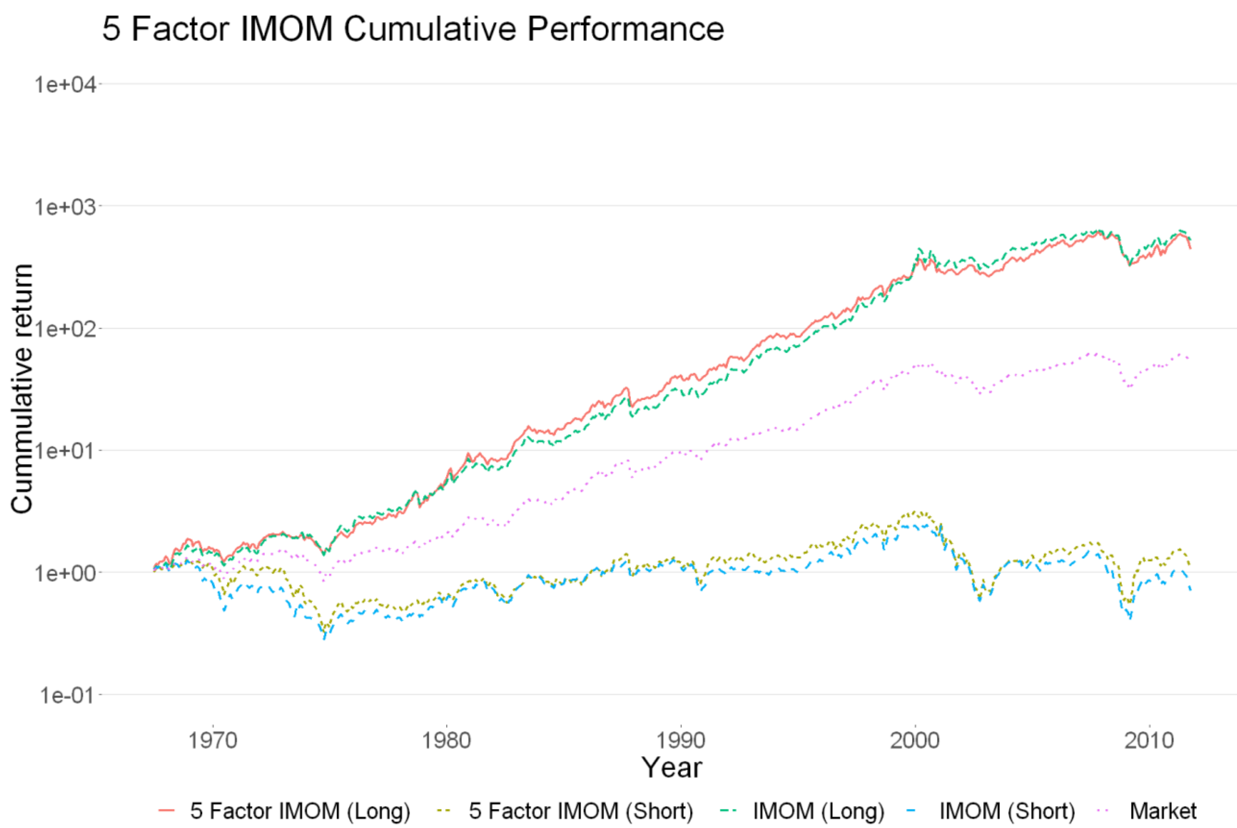

Table 8.1a: Five-factor IMOM Summary (Out-of-sample)

This table reports excess returns (annualized, percent) and t-stats (in parentheses) for the five sorted portfolios and the long–short portfolio (WML). Out-of-sample data.

Similar to IMOM, the 5F_IMOM long–short portfolio (WML) no longer produces a significant return. The portfolios no longer show a monotonic increasing pattern.

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Table 8.2a: Five-factor IMOM Factor Regressions (Out-of-sample)

This table reports alphas (annualized, percent), coefficients, and t-stats (in parentheses) for regression of the long-short portfolio (WML). Out-of-sample data.

Similar to IMOM, the 5F_IMOM alphas are insignificant for CAPM, 3-factor, 4-factor and 5-factor model for both equal-weighted and value-weighted portfolios.

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Conclusion

This article verified that idiosyncratic momentum strategy produced by Chaves is valid during the time of publication. However, this strategy was rapidly traded by the market and is no longer able to produce significant alpha currently.

Moreover, this article also shows that five-factor idiosyncratic momentum is inferior to that idiosyncratic momentum produced by Chaves.

References

Chaves, D. B. (2012). Eureka! A momentum strategy that also works in Japan. *A Momentum Strategy that Also Works in Japan (January 9, 2012)*.