ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis [programme Financial Economics]

Residual Momentum on Dividend Paying Equities

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Date final version: October 12, 2021

Table of Contents

1. Residual Momentum on Dividend Paying Equities

1.1 Momentum Strategies

Trading strategies that buy past winners and sell past losers are well known within the finance industry as they show evidence of generating positive abnormal returns. One prominent trading strategy is the momentum strategy pioneered by Jagadeesh and Titman (1993) which was introduced in their seminal work on total return momentum strategy. In their paper, they illustrate that selecting stocks based on past six-month return and subsequently holding that portfolio for the next six-months, realizes a compound excess return of 12% per year on average (Jagadeesh & Titman, 1993). However, these positive returns are short-lived. Their detailed analysis on momentum strategies also indicates that gains in the year after the portfolio formation disappear within the following two years. The insight presented in their influential paper led to their theory being implemented by practitioners, but as well to new findings within academic literature. Subsequent literature, such as the research conducted by Blitz et al. (2011) builds on the momentum strategy by focusing on residual momentum. They leverage on the portfolio formation process pioneered by Jagadeesh and Titman (1993) by constructing deciles using monthly, quarterly, semi-annual, and yearly holding periods. Though Blitz et al. (2011) emulate the portfolio formation process, they do not use price momentum to rank stocks, instead they use an alternative innovative way to rank the stocks within deciles. Furthermore, they obtain residual returns for each stock based on Fama and French (1993) factors. By doing this they effectively create an approach to isolate the stock specific component of momentum. This approach ultimately resulted in twice as large risk-adjusted profits, compared to the total return momentum (Blitz et al., 2011). Furthermore, residual momentum illustrates lower exposure to common factors such as market, value, and size which results in lower volatility. In contrast, the total return momentum is susceptible to overweighing on small cap stocks during the portfolio formation,

particularly on expansionary periods resulting in significant exposure to the size factor. In addition, the residual momentum strategy outperforms total return momentum during contractionary periods (Lin, 2019).

Residual momentum has been proven to be superior to the total return momentum when considering all domestic primary stocks listed on the New York (NYSE), American (AMEX), and Nasdaq stock markets (Blitz et al., 2011). It has also shown outperformance for stocks listed in the Chinese equity markets where residual momentum generated an annualized return of 10.6% as opposed to price momentum strategy which fails to generate any significant profits (Lin, 2019). Furthermore, when extended to other Asian markets such as Thailand, Hong Kong, Singapore and Taiwan, residual momentum generates higher and more consistent returns than the conventional momentum strategy (Chiao et al., 2020). The proliferation of evidence around global markets where residual momentum is superior to price momentum suggests the notion that residual momentum is a phenomenon that can anticipate returns in both emerging equity markets, as well as in established equity markets.

1.2 Dividend Investing

On the other spectrum of investing strategies lies dividend investing where investors buy equities with above average yield returns with a focus on dividend persistence and sustainability. These investment strategies are often considered as a subset of value investing, as these equities appear to possess inherently higher quality, leading to an underpricing when compared to their fundamental analysis. Dividend investing exhibits lower risk than the market average and outperforms the market over the long run (Clemens, 2013). Furthermore, Fama and French (1988) also posit an increasing predictive power of dividend yield for longer time horizons. They illustrate that dividend yields explain less than 5% of variances of monthly or quarterly returns. However, they show interesting evidence that dividend yields of

expected returns are more prominent in a longer time horizon of returns and conclude that "dividend yields often explain more than 25% of the variances of two- to four-year returns" (Fama and French, 1988, p. 24). In a contrarian notion however, Black and Scholes (1974) suggest that a dividend should not have any effect on a company's stock price, as the dividend payment does not add inherent value to the company. Further research supports this trajectory as it suggests that stocks with higher dividend yields tend to have fewer growth opportunities (Naranjo et al., 1998). Despite the opposing views, it is evident that dividend investing is a viable and relevant investing strategy which is attractive for investors. Beyond sharing similar characteristics of value investing and low volatility investing, the stickiness of dividends may also contribute to the attractiveness and the continued persistence of excess performance for dividend investing (Clemens, 2013). Analogous to how dividends influence returns in the long-run, profits generated on residual momentum have also shown to be persistent on average for at least two years (Lin, 2019) and have limited overlap with Fama and French factors (Blitz et al., 2011). These advances in the academic literature provide robust evidence which further underpins the superiority of the residual momentum trading strategy over the total return momentum.

1.3 Residual Momentum on Dividend Paying Equities

Research shows that dividend investing in the long run provides low volatility and above average market returns (Clemens, 2013). It also provides the benefit of frequent dividend payments which is attractive to the investor. On the other hand, there is extensive evidence that residual momentum can generate profits which do not exhibit reversal for longer term holding periods (Lin, 2019). The combination of these two notions leads to an interesting area of exploration and the concept where these two strategies could be integrated into a single trading strategy. This integrated strategy would combine the benefit of dividend

investments and should simultaneously obtain excess returns with reduced volatility yielded by the residual momentum formation process. This is intriguing due to the intersection of two popular investing strategies, momentum investing and dividing investing. The deficiency of traditional momentum trading for long-term investors is its mean reversion of returns in the long run. However, by leveraging from residual momentum, the hypothesis of this paper is that more robust portfolios can be created which generate positive returns for longer time horizons. The benefit of momentum strategy lies on one side, while on the other the benefit of dividend investing which exhibits lower volatility and outperforms the market in the long run (Clemens, 2013). The combination of these two investing strategies in a single investing strategy is a novel notion within factor investing. Moreover, if this strategy is successful in generating above average returns for longer time horizons it would be the first of its kind.

This new strategy is intended to exhibit low volatility, provide stable cash flow via frequent dividend payments beyond consistently generating positive risk adjusted returns in the long term. The portfolio structure under this investing strategy consists exclusively of dividend paying equities, built with the residual momentum factor modeled by Blitz et al. (2011). Furthermore, portfolios constructed on the total return momentum as presented by Jagadeesh and Titman (1993) are also assessed. The analysis and research of this paper seeks to establish empirical evidence for the following hypotheses. The first hypothesis is that a portfolio can be generated exclusively from dividend paying equities that provides both excess returns and a stable stream of dividend income. The second hypothesis extends on the first, as it explores if the residual momentum portfolio would outperform the total return momentum portfolio built exclusively from dividend paying equities.

The remainder of this paper is organized as follows. Section 2 describes the data and methodology which outlines the construction of the residual momentum and total return momentum portfolios. Section 3 documents the results of the empirical analysis while section

4 conducts a series of robustness checks to ensure the validity of the results. Section 5 concludes the paper.

2. Methodology

2.1 Data

Stock price data is from the Center for Research in Security Prices (CRSP) database. All domestic, primary stocks listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX) and Nasdaq Stock Market are considered for this study. Daily stock prices data is retrieved for all stocks within the selected stock exchanges. The sample period aims to cover a sufficient time span of data to facilitate portfolio formation periods and holding periods. The time frame chosen is from January 1st, 2005, until December 31st, 2020, as this time horizon includes both the global financial crisis of 2007-2008 and the COVID-19 pandemic. The inclusion of these two large drawdowns in the time horizon is important as it adds critical stress periods to the dataset, and thus enhancing the validity of the results and the sustainability of the portfolios. This will show if portfolios are able to survive these crisis periods by being able to generate on average positive returns. The 15-year timeframe also allows for extended holding periods to properly assess if the dividend portfolios continue to provide positive returns in longer holding periods. Complete price history over the sample period is a prerequisite for the equities to be included. Furthermore, equities with stock prices below $1 are omitted to limit the impact of micro capitalization within the sample set. Dividend payment data, such as dividend payment amount and payment date are also collected along their respective stock prices. The additional dividend payment information allows the creation of a dividend payment indicator element, an important element enabling the segmentation of portfolios. The dividend indicator allows the separation of equities into two distinct segments, dividend paying stocks and non-dividend paying stocks. The dataset is

thus enhanced by this dividend payment indicator which enables the exclusion of non-dividend paying equities. To create the dividend indicator the following process is used. First, any entries in the dataset that do not have a dividend payment are removed. The remaining entries are companies that have paid a dividend within the 15 years. The dividend is then averaged by ticker, and the remaining companies create the list for the dividend payment indicator. By applying the two above-mentioned selection criteria to the data, the total number of firms left is 8.981 unique companies. The regressions and portfolio formation are performed on this filtered dataset. The data on common factors of market, size and value are retrieved from the webpage by Kenneth French (French, 2021). The Python programming language is used to conduct all analysis.

2.2 Total Return Momentum

With the dataset properly refined, the dividend paying stocks are segmented into deciles to create ten total return momentum portfolios based on prior performance. The portfolio formation period uses overlapping periods for both the formation itself as well as the holding periods like Jagadeesh and Titman (1993), to increase the power of the tests for the portfolio strategies. Their research showed the most successful strategy was based on building portfolios over the previous 12-month returns and holding these portfolios for three months. Leveraging from this observation, this study also builds the portfolio selection for the total return momentum on the previous 12-month of trading history. The formation period, referred to as the J parameter, represents the period during which the portfolio is evaluated and thus created. Similarly, once the portfolio has been created, the parameter K refers to the holding period for the portfolio strategy. The portfolio formation and holding periods include J-months for the portfolio formation and K-months for how long the portfolio is held (Jagadeesh & Titman, 1993). A 12-month rolling window skipping the most recent

month is utilized to conduct the portfolio formation period. The most recent month is skipped to cancel out the short-term reversal effect. The portfolios are ranked on their performance during the formation period, where the top decile is named the 'winner portfolio'. The winner portfolio houses the top 10% of stocks with the highest yielding return. Similarly, the bottom decile is composed of the 10% worst performing stocks, named the 'loser portfolio'.

To create the ten portfolios, the above-mentioned sample selection criteria is applied to the data. The daily price data per stock is resampled to obtain the last price of each month, for each dividend paying equity. The resampling enables the creation of the 11-month rolling window. The first formation date is defined as January 31, 2006, as the data sample starts on January 1, 2005, and hence allows a 12-month formation period. For each rolling window, the portfolio formation start date is set to 12 months prior to the portfolio formation date. As previously indicated, a 12-month portfolio formation period is utilized skipping the most recent month. The return yielded for each security is then calculated by taking the end price of the stock divided by the beginning price of the stocks and subtracting one. The stocks are then separated into ten portfolios based on their performance and they are held for various holding period lengths as the methodology section outlines. The return of the different constituents of each portfolio is then averaged to get the total return momentum by portfolio, for each holding period length. All portfolios are equally weighted within each decile and the positions are closed out fully at the end of each holding period.

2.3 Residual Momentum

Like the total return momentum, the sample selection criteria are applied to properly refine the dataset to include only dividend paying equities. The cumulative monthly return is calculated for each stock for each month. The dataset is then augmented with the Fama and French common factor of market, size, and value from the Kenneth French website (French,

2021). The risk-free rate is also retrieved from the website to calculate the risk-free returns. The monthly common factors included start on January 1st, 2005, until December 31st, 2020, to match the time horizon of the stock price data retrieved from CRSP. With the dataset including all monthly returns per equity as well as the accompanying risk-free rate, size, market and value factors, a regression analysis can be run to estimate the residuals for each stock over the time horizon.

Equities which meet the criteria above as dividend paying are individually assessed with a Fama and French regression, following the residual momentum formula. The market (Mkt-RF), size (SMB) and value (HML) coefficients are obtained from the regression, to assess the portion of profitability that is attributed to the common factors. To obtain the residuals, the sum of the squared residuals (ssrs) is rendered for the equity leading to the residual factor. This same procedure is conducted for each stock, leading to a residual factor of each stock within the complete universe of dividend-paying equities. With a residual factor for each stock, the equities are then ranked in descending order based on their ssrs value, enabling the construction of deciles. Obtaining the residual returns for each stock based on Fama and French (1993) factors effectively creates an approach to isolate the stock specific component of momentum (Blitz et al., 2011). The first decile consists of the top 10% of securities that have the highest residual momentum factor, this is the 'winner' portfolio. The second decile consists of the second top 10% of stocks with the next highest residual momentum values. This process continues until the last decile, which consists of the bottom 10% of stocks with the lowest residual momentum factor, named the 'loser' portfolio. This method of structuring portfolios leads to creation of ten portfolios based on the following foundation. The winner portfolio of stocks has high residual momentum as their gains have the least overlap with the Fama and French factors. This limited overlap is important as this portfolio is less likely to be affected by market crashes, have more consistent returns, and

generate abnormal returns in recessionary periods (Lin, 2019) when compared to the total return momentum. This is because a larger proportion of the return of the top residual momentum portfolios have less overlap with size, market, or value factors, where total return momentum top portfolios have more exposure to these factors. More specifically, the total return momentum formation period tends to have a higher concentration of high beta and small capitalization stocks on average (Jagadeesh & Titman, 1993), thus overloading on the size factor leading to higher volatility in recessionary periods. The loser portfolio is the group of stocks with the lowest residual factor and thus the highest overlap with Fama and French factors.

With all the dividend paying equities separated into portfolios based on their residual momentum as explained above, the date for the first holding period can be established enabling the creation of a rolling window for different holding periods. The formation date is defined as January 31, 2006, like the total return momentum. The rolling window for different holding periods is constructed and the respective return is calculated with the last price of the stock for each month. The return of the different constituents of each portfolio is then averaged to get the residual momentum return for each portfolio and for each holding period length. All portfolios are equally weighted within each decile and the positions are closed out fully at the end of each holding period.

2.4 Residual Momentum Formula

The regression components are based on the three common risk factors within the returns of equities as outlined by Fama and French (1993). The small minus big (SMB) factor represents the difference between small-stocks and big-stocks with similar book-to-market equities, while the high minus low (HML) coefficient is the difference between the returns of high and low book-to-market with similar weighted average size (Fama & French, 1993;

Fama & French, 2015). The market excess return on the market (RMRF) is the market return minus the risk-free rate, where the risk-free rate is the one-month Treasury bill rate at the beginning of the month (Fama & French, 1993).

Residual returns are estimated following Blitz et al. (2011) methodology, applying the Fama and French (1993) three factor model:

$$r_{i,t} = \alpha_i + \beta_{1,i} RMRF_t + \beta_{2,i} SMB_t + \beta_{3,i} HML_t + \varepsilon_{i,t}$$

The return of a stock in excess of the risk free rate ($r_{i,t}$) can be attributed by its component of $RMRF_t$, SMB_t , HML_t which resemble the market, size and value portfolios respectively. Within this structure, the residual return of stock i in month t is the residual term $\mathcal{E}_{i,t}$. The construction of the residual momentum portfolios leverages from previous momentum research as it models different holding periods.

2.5 Long Strategy and Portfolio Holding Periods

Given that the strategy focuses on dividend paying stocks exclusively, a consequence is that the strategy does not lend itself well to shorting the lowest performing decile. When going long and holding a dividend paying position, one is entitled to the dividend payment made by the institution. On the contrary however, when a short position is taken for a dividend paying stock, the position does not entitle the investor to the dividend payment and as the share is borrowed, the investor shorting the stock can be responsible for paying out any dividends to the lender (The Investopedia Team, 2020). This would in turn increase transaction costs as well as expenses to the strategy if shorting periods were incorporated. Due to this dynamic, the structure of the residual momentum and total return momentum strategies modeled on dividend paying equities are strictly long positions on the winner

portfolio and do not short the loser portfolio. This consideration has the added practical value that for longer holding periods there will be less transactional expenses for the investor.

The trading strategy aims to minimize volatility, maximize returns, and provide a constant stream of income from dividend paying equities. As such, holding stocks for a short amount of time would impede this goal due to increased transaction costs to the practitioner. Longer holding periods can alleviate this concern. To this effect, in addition to the standard one-month, three-month, six-month and 12-month holding periods, further intervals of three months are added until the 36-month holding period. There are in total 18 different holding periods for each of the strategies. The motivation for longer holding periods is based on the research by Gutierrez and Prinsky (2007), which suggests that there is limited difference between total return and residual momentum in the first year following formation, but it does however become significant in the subsequent years. For this reason, holding periods up to and including three years are implemented. Further research on this notion shows that residual momentum trumps total momentum, as it produces higher risk adjusted performance, is more consistent over time as well as in business cycles, and shows less concentrated extremes in the cross-section (Blitz et al., 2011).

3. Empirical Results

This section includes the results of constructing investment portfolios built from the residual factor derived from performing a Fama and French (1993) regression on each stock's performance. Consistent with the method by Jagadeesh and Titman (1993), the total return momentum portfolios use a 12-month formation period which excludes the most recent month. A multitude of holding periods are used to compare the average profit of the strategies.

3.1 Residual Momentum Portfolio Comparisons

The empirical assessments are aimed at investigating if a portfolio built exclusively from dividend paying equities can generate positive capital appreciation. Furthermore, the aim of the residual momentum portfolios built exclusively on dividend paying equities is to generate both risk-adjusted returns with low volatility, and simultaneously provide a constant reliable stream of dividend income. As outlined in section two, the winner portfolio is the group of equities that have the lowest exposure to the Fama and French factors. Table 1 demonstrates the residual momentum results. The residual momentum strategy shows encouraging results, as on average returns are positive across the different holding periods over the time horizon of 2005-2020. As previously explained, the time frame chosen includes both the global financial crisis of 2007-2008 and the COVID-19 pandemic which were two large drawdown periods that add critical stress points. As the returns are positive despite the large drawdowns, this enhances the validity of the portfolios.

Further analysis of the results in Table 1 shows the residual momentum returns of the winner portfolio, named ‘R10’ in the table. All other portfolios are also depicted including the loser portfolio, named ‘R1’ in the table. Assessing the return of the different portfolios, it can be observed that the residual momentum strategy returns on average 1.17% per month and 10.64% annually for the winner portfolio. When comparing the returns of the winner portfolio against portfolios at the other end of the spectrum, there are considerable differences in performance. For example, the loser portfolio which has the highest overlap of the three common Fama and French factors and the lowest sum of squared residuals (ssrs), has the second lowest performance amongst all portfolios. The loser portfolio has an average monthly return of 0.35% and an annual average return of approximately 3.59%. This is a considerable difference, as this is less than half of the winner's portfolio. At initial consideration, one could imagine that the higher overlap with the Fama and French factors

should mean higher SMB factor and thus higher returns in expansionary periods, as growth stocks tend to overperform value stocks in the long-term (Beneda, 2002). This assumption is reasonable for traditional momentum strategies, as total return momentum strategies can overweight on small capitalization stocks as previously explained. The strategy modelled within this paper, however, focuses exclusively on dividend paying equities. Many of the small capitalization companies that do well in total return momentum strategies are excluded from the database as they do not meet baseline criteria. This criterion benefits the residual momentum strategy as the stocks selected for the winner portfolio have a very different composition from the stocks selected in the top portfolio of the total return momentum. Another added benefit of excluding non-dividend paying equities is that the companies that pay a dividend tend to be larger capitalization companies, more established, and should have less overlap with the SMB factor. This equips the winner portfolio within the residual momentum strategy on dividend paying equities to be more resilient in contractionary periods than any other portfolio created. In contrast, the portfolios with higher overlap with common factors are more susceptible to decreases in performance as shown by their lower average performance, see Table 1.

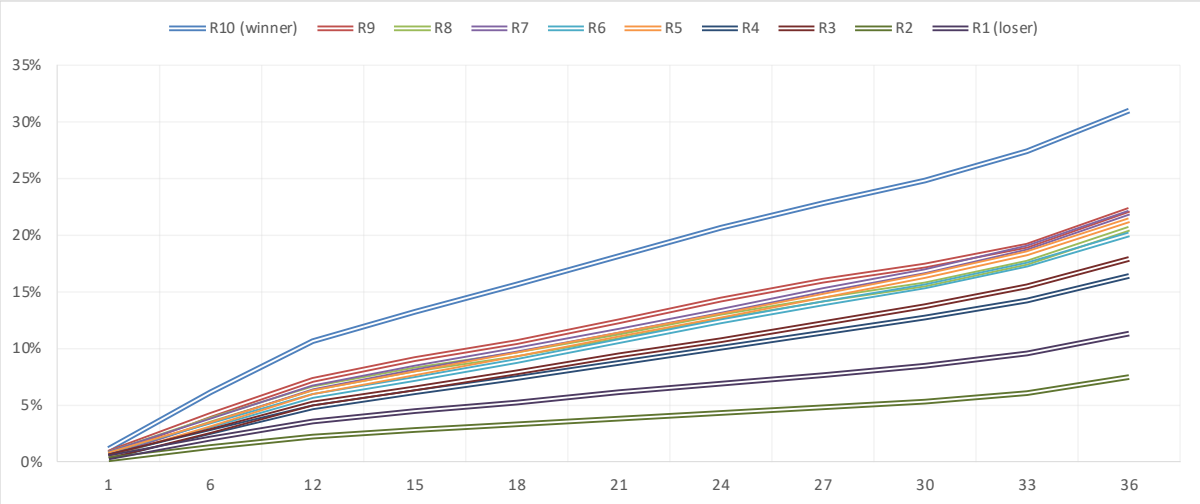
Table 1

Residual momentum profit. Returns on residual momentum across all ten portfolios with K-month holding periods. This table demonstrates the results from the winner portfolio (R10) that has the least overlap with Fama and French factors and the loser portfolio (R1) that has the most overlap with Fama French factors. The portfolios are held from one-month until 36-month, using a rolling window and averaging results for the respective holding periods. The time horizon is from January 2005 to December 2020.

Holding Period (K)	R10 (winner)	R9	R8	R7	R6	R5	R4	R3	R2	R1 (loser)
1-month	1.17%	0.81%	0.71%	0.71%	0.63%	0.63%	0.49%	0.49%	0.23%	0.35%
6-month	6.17%	4.11%	3.75%	3.61%	3.24%	3.31%	2.64%	2.73%	1.32%	2.01%
12-month	10.64%	7.22%	6.51%	6.56%	5.77%	6.17%	4.84%	5.13%	2.25%	3.59%
15-month	13.19%	9.03%	8.14%	8.29%	7.34%	7.84%	6.12%	6.49%	2.76%	4.44%
18-month	15.61%	10.55%	9.48%	9.87%	8.88%	9.46%	7.39%	7.88%	3.27%	5.26%
21-month	18.12%	12.37%	11.07%	11.55%	10.61%	11.19%	8.75%	9.35%	3.84%	6.10%
24-month	20.60%	14.31%	12.80%	13.34%	12.35%	12.90%	10.09%	10.76%	4.33%	6.87%
27-month	22.82%	16.01%	14.28%	15.10%	13.95%	14.62%	11.40%	12.21%	4.78%	7.61%
30-month	24.84%	17.32%	15.63%	16.84%	15.50%	16.40%	12.70%	13.73%	5.31%	8.47%
33-month	27.38%	19.09%	17.54%	18.89%	17.35%	18.42%	14.20%	15.47%	6.06%	9.57%
36-month	30.94%	22.27%	20.60%	21.94%	20.04%	21.28%	16.40%	17.89%	7.43%	11.29%

Figure 1

Residual momentum profit. The graph portrays the results from Table 1. The graph shows the performance comparing across all portfolios, from one-month up to 36 months holding period. The portfolios are held for K-months shown in the x-axis and returns percentage on the y-axis. Each line represents a portfolio and shows the average return over the holding period indicated by K-months.



The strength of selecting the equities with highest ssrs value is beneficial within the first year. However, greater benefit arises in the longer-term horizon as the performance from the winner portfolio diverges from other portfolios as represented by the blue line in Figure 1. Comparing the portfolios with the least and most overlap of the Fama and French factors, the portfolio with higher ssrs outperforms portfolios with lower ssrs and thus have a higher overlap with the common risk factors. Figure 1 displays the return results of the winner, the loser, and all the portfolios in between. From the graph, it can be observed that a

concentration of performance among the middle portfolios, as well as a significant underperformance in comparison with the two bottom portfolios indicated in purple and green. Furthermore, when comparing the winner and loser portfolios head-to-head, the mean return over a two-year time frame for the winner is 20.60% compared to 6.87% for the loser portfolio. For longer holding periods, the gap widens as the winner decile continues to outperform the other portfolios. The 36-month holding period yields a mean return for the winner portfolio of 30.94%, compared to 11.29% for the loser portfolio. To ensure that the outperformance across portfolios is not due to random chance, an independent t-test is conducted for the 15-year time horizon to compare the winner portfolio (R10) and loser portfolio (R1). The outcome of the t-test suggests that there is a difference between the portfolios; the top performing portfolio is significantly better than the worst performing portfolio ($p < 0.01$). In addition to the outperformance of the winner deciles by approximately three times compared to the bottom decile, the investor would also be receiving the frequent dividend payment on top of enjoying the capital appreciation of the portfolio.

3.2 Regression Analysis on Residual Momentum Strategy

Analyzing the ordinary least square regression results on the different portfolios provides important insight into the robustness of the predictors and the reliability of the model. The outcome of the ordinary least square regression for the winner portfolio is presented in Table 2. The winner portfolio has the lowest R-squared value compared to all other portfolios. This might be as the portfolio is built from the equities that have the highest level of residuals from the residual momentum regressions. Higher residual values in turn could result in higher levels of idiosyncratic volatility and thus a lower R-square. The winner portfolio has an R-squared value of 0.64, which is the lowest amongst all portfolios. In contrast, as shown in Table 3, P6 and P7 have an R-squared value of 0.96 which is the

highest amongst all portfolios, indicating that the model used is well fitted. The bottom decile has a R-squared value of 0.90 indicating a better fit than the top decile. This is not surprising as this portfolio has a higher correlation with the Fama and French factors. Based on the adjusted R-squared value, the residual momentum formula is a well fit model for this data frame. Adjusted R-squared penalizes non-useful predictors added in the overall model formula and the value of the adjusted R-squared decreases as non-useful predictors are added in the overall prediction model. As the R-squared value of 0.64 from the regression mirrors that of the adjusted R-squared value of 0.63, this is an indication that the variables used to fit the model are useful predictors within the regression.

Table 2

Residual momentum regression results for the winner portfolio (R10). Summary table of the ordinary least square regression of the winner portfolio (R10) for the residual momentum strategy.

Variable	Coefficient	Std. error	t	P>|t|	[0.025	0.975]
const	0.00	0.00	-3.63	0.00	-0.01	0.00
Mkt-RF	0.69	0.02	32.40	0.00	0.65	0.73
SMB	-0.01	0.04	-0.26	0.80	-0.09	0.07
HML	-0.03	0.03	-0.98	0.33	-0.09	0.03
	R-squared	0.64		F-statistic	109.00	
	Adj. R-squared	0.63		Prob (F-statistic)	6.44e -41	

To assess the portfolios, Table 3 provides a summarized version of the regression analysis for each portfolio created from the residual momentum strategy. The table shows the mean returns for the holding periods of 12 and 36 months and includes the market, value, and size coefficients. A market risk coefficient of 1 means the same risk as the market. As the winner portfolio has a market risk coefficient of 1.09 it indicates that it has more market risk than the average asset. In contrast, portfolio P2 shows the lowest market risk from all the portfolios. Furthermore, the table also shows the small minus big (SMB) factor. The SMB factor for the winner portfolio has a value of 0.62 and is statistically significant ($p < 0.01$) suggesting that the portfolio has the tendency to invest in rather smaller stocks. In contrast,

the outcome of the loser portfolio is not statistically significant ($p > 0.01$). Table 3 also indicates the high minus low (HML) factor, where 'high' refers to companies with a high book-to-market ratio. These companies are considered "value" stocks. Likewise, the 'low' refers to companies with a low book-to-market ratio and these companies are "growth" stocks. The HML factor is also referred to as "the value versus growth factor" where value stocks tend to outperform growth stocks in the long run (Beneda, 2002). Despite the top portfolio not showing significant results ($p > 0.01$), portfolios R9 to R5 with returns above 20% for the 36-month holding period are statistically significant ($p < 0.01$). The HML coefficient of portfolio R9 for example, is 0.34 which demonstrates that the portfolio might be slightly overweighing value stocks relative to the whole market. This makes sense as value stocks have higher book-to-market values which allows them to payout dividends. Furthermore, high dividend yielding stocks tend to have fewer growth opportunities (Naranjo et al., 1998) that may lead to asset rich balance sheets.

Table 3

Residual momentum portfolios. A summarized table for all residual momentum portfolios. Table shows the 12-month mean return as well as the 36-month mean return for all portfolios. The market, value and size coefficients are also included along with their p-value for the t-statistic.

Portfolio	K12 return	K36 return	Mkt-RF	P>|t|	SMB	P>|t|	HML	P>|t|	Adj.RSQ
R10 (winner)	10.64%	30.94%	1.09	0.00	0.62	0.00	0.17	0.14	0.63
R9	7.22%	22.27%	1.22	0.00	0.71	0.00	0.34	0.00	0.93
R8	6.51%	20.60%	1.09	0.00	0.55	0.00	0.36	0.00	0.95
R7	6.56%	21.94%	1.03	0.00	0.51	0.00	0.39	0.00	0.96
R6	5.77%	20.04%	0.96	0.00	0.36	0.00	0.36	0.00	0.96
R5	6.17%	21.28%	0.88	0.00	0.34	0.00	0.21	0.00	0.94
R4	4.84%	16.40%	0.84	0.00	0.17	0.00	0.24	0.00	0.91
R3	5.13%	17.89%	0.76	0.00	0.03	0.42	0.14	0.00	0.92
R2	2.25%	7.43%	0.61	0.00	-0.03	0.62	-0.04	0.45	0.67
R1 (loser)	3.59%	11.29%	0.69	0.00	-0.01	0.80	-0.03	0.33	0.87

3.3 Total Return Momentum Portfolio Comparisons

In addition to the residual momentum strategy implemented thus far, it is also relevant to assess the projected mean return that would be derived by implementing a total return momentum strategy. Within this strategy the same selection parameters are applied as with the residual momentum to make the two strategies comparable. This criterion ensures that the same data set is used by both strategies and the return calculated is based exclusively on dividend paying equities. As mentioned in section two, returns generated are a result from creating ten portfolios built on past 12-month performance skipping the most recent month. The relevance of including the total return momentum as a comparison to the residual momentum portfolios is nontrivial as previous studies suggest residual momentum is superior to total return momentum in many stock markets around the world (Chiao et al., 2020). However, if total return momentum can generate higher returns than residual momentum for dividend paying equities, then the added complexities of running through regressions for each stock would be unavailing.

Results from the total return momentum on dividend paying equities show a considerably different trend than the residual momentum. The results of the total return momentum are displayed in Table 4. As can be observed in Table 4, past winners do not outperform past losers on average over the full 15-year time horizon. Furthermore, for every holding period the loser portfolio outperforms the past winners. For the 1-month holding period, the loser portfolio outperforms the winner portfolio by 0.04%. When assessing the 12-month, 24-month and 36-month holding periods, the loser portfolio outperforms the winner portfolio by 2.02%, 4.54% and 6.94% respectively. This suggests that there appears to be a reversal in the momentum for dividend paying equities when utilizing the total return momentum factor. In other words, dividend paying stocks that have experienced a loss within the last 12 months, skipping the most recent month, appear to come back and outperform

other dividend paying companies. Another observation is that portfolios' return do not appear to have a uniform trend within the ten different portfolios created. Furthermore, for a 36-month holding period, T1 is always the top performing portfolio with a return of 25.69% on average. The top performing portfolio is followed by T2 at 22.74%, then T8 at 21.86% and T6 in fourth place at 21.01%. The worst performing portfolios are the mid portfolios T3 and T4 returning on average 13.84% and 12.58% respectively for a three-year holding period. An independent t-test using the 15-year time horizon is conducted to verify that the outperformance of T1 relative to T10 is not random. The outcome suggests that there is a difference between the mean returns of the portfolios and the outperformance is statistically significant ($p < 0.01$).

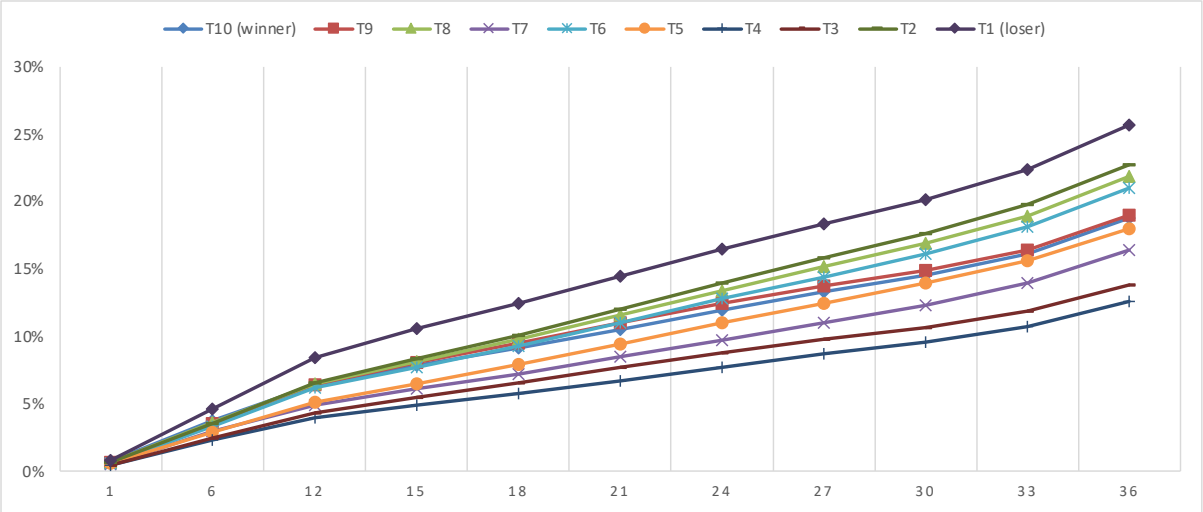
Table 4

Total return momentum profit. A summarized table for all total return momentum portfolios. The table shows a formation period of 12 months skipping the most recent month and holding periods mean returns varying from one-month to 36 months. The color gradient indicates the mean returns from high (green) to low (red).

Holding Period (K)	T10 (winner)	T9	T8	T7	T6	T5	T4	T3	T2	T1 (loser)
1-month	0.77%	0.69%	0.69%	0.53%	0.59%	0.56%	0.44%	0.49%	0.64%	0.82%
6-month	3.73%	3.52%	3.58%	2.94%	3.30%	2.89%	2.30%	2.48%	3.53%	4.64%
12-month	6.40%	6.41%	6.47%	4.92%	6.17%	5.11%	3.95%	4.30%	6.57%	8.43%
15-month	7.85%	8.07%	8.14%	6.11%	7.74%	6.52%	4.90%	5.45%	8.35%	10.55%
18-month	9.11%	9.50%	9.77%	7.23%	9.29%	7.90%	5.79%	6.55%	10.07%	12.47%
21-month	10.48%	10.99%	11.59%	8.47%	11.03%	9.43%	6.72%	7.72%	12.04%	14.49%
24-month	11.95%	12.47%	13.42%	9.72%	12.78%	10.99%	7.74%	8.82%	13.96%	16.50%
27-month	13.29%	13.76%	15.19%	10.99%	14.41%	12.45%	8.74%	9.78%	15.80%	18.33%
30-month	14.51%	14.92%	16.88%	12.30%	16.09%	13.93%	9.61%	10.69%	17.64%	20.12%
33-month	16.13%	16.43%	18.90%	13.93%	18.11%	15.63%	10.74%	11.88%	19.76%	22.38%
36-month	18.75%	19.03%	21.86%	16.41%	21.01%	18.01%	12.58%	13.84%	22.74%	25.69%

Figure 3

Total return momentum profit. The graph portrays the results from Table 4. A summary comparing the performance of all total return momentum portfolios across various holding periods, built with a formation period of 12 months skipping the most recent month. The results show mean return per portfolio for the holding period for K-months. The portfolios are held for K-months shown in the x-axis and returns percentage on the y-axis.



3.4 Total Return Momentum Strategy vs Residual Momentum Strategy

Comparing the two momentum strategies head-to-head demonstrates the residual momentum has higher mean return in the short-term as well as in the long-term. While both strategies have positive returns over the holding periods, the top performing residual momentum generates 5.25% more than the total return momentum for a 36-month holding period. Table 5 shows a summary of the top and bottom decile portfolios for each strategy, as well as the difference between the top two performing portfolios. As can be seen in the table, the worst performing portfolio is the portfolio with the lowest amount of residual factor, R1. This portfolio is consistently the worst performer for all holding periods. It can also be observed that R10, the portfolio with the highest amount of ssrs, is the top performing portfolio amongst all four portfolios. Furthermore, this portfolio is the best performing across all the 20 portfolios created for each of the holding period. Another interesting observation is that while the residual momentum strategy creates the portfolio with the highest average returns, it also creates the portfolio with the worst performing returns. The segmentation of the ssrs values generates a polarity within the portfolios where stocks likely have similar idiosyncratic characteristics, resulting in either high or little overlap with Fama and French factors. This leads to similar stocks diverging and pooling together where some have high

overlap with common factors in the bottom decile. While, in the top decile stocks have very little to no overlap with common factors. This polarity creates a greater dispersion of returns across portfolios within the residual momentum strategy. In contrast, the returns of the portfolios created from the total return momentum do not show such a wide range of returns and tend to be more concentrated within the different holding periods. A potential explanation for this is that the portfolios are created based on the historical performance and the overlap with common factors has less impact on portfolio creation, which leads to reduced dispersion across portfolio returns.

Table 5

Residual momentum versus total return momentum comparison. A summarized table for the top and bottom decile portfolios of the residual momentum strategy, which also includes the top and bottom decile portfolios of the total return momentum strategy. The color gradient indicates the mean returns from high (green) to low (red). The difference between the best performing portfolios of each of the strategies are compared and their difference is included on the right-hand side of the table.

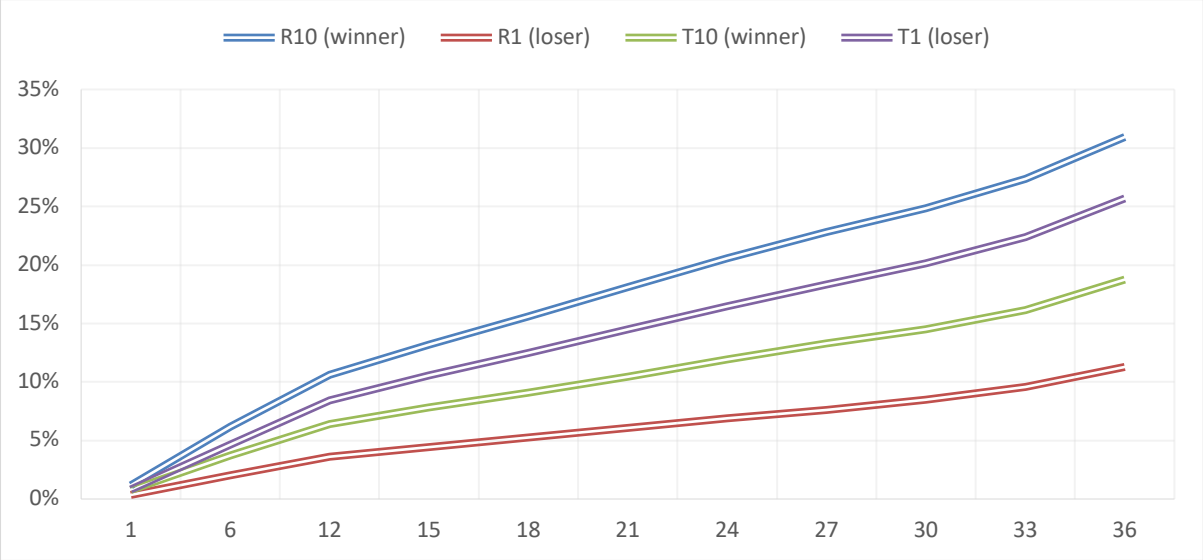
	Residual Momentum		Total Return Momentum		R10 vs T1
(K) Holding Period	R10 (winner)	R1 (loser)	T10 (winner)	T1 (loser)	
1-month	1.17%	0.35%	0.77%	0.82%	0.35%
6-month	6.17%	2.01%	3.73%	4.64%	1.53%
12-month	10.64%	3.59%	6.40%	8.43%	2.22%
15-month	13.19%	4.44%	7.85%	10.55%	2.64%
18-month	15.61%	5.26%	9.11%	12.47%	3.14%
21-month	18.12%	6.10%	10.48%	14.49%	3.63%
24-month	20.60%	6.87%	11.95%	16.50%	4.11%
27-month	22.82%	7.61%	13.29%	18.33%	4.49%
30-month	24.84%	8.47%	14.51%	20.12%	4.73%
33-month	27.38%	9.57%	16.13%	22.38%	5.00%
36-month	30.94%	11.29%	18.75%	25.69%	5.25%

The monthly returns among all four different portfolios hover at approximately one percent and no clear superiority is defined at this short-term holding period. Even when extending the period to a six-month holding period, the best performing residual momentum portfolio is 6.17% while the top performing total return momentum portfolio is 4.64%. The

overachievement is marginal at 1.53% between the two strategies. The greater benefit and clearer overachievement arise when portfolios are held for longer time horizons, for example one-, two-, and three-years. The overachievement between the top performing portfolios of each strategy for a one-year holding period is 2.22%, while for a two- and three-year holding period is 4.11% and 5.25% respectively. The differences in return for the four portfolios is visualized in Figure 4.

Figure 4

Residual momentum versus total return momentum comparison. A visual summary of the top and bottom decile portfolios of the residual momentum and total return momentum strategies. Each result presents the mean return per portfolio for K-month holding period as shown in the x-axis, and returns percentage on the y-axis



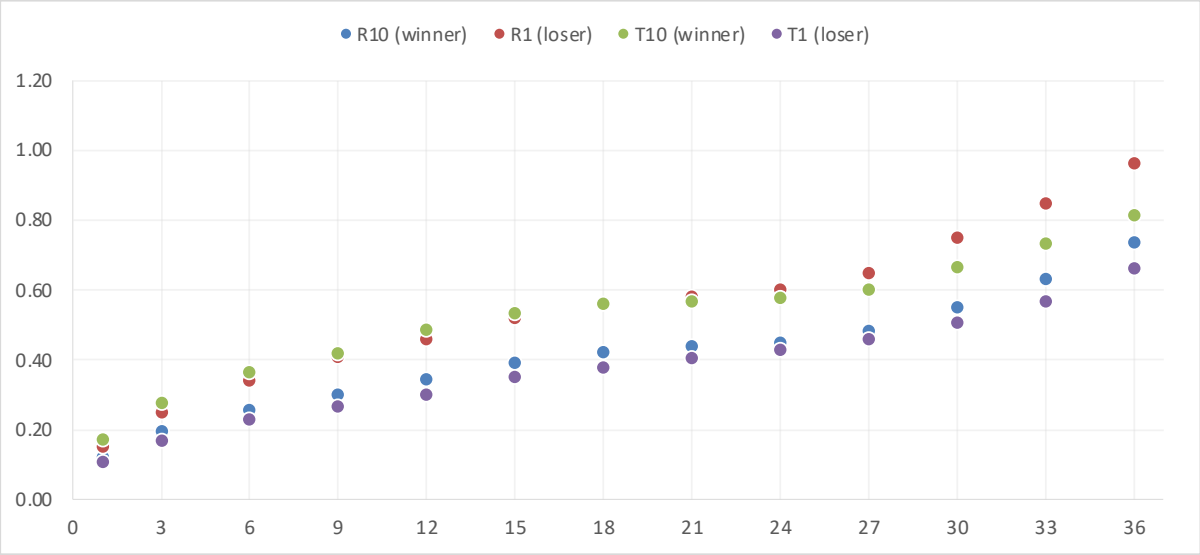
3.5 Sharpe Ratio

Though the mean returns of the residual momentum strategy surpass those of the total return momentum, it does not provide insight into the volatility of the different portfolios. Utilizing the standard deviation of the portfolios' by applying the Sharpe ratio, makes it possible to assess the portfolios' risk-adjusted return. The higher the Sharpe ratio, the better the portfolio's return relative to its volatility. Figure 5 plots the Sharpe ratio for the top and the and bottom decile portfolios for each strategy and each holding period. From this, two

interesting findings arise. First, the Sharpe ratio appears to stabilize in a mid-holding period from 9-month to 27-month at a range of 0.4-0.6, after which there is a clear upward trend reaching a Sharpe ratio of 0.96 for R1. Second, although R10 yields the highest mean returns, it does not possess the highest Sharpe ratio. Instead, the highest Sharpe ratio is achieved by R1, the lowest performing portfolio in terms of mean returns. This outcome resembles the portfolio opportunities of the Capital Asset Pricing Model (CAPM) where higher expected return suggests acceptance of higher volatility (Markowitz,1952; Sharpe, 1964). In other words, the higher returns of R10 come at the cost of higher volatility compared to R1 within the residual momentum strategy.

Figure 5

Sharpe ratio for residual momentum versus total return momentum comparison. The graph plots the top and bottom decile portfolios for each strategy. The y-axis plots the Sharpe ratio of the portfolio across the different holding periods. The x-axis plots different holding periods starting at 1-month, then increasing by three months from 3 months up to 36 months.



Comparing the highest mean return portfolios across strategies further demonstrates the over performance of the residual momentum strategy over the total return momentum. Table 6 shows the mean return for the top and bottom decile portfolios for each strategy as well as their corresponding Sharpe ratio. As can be seen the residual momentum portfolio

R10 yields 30.94%, which is the highest mean return across all portfolios for the 36-month holding period. The second highest mean return portfolio is T1 at 25.69% from the total return momentum. This generates a difference of 5.25% between R10 and T1. The outperformance is accompanied by a higher Sharpe ratio of 0.07, as R10 has a Sharpe ratio of 0.74 and T1 has a Sharpe ratio of 0.66. This indicates that R10 takes less risk than T1 and can also generate higher returns.

Table 6

Sharpe ratio and mean return for residual momentum versus total return momentum comparison. The table summarizes the mean returns and Sharpe ratios of the top and bottom decile portfolios for each strategy, for a 1-month, 6-month, 12-month, 24-month, and 36-month holding period. Sharpe ratios are indicated in blue. A summary of the difference between the best performing mean return portfolios of each of the strategies are displayed on the right-hand side.

	Residual Momentum		Total Return Momentum (J12m)		R10 vs T1
Holding Period (K)	**R10 (winner)**	**R1 (loser)**	**T10 (winner)**	**T1 (loser)**	
1-month return	1.17%	0.35%	0.77%	0.82%	0.35%
Sharpe ratio	*0.19*	*0.25*	*0.27*	*0.17*	0.03
6-month return	6.17%	2.01%	3.73%	4.64%	1.53%
Sharpe ratio	*0.26*	*0.34*	*0.36*	*0.23*	0.03
12-month return	10.64%	3.59%	6.40%	8.43%	2.22%
Sharpe ratio	*0.34*	*0.46*	*0.49*	*0.30*	0.04
24-month return	20.60%	6.87%	11.95%	16.50%	4.11%
Sharpe ratio	*0.45*	*0.60*	*0.58*	*0.43*	0.02
36-month return	30.94%	11.29%	18.75%	25.69%	5.25%
Sharpe ratio	*0.74*	*0.96*	*0.81*	*0.66*	0.07

4. Robustness Checks

4.1 Crisis Periods

The 15-year time horizon could have softened the large draw down periods in the data. Therefore, focusing on the two periods that include the global financial crisis of 2007-2008 and the COVID-19 pandemic may provide insight in how these strategies fare during stress periods. The portfolio formation and holding periods are reconstructed using five years of data from January 1st, 2005, until December 31st, 2009, to allow holding periods of up to

36 months within the rolling window and allowing to measure performance for the global financial crises. Similarly, the period of January 1st, 2016, until December 31st, 2020, is applied to center attention on the COVID-19 pandemic. This is done for R10, the top performing portfolio across both strategies, to assess if similar mean returns could be achieved during these stress periods.

Table 7

Residual momentum profit of R10 across three different time frames. Returns on residual momentum for the R10 portfolio are illustrated across three different time frames. The different time frames are the full 15-year dataset, a five-year time horizon for the global financial crises, and the COVID-19 pandemic. The figures represent mean returns. The portfolios are held from 1-month until 36-month using a rolling window, and averaging returns for the respective holding periods.

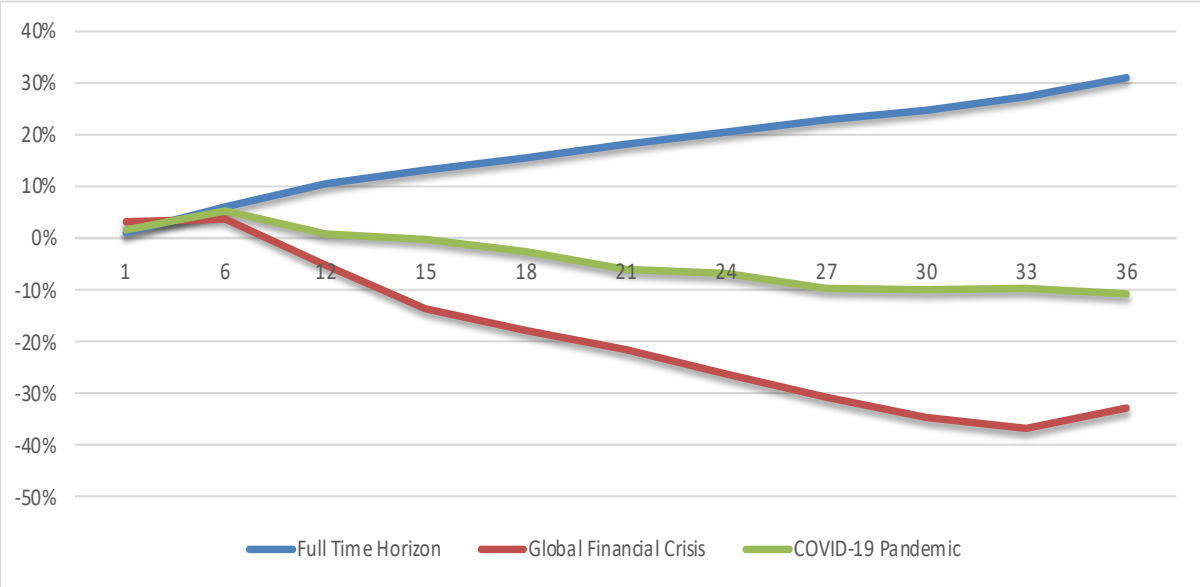
	Jan 2005 - Dec 2020	*Jan 2005 - Dec 2009*	*Jan 2016 - Dec 2020*
Holding Period (K)	**Full Time Horizon**	**Global Financial Crisis**	**COVID-19 Pandemic**
1-month	1.17%	3.06%	1.63%
6-month	6.17%	3.79%	5.26%
12-month	10.64%	-5.20%	0.75%
15-month	13.19%	-13.68%	-0.17%
18-month	15.61%	-17.89%	-2.56%
21-month	18.12%	-21.45%	-5.89%
24-month	20.60%	-26.35%	-6.92%
27-month	22.82%	-30.63%	-9.61%
30-month	24.84%	-34.77%	-9.88%
33-month	27.38%	-36.81%	-9.63%
36-month	30.94%	-32.72%	-10.83%

Table 7 demonstrates that similar results are not replicable during stress period with shorter-time horizons as the returns for both crises periods are mostly negative. While residual momentum on a 15-year time horizon can generate 10.64% for a 12-month holding period, the same strategy during the COVID-19 pandemic would only generate 0.75% and during the global financial crises it would yield a negative return of -5.20%. Furthermore, as illustrated in Figure 6, the returns of holding periods longer than 12 months and up to 36 months are negative for both crisis periods. This leads to the disposition that the residual

momentum strategy on dividend paying equities is not a feasible strategy using five years of data. This is not surprising however, as longer time horizons soften portfolio losses during crisis periods, and hence when isolating the crisis periods the cushion is not present to offset losses on average returns. This observation supports the results of this paper that the residual momentum strategy on dividend paying equities is intended for longer time horizons and most beneficial for longer holding periods.

Figure 6

Residual momentum profit of R10 across three different time frames. The graph portrays the results from Table 7. Returns on residual momentum for R10 portfolio are illustrated across three different time frames. The different time frames are the full 15-year dataset, a five-year time horizon for the global financial crises, and the COVID-19 pandemic. The results show the mean returns for the different time frames. The portfolio R10 is held for K-months shown in the x-axis, and returns percentage shown on the y-axis.



4.2 A 24-month Formation Period

The empirical results show that residual momentum outperforms total return momentum with a formation period of 12 months skipping the most recent month. To check the strength of the results and the persistence of residual momentum outperforming total return momentum, a formation period of 24 months was also compared. The motivation

behind this robustness check is that total return momentum can have a reversal effect and a longer formation period could alleviate this concern. The table below compares the two strategies conducted, extending the formation period from 12 to 24 months.

Table 8

Residual momentum versus total return momentum with 24-month formation period comparison. A summarized table for the top and bottom decile portfolios of the residual momentum strategy. Table also includes the top and bottom decile portfolios of the total return momentum strategy built on a 24-month formation period. The difference between the best performing portfolios of each of the strategies are compared and the difference is demonstrated on the right-hand side of the table. The color gradient indicates the mean returns from high (green) to low (red).

	Residual Momentum		Total Return Momentum (J24m)		R10 vs T1
(K) Holding Period	R10 (winner)	R1 (loser)	T10 (winner)	T1 (loser)	
1-month	1.17%	0.35%	0.85%	0.73%	0.44%
6-month	6.17%	2.01%	4.37%	4.24%	1.94%
12-month	10.64%	3.59%	7.53%	8.14%	2.50%
15-month	13.19%	4.44%	9.11%	10.40%	2.79%
18-month	15.61%	5.26%	10.49%	12.40%	3.20%
21-month	18.12%	6.10%	12.05%	14.42%	3.70%
24-month	20.60%	6.87%	13.43%	16.42%	4.19%
27-month	22.82%	7.61%	14.74%	18.26%	4.56%
30-month	24.84%	8.47%	15.85%	20.22%	4.62%
33-month	27.38%	9.57%	17.27%	22.73%	4.65%
36-month	30.94%	11.29%	20.03%	26.28%	4.66%

Despite the increase of the formation period by 12 additional months for the total return momentum, the residual momentum strategy prevails (see Table 8). The residual momentum still outperforms the top performing total return momentum by 4.66% for a three-year holding period. Interestingly, a longer formation period leads to higher returns in the total return momentum. For example, the 12-month formation period for a three-year holding period yields 25.69% while the 24-month formation period is higher by 0.59% at 26.28% for the same holding period. This could indicate that a reversal effect is partly mitigated if longer formation periods are utilized for the total return momentum strategy.

5. Conclusion

The residual momentum can generate 5.25% more return with lower volatility over a 36-month period compared to the total return momentum for portfolios built exclusively from dividend paying equities. The top performing portfolio across both strategies is the portfolio with the least amount of overlap with the three Fama and French factors of market, size, and value and thus the highest sum of the squared residuals.

The first hypothesis of this paper explored the notion of creating a portfolio exclusively from dividend paying equities to assess if capital appreciation was possible by investing in portfolios created from a residual momentum strategy. Through the research conducted it was confirmed that positive returns are possible on average utilizing a holding period of up to three years, over a 15-year time horizon expanding from 2005 to 2020. Furthermore, despite the inclusion of two stress points within the data, the global financial crisis of 2007-2008 and the COVID-19 pandemic, both strategies were able to render positive returns on average over the 15-year time horizon. The second hypothesis compares the residual momentum strategy against the total return momentum strategy to investigate if the residual momentum portfolios would outperform the total return momentum portfolios built exclusively from dividend paying equities. The research and analysis also confirmed that residual momentum outperforms total return momentum for all holding periods, which holds true even when extending the formation period from 12 months to 24 months.

This research opens interesting avenues for future areas of research, such as including the total dividend cash flow received by the different portfolio for each holding period. This would provide further information to conclude if the top residual portfolio is better than the top total return portfolio after dividend cash flow payments received, capturing the complete total return. It is possible that the stocks held in the top residual portfolio pay less dividends in total than the top total return portfolios. If stocks in the total return portfolio pay more

dividends, then the total return including dividend payments could match or even outperform the residual momentum portfolio. Another expansion on this topic would be to perform similar analysis expanding to stock markets within emerging markets as well as extending the time horizon to longer than 15-years.

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