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**Short-Term Reversal style description:**

Short-Term Reversal is a highly documented zero-investment strategy which was primarily introduced through Narasimhan Jagadeesh’s 1990 body of work that used an exhaustive approach to prove the effectiveness of the strategy. The study uses Fama (1970), Fama and French (1988), and Lo and MacKinlay (1988) as a jumping point for the work, suggesting that although those bodies of work yielded significant results, there is not much certainty that there is economic differences among the strategies. Later on, other works were made to explore short-term reversal and secure its place as a well-researched and documented strategy. Researchers like Hameed, Huang, and Mian (2009), Da, Liu, and Schaumburg (2011, 2014), and Gulen, Woeppel (2022) have dove deeper into the strategy and what makes it efficient to provide detailed information on its idea, how measurements are taken, portfolio formation, and general other comments made during research.

Jagadeesh first used an empirical test with a fitted multivariate OLS regression model to predict returns, citing highly correlated, dependent estimates, thus not sticking to Fama’s original market efficiency regression model. This initial test, when January was left out, due to the highly documented market anomaly in that sphere, garnered a model full with highly correlated, often significant estimates. It was also important to note that the suggestions that the empirical model’s significance was not generated by market anomalies in January. Through this study, the style became a point of discussion in the academic literature and community and a more common definition of it began to circulate and be adopted. It is described as a zero-investment strategy in which stocks are sorted for each month in deciles based on previous month returns. Then stocks are bought, sorted at the bottom decile, and sold at the top decile. It has also been specified in some bodies of research that this strategy, like general well-performing strategies, are comprised of intra-industry positions. In more general terms, stocks are selected according to the previous time period’s, which is usually a month, losers in terms of relative performance, rather than absolute and other, well performing stocks in the previous period are shorted. This month-long period aids in the coining of the “short-term” name, as other strategies focus on the long-run returns of stocks. In terms of trading and investment strategy, this seemingly simple strategy yields high returns, but could possibly succumb to the pitfalls seen by overactivity of investors due to the short timeframe of investing and stock picking.

It is first important to discuss the composition of the portfolios under this strategy. Jagadeesh composed the portfolios for his body of work with high precision by ranking stocks according to the previous month’s performance, split by decile, and assigned equal weight in ten predictive portfolios by rank. These rankings are re-evaluated on a monthly basis. Since this strategy is somewhat designed to try to minimize the response to overreaction on news regarding individual stocks, these re-evaluations help to minimize that. However, this strategy is prone to being affected by bid-ask bounce, which Hameed, Huang, and Mian (2009) tried to correct in their work. The work states that specifically, they “rank stocks based on their returns during the first 25 days of month t and examine the contrarian returns during month t+1.” This allows for them to hopefully skirt around the effects induced by bid-ask bounce. This work also specifies the need for intra-industry investing for returns, focusing on true diversification. These strategies for portfolio formation seemingly are carried throughout all succeeding research by other researchers, so other results can be compared without much issue.

Jagadeesh’s body of work focuses on the usage of differing strategies with respect to lagging. The first strategy used out-of-sample return values as predicted by:

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The second and third strategies, however, were used with lagged values, lagging strategy two by one month and strategy three by one year. A large portion of Jagadeesh’s results are summarized by abnormal return percentages. With the inclusion of all these values for each portfolio, P1 through P10 based off the previously discussed strategy, both strategy one and two not only had statistically significant results, but economically significant results, which was the main goal of the paper he wrote – to prove statistical significance does not mean much in the context of economical significance. Showing significance in strategy one and two show the higher percentages of abnormal returns came from the strategies focusing on those short-term time periods. It is important to note at this point that Jagadeesh’s work was instrumental in proving and explaining short-term reversal strategy, therefore, in this case, while examining short-term reversal, it is natural to deep-dive into Jagadeesh’s 1990 paper. This then allowed measurements to be taken by other researchers using the short-term reversal strategy.

While Jagadeesh focused mainly on the abnormal returns, the 2009 work by Hameed, Huang, and Mian looked further into the strategy’s intra-industry return reversals. This measurement stayed steady throughout adjustments for risk and other economic factors, making it the metric of choice for the work. With this, they were able to make comparisons to a benchmark and prove success of the strategy. However, this body of work focused more on the industry that the relevant stocks were being picked from and ensured that there was a neutral zone in the stock picking. Da, Liu, and Schaumburg (2011) were able to create proxies such that they were able to prove the success of the strategy, citing short-term reversal was able to mitigate the effects of investor overreaction (the sentiment explanation) and the effects of the general demand curve. Their focus on controlling for discount rates and cash flow news allowed them to realize profits from buying losers on the lagged information controlling for illiquidity and volatility of big indices. The successive nature of these bodies of work after Jagadeesh set the standard for short-term reversal work allowed for the evidence found in this work to show the realization of approximately 1.5% returns using the strategy clearly with stated assumptions.

The expansive literature provided on short-term reversal details the entire process of setting up the strategy as a valid one, then fine-tuning it such that investors can realize even higher returns. Jagadeesh was able to prove that the ranking of portfolios in the short term and re-evaluating them month by month to come up with the composition of the portfolio was effective. Showing intra-industry diversification and then controlling for other common market effects work in conjunction with the general structure of the strategy allowed the solidification a seemingly simple strategy as one that consistently allows for greater than expected predicted and actual returns. In all, this highly documented strategy works well for those highly involved investors who want to avoid certain market pitfalls and attempt to minimize other behavioral investing factors.

**2. Full Sample Summary Statistics:**

We have made the following assumption to help us perform the statistical analysis:

Assumptions:

1. We used data only after 1926 July(including) as RF was not given for those periods.

For our regression analysis, we used R tool to determine the statistic summaries. The following procedure was used to calculate:

1. **Mean**: We calculated the average of respective deciles from Low to High
2. **Standard Deviation**: Standard deviation function was used to calculate respective decile values.
3. **Sharpe Ratio**: We took the cumulative return of the monthly returns and the cumulative of the risk-free returns and divided it by the respective decile.
4. **CAPM estimates**: We calculated the excess returns by deducting the risk-free rate from the monthly returns. We then used this value, the market return obtained from our secondary research and the risk-free rate provided to calculate the and values for the CAPM model.
5. **Fama French estimates:** The additional two risk factors make this model more flexible relative to CAPM. The rationale is high value and small cap companies tend to outperform the overall market. Hence, we use the provided data for SMB and HML in our equation against the monthly returns and risk-free rate to estimate the coefficient s. The error term is assumed to be zero

The results for the **value-weighted** portfolios:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | St. Dev | Sharpe Ratio | CAPM alpha | CAPM beta | FF alpha | FFbeta1 (MKTEX) | FFbeta2 (SMB) | FFbeta3 (HML) |
| Dec 1 (low) | 0.013749 | 0.08609 | -2.93261 | -0.2638 | 1.7113 | -0.2638 | 1.6129 | 0.0068 | -0.001937 |
| Dec 2 | 0.01141 | 0.068175 | -3.737633 | -0.2646 | 1.4754 | -0.2644 | 1.4217 | 0.0044 | -0.001906 |
| Dec 3 | 0.011139 | 0.060287 | -4.231155 | -0.2641 | 1.3619 | -0.2636 | 1.3441 | 0.0031 | -0.002606 |
| Dec 4 | 0.01027 | 0.056312 | -4.545487 | -0.2647 | 1.3102 | -0.2642 | 1.2959 | 0.0028 | -0.0025 |
| Dec 5 | 0.010113 | 0.05547 | -4.616947 | -0.2648 | 1.3027 | -0.2644 | 1.2936 | 0.0023 | -0.002283 |
| Dec 6 | 0.009912 | 0.05358 | -4.783453 | -0.2648 | 1.2744 | -0.2642 | 1.2705 | 0.0024 | -0.002736 |
| Dec 7 | 0.009643 | 0.05530 | -4.639696 | -0.2652 | 1.3028 | -0.2650 | 1.2881 | 0.0020 | -0.001515 |
| Dec 8 | 0.009041 | 0.05717 | -4.498267 | -0.266 | 1.320 | -0.2657 | 1.3096 | 0.0020 | -0.001786 |
| Dec 9 | 0.008302 | 0.061318 | -4.20633 | -0.267 | 1.370 | -0.2668 | 1.3436 | 0.0027 | -0.001633 |
| Dec 10 (High) | 0.005184 | 0.069017 | -3.7823 | -0.2707 | 1.4551 | -0.2706 | 1.3848 | 0.0051 | -0.001653 |
| Dec 10-Dec 1 |  |  | -4.5581 | -0.00686 | -0.2562 | -0.00682 | -0.2281 | -0.00173 | 0.000284 |
| t-stat(d10-d1) | -7.2245 | xxxx | xxxx | -1.2321 | -2.2348 | -3.915 | -6.574 | -3.020 | 0.571 |

The results for the **equal-weighted** portfolios:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | St. Dev | Sharpe Ratio | CAPM alpha | CAPM beta | FF alpha | FFbeta1 (MKTEX) | FFbeta2 (SMB) | FFbeta3 (HML) |
| Dec 1 (low) | 0.026426 | 0.10679 | -2.2453 | -0.2524 | 1.8957 | -0.2541 | 1.5533 | 0.01638 | 0.002307 |
| Dec 2 | 0.015029 | 0.08104 | -3.0998 | -0.2622 | 1.6497 | -0.2631 | 1.4225 | 0.0115 | 0.000723 |
| Dec 3 | 0.013247 | 0.07451 | -3.3953 | -0.2633 | 1.5598 | -0.2642 | 1.3519 | 0.010568 | 0.000634 |
| Dec 4 | 0.012282 | 0.06793 | -3.7385 | -0.2636 | 1.4569 | -2.643e-01 | 1.274e+00 | 9.809e-03 | -5.071e-05 |
| Dec 5 | 0.012197 | 0.06753 | -3.7612 | -0.2638 | 1.4646 | -0.2645 | 1.2830 | 0.00929 | 0.0004796 |
| Dec 6 | 0.011713 | 0.06385 | -3.9856 | -0.2639 | 1.4110 | -2.645e-010 | 1.250e+00 | 8.609e-03 | -3.893e-05 |
| Dec 7 | 0.010744 | 0.06580 | -3.8821 | -0.265 | 1.428 | -0.2657 | 1.2508 | 0.0090675 | 0.0004526 |
| Dec 8 | 0.010008 | 0.06799 | -3.7683 | -0.2659 | 1.4612 | -0.2667 | 1.2800 | 0.0091875 | 0.0005842 |
| Dec 9 | 0.010008 | 0.07015 | -3.6828 | -0.2682 | 1.4865 | -0.26894 | 1.305646 | 0.0094997 | 0.000177 |
| Dec10 (High) | 0.0009362 | 0.07872 | -3.3700 | -0.2756 | 1.5505 | -0.27637 | 1.32162 | 0.01242 | -0.0002589 |
| Dec10-Dec 1 |  |  | -4.6614 | -0.0232 | -0.3452 | -0.02228 | -0.2317 | -0.003964 | -0.002566 |
| t-stat(d10-d1) | -9.2833 | xxxx | xxxx | -4.1231 | -6.5362 | -12.941 | -6.754 | -6.990 | -5.210 |

**3. Partial Period Analysis:**

We found the following mean returns for Decile 1, Decile 10 and for the spread portfolios over the given sub-periods:

The following are the results for the **value-weighted** portfolios:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1960s | 1970s | 1980s | 1990s | 2000s | 2010s | Recessions | Expansions |
| Dec 1 (low) | 0.009708 | 0.0138 | 0.01305 | 0.0113 | -0.00028 | 0.01145 | 0.00804 | 0.01495 |
| Dec 10 (High) | 0.003932 | 0.00445 | 0.00684 | 0.0144 | -0.00304 | 0.00949 | -0.01208 | 0.0088 |
| Dec 10-Dec 1 | -0.00578 | -0.00935 | -0.00622 | 0.0031 | -0.00275 | -0.0020 | -0.0201 | -0.0061 |
| t-stat (d10-d1) | -4.5633 | -8.9872 | -6.4839 | -4.3445 | 0.0324 | -3.123 | -2.1230 | 1.2323 |

And, the following are the results for the **equal-weighted** portfolios:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1960s | 1970s | 1980s | 1990s | 2000s | 2010s | Recessions | Expansions |
| Dec 1 (low) | 0.019339 | 0.031286 | 0.01798 | 0.0289 | 0.01623 | 0.01028 | 0.030648 | 0.02553 |
| Dec 10 (High) | 0.003736 | -0.00388 | -0.000334 | 0.0068 | 0.00312 | 0.00548 | -0.02265 | 0.00591 |
| Dec 10-Dec 1 | -0.01560 | -0.03517 | -0.01831 | -0.0221 | -0.0131 | -0.0048 | -0.05330 | -0.0196 |
| t-stat (d10-d1) | -4.6743 | -8.5525 | -5.2352 | -3.2353 | -0.0925 | -2.1085 | 0.00233 | 0.2045 |

Commenting on these results, we find that our dominant strategy is not short-term reversal. Because it proves to be a very risky approach, with limited potential returns. Risky strategies must be coupled with higher expected returns to be competitive with safer alternatives.

Since this is not the case, we recommend to any investors to invest capital in the December 1st (low) portfolios. Because these portfolios are the most competitive with returns against their risk.

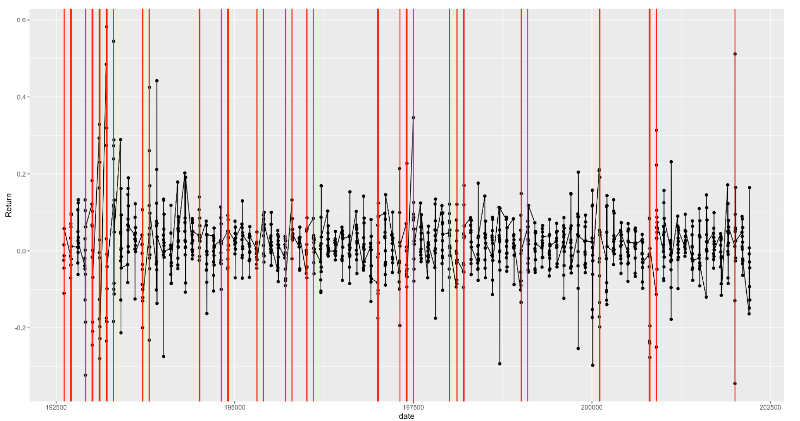
**4. Time-Series Plot:**

i). Decile 1 and Decile 10

The monthly returns to decile 1 and decile 10 portfolios are plotted as below and recession periods are highlighted with vertical lines. To showcase the impact of recession on returns for each decile at a more granular level, we have taken a sample of data only from 1960 to 1969

Value weighted portfolio:

* **A picture containing antenna

  Description automatically generated**Decile 1 Sample data for period of 1960-1969
* **Chart

  Description automatically generated**Decile 10 Sample data for period of 1960-1969

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Equal weighted portfolio:

* Decile 1 Sample data for period of 1960-1969

**Chart, line chart

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Description automatically generated**

* Decile 10 Sample data for period of 1960-1969

**Chart, histogram

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ii). Spread Portfolio

Similarly, the monthly returns of spread portfolios are plotted as below and recession periods are highlighted with vertical lines. To showcase the impact of recession on returns for spread portfolio at a more granular level, we have taken a sample of data only from 1960 to 1969

Value weighted portfolio:

**A picture containing antenna

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Description automatically generated** Sample data for period of 1960-1969:

Equal weighted portfolio: Sample data for period of 1960-1969:

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**5 Additional Tests**:

A supplementary test was conducted on whether or not the mean decile return values for positions had a significantly different value from that of the hypothesized mean as found in the literature reviewed above. Through t-testing, a very insignificant t-statistic and p-value were garnered testing a difference from those mean values to a 1.5% return. This suggests that there is no economic or statistical significant difference (higher or lower) between the data tested here and the data used to yield the original estimate in Jagadeesh’s 1990 study and studies succeeding that.