Exploring Momentum: The Hidden Drivers of Stock Returns in the Nordic Market

A Comparative Analysis of Price and Earnings Momentum Strategies

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Abstract

This thesis investigates the relationship between price momentum, earnings momentum, and stock returns in the Nordic region by examining the risk-adjusted performance measures of various momentum strategy portfolios. Inspired by Novy-Marx's 2015 theory that momentum in firm fundamentals explains the performance of price momentum strategies, this study seeks to provide deeper insights into momentum drivers and their implications for investment professionals.

The paper focuses on 'Price Momentum' measured through eleven-month past performance (11MPM) and 'Earnings Momentum' measured through 'Standardized Unexpected Earnings' (SUE) and 'Standardized Earnings Surprise' (SES).

Using monthly data from January 2003 to March 2023, we construct momentum strategy portfolios and calculate their portfolio excess returns, adjust for risk with Sharpe Ratios, and perform a series of linear regression analyses.

Our findings show that while earnings momentum strategies outperform the market they do not outperform price momentum strategies. As a result, there is insufficient evidence to support the notion that price momentum is merely a weak manifestation of fundamental momentum.

Key Words:

Momentum

Price Momentum

Earnings Momentum

Earnings Surprises

Eleven Month Price Momentum, 11MPM

Standardized Unexpected Earnings, SUE

Standardized Earnings Surprise, SES

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1 INTRODUCTION

Momentum has been the subject of extensive research in the finance literature, owing to the potential to generate excess returns and assist investors in making informed economic decisions. This study focuses on the Nordic market, which provides a regional perspective and an opportunity to contribute to the local understanding of price momentum and earnings momentum strategies.

Momentum strategies are based on the observation that stocks that have performed well in the past tend to perform well in the future, whereas stocks that have performed poorly in the past are likely to continue underperforming, Jegadeesh and Titman (1993). The key theories underlying momentum strategies can be divided into two categories: behavioral and risk-based explanations.

According to behavioral explanations, psychological biases among investors cause momentum effects. Barberis, Shleifer, and Vishny (1998) propose a model of investor sentiment, arguing that stock price momentum and reversal patterns can result from overreaction and underreaction to news. Daniel, Hirshleifer, and Subrahmanyam (1998) expand on this concept by presenting an investor psychology model that demonstrates how underreaction and overreaction to information can generate momentum and reversal effects.

Hong and Stein (1999) propose a theory of asset market underreaction, momentum trading, and overreaction that combines the concepts of slow information diffusion and investor sentiment. Underreaction to news, according to their theory, can generate short-term momentum, whereas overreaction can result in longer-term reversals.

Risk-based explanations focus on the role of risk factors in driving momentum returns. Fama and French (1996) investigate multifactor explanations for asset pricing anomalies, including momentum, by developing and testing a multifactor asset pricing model. Pastor and Stambaugh (2003) investigate the relationship between liquidity risk and expected stock returns, providing a risk-based explanation for momentum and other asset pricing anomalies.

In the context of earnings momentum, Novy-Marx (2015) argues in his article "Fundamentally, Momentum is Fundamental Momentum" that momentum in firm fundamentals, specifically earnings momentum measured through Standardized Unexpected Earnings (SUE), explains the performance of price momentum strategies. His research indicates a strong relationship between

fundamental momentum and price momentum. This has implications for both the design and performance of momentum strategies as the results show that earnings surprises subsume the power of past performance to predict returns.

The primary goal of this thesis is to test Novy-Marx's conclusions: Does firm fundamental momentum truly explain the performance of price momentum strategies? In this study, we look at Nordic stocks, specifically members of the all-share indexes SAX, KAX, OSEAX, HEX, and ICEXI. We identified 1,540 unique members of the five all-share indexes between January 2003 and March 2023. Earnings per share (EPS) data, Bloomberg Estimated EPS, and quarterly report dates were obtained from Bloomberg. Bloomberg's total return field was used to calculate portfolio returns, with the MSCI Nordic and the average Swedish Three-Month Interbank Rate serving as proxies for market return and risk-free rate, respectively.

We employ three measures to evaluate the stocks: Standardized Unexpected Earnings (SUE), Standardized Earnings Surprise (SES), and 11-Month Price Momentum (11MPM). SUE and SES are earnings-based measures while 11MPM represents price momentum.

To measure earnings momentum, we introduce the new metric SES, which seeks to investigate earnings surprises by using consensus estimates as a proxy for market expectations of reported earnings figures. It represents the difference between actual reported EPS and consensus EPS estimates. We then scale the difference by the standard deviation of earnings over the last eight announcements, subject to a minimum of six observed announcements over the two-year window. In other words, we ask: By how many standard deviations of actual earnings was the earnings surprise?

The use of consensus EPS estimates is particularly relevant in the Nordic setting, as they are widely used by market participants to gauge market expectations and to evaluate the market's reaction to earnings surprises. Consensus EPS estimates are an aggregation of earnings forecasts provided by a diverse group of financial sell-side analysts. These analysts often have deep industry knowledge and access to a variety of information sources, allowing them to form well-informed opinions on the earnings prospects of the companies they cover. However, it is important to note that consensus estimates may still be subject to biases and errors, as analysts' individual forecasts can be influenced by factors such as overoptimism, groupthink, or inadequate information. Of course, SES does not

consider the fact that market participants may have access to information other than analyst estimates and may have adjusted their expectations accordingly.

Despite these potential limitations, consensus EPS estimates remain an essential tool for investors and analysts in the Nordic market, as they provide a benchmark for assessing the earnings performance of companies and their potential impact on stock prices.

We used a rank-based weighting approach to build portfolios, dividing stocks into deciles based on the strength of the momentum signals. Stocks with a stronger signal were given more weight in the subportfolios. The portfolios were built monthly and held for half a year.

We used regressions as part of our analysis to understand the relationship between the monthly excess return (excess over each stock's index return) of the different portfolios and the market excess return, as well as the relationship between price momentum and earnings momentum strategies. The regression analysis provided performance evaluation metrics such as alphas and appraisal ratios.

Null Hypothesis, H0: Price momentum is independent from fundamental momentum. Price momentum strategies have significantly higher excess risk-adjusted returns compared to earnings momentum strategies.

Alternative Hypothesis, H1: Price momentum is fundamental momentum. Earnings momentum strategies have significantly higher excess risk-adjusted returns compared to price momentum strategies.

The primary goal of our research is to determine whether price momentum is merely a weak expression of fundamental momentum or if it has independent significance. Following a thorough examination, our findings indicated that there is insufficient evidence to reject the null hypothesis, implying that price momentum may be an independent phenomenon and our findings suggest that it is not solely dependent on fundamental momentum.

This discovery is critical because it challenges commonly held beliefs and opens up new research avenues. It not only adds to the academic discussion of price momentum, but it also has practical implications for financial analysts and traders. Furthermore, our research provides useful insights

into the workings of the stock market and may help to guide future investment strategies. To be clear, the study does not conclude that price momentum is completely independent, but it does show that it is not simply a weaker version of fundamental momentum. Despite the lack of conclusive evidence, these findings shed light on the complexities of the stock market and pave the way for more nuanced investment strategies.

The thesis is structured as follows: Section two provides a review of relevant studies on momentum strategies, discussing some of the key frameworks while providing the reader with clarity on their relevance to the study. Section three describes the study's data and methodology, including the selection of research methods, data selection, portfolio construction, and regression analysis. This section aims to give the reader an understanding of the approaches used and includes a critical reflection on the study's limitations. Section four presents the empirical findings, which are followed by section five, where the findings and their implications for investors and market participants are discussed. Finally, section six provides a conclusion, summarizing the study and suggesting avenues for future research. An Appendix is also included, featuring robustness tests and a reference list of all sources used to support this study.

2 LITERATURE REVIEW

2.1 Price Momentum

The explanatory power of momentum in stock prices was first documented by Jegadeesh and Titman (1993), and their approach of quantifying price momentum has become the industry standard. They discovered that stocks that had performed well in the past 3 to 12 months tend to continue to perform well in the subsequent period, while stocks that have performed poorly in the past tend to continue underperforming. They considered a portfolio that is long in the decile of stocks that had the highest return in the previous period and is short in the decile of stocks that had the lowest return. They found such a price momentum strategy to earn more than 1% above the risk-free rate per month. Even though the decile portfolios usually consist of small-sized companies with a high beta risk, the strategy’s return cannot be fully explained by significant size or market exposure. That the momentum anomaly has not been arbitraged away and persists is even more intriguing (see Jegadeesh and Titman 2001).

Not only is the price momentum anomaly confined to the USA, but it has also been documented in several international studies, such as in Rouwenhorst (1998) for Europe and, more recently, in Griffin, Ji, and Martin (2003, 2005) for a large set of countries. Asness, Moskowitz, and Pedersen (2013) provided evidence that the momentum effect is present in multiple asset classes and across various countries, including the Nordic market.

The presence of reversals is an intriguing aspect of price momentum. De Bondt and Thaler (1985) demonstrated that stocks that have experienced extreme gains or losses tend to exhibit reversals in the subsequent period, which contradicts the traditional momentum effect. These reversals highlight the complexities of price momentum and suggest that the anomaly is caused by both under- and overreaction to information.

2.2 Earnings Momentum

Earnings momentum is a phenomenon related to the market's reaction to earnings surprises and fundamental improvements. In this study we measure earnings momentum using Standardized Unexpected Earnings (SUE) and a novel measure, Standardized Earnings Surprise (SES), that we introduce in this study to explore earnings surprises using consensus estimates.

To measure earnings surprises, SUE is commonly used in the literature. SUE is defined as the most recent year-over-year change in earnings per share, scaled by the standard deviation of the earnings innovations over the last eight announcements, subject to a requirement of at least six observed announcements over the two-year window (Novy-Marx, 2015).

Relating to earnings momentum, we want to mention Ball and Brown (1968) who first documented the tendency of stock prices to drift in the direction suggested by recent earnings surprises, a phenomenon known as post-earnings announcement drift. This observation is driven by investors failing to fully appreciate the earnings information, which results in a delayed price response (see Bernard and Thomas 1989).

2.3 Theories Underlying Momentum

The theories that underpin momentum strategies in finance are broadly classified into two categories: behavioral explanations and risk-based explanations. These theories offer different perspectives on the persistence of momentum and its effect on stock returns.

2.3.1 Behavioral Explanations

Momentum effects, according to behavioral finance theory, emerge as a result of cognitive biases among investors. Barberis, Shleifer, and Vishny (1998) created an investor sentiment model based on the "representativeness heuristic" and "conservatism" of investors. The representativeness heuristic is a cognitive bias in which people judge probabilities based on perceived similarities and patterns, whereas conservatism is the tendency to underreact to new information. When these biases combine, they can cause both initial underreaction and subsequent overreaction to news, resulting in momentum and reversal patterns in stock prices.

This theory was expanded by Daniel, Hirshleifer, and Subrahmanyam (1998), who introduced an investor psychology model. This model demonstrated how overconfidence, in which investors overestimate their knowledge, and self-attribution bias, in which success is internalized and failure is externalized, can cause investors to initially underreact to private information, resulting in momentum effects. Overreaction to public information, on the other hand, can result in reversals.

The model proposed by Hong and Stein (1999), which combines investor sentiment and slow information diffusion, is another significant contribution to behavioral explanations. They say that investor underreaction to news can drive short-term momentum, whereas overreaction can cause longer-term reversals due to slow information diffusion.

2.3.2 Risk-based Explanations

According to risk-based theories, momentum returns are a reward for taking systematic risks. Fama and French's (1996) work is an important contribution to this viewpoint. They created a multifactor asset pricing model in order to explain asset pricing anomalies such as momentum.

Pastor and Stambaugh (2003) investigated the relationship between liquidity risk, or the risk arising from the difficulty of selling assets quickly without affecting their price and expected stock returns. They propose a risk-based explanation for momentum, arguing that stocks with higher sensitivity to changes in aggregate liquidity have higher average returns, which contributes to momentum returns.

In essence, these behavioral and risk-based theories provide complementary explanations of momentum effects in finance. Each theory provides insight into the various mechanisms that drive

momentum strategies. Understanding these theories is the foundation of our investigation into the role of fundamental momentum in explaining the performance of price momentum strategies.

As we continue to investigate this topic, it is critical to consider the implications of these theories for our research questions and hypotheses. These theories not only provide a broad understanding of momentum, but they also pave the way for a more in-depth investigation of the relationship between price and fundamental momentum.

2.4 Linking Price and Earnings Momentum

It has been speculated in the literature as to whether price and earnings momentum may reflect the very same mispricing of through behavioral biases. In fact, studies such as Chan, Jegadeesh, and Lako Nishok (1996) found that the US momentum effect is concentrated around earnings announcements and showed that price momentum may partially be explained by under-reaction to earnings information. However, they contended that price momentum is not subsumed by earnings momentum, since "each ranking variable has some incremental predictive power for future returns". This view is substantiated by Griffin, Ji, and Martin (2005), who extended this evidence to international markets. The fact that Hong, Lee, and Swaminathan (2003) only detected price momentum in countries that also exhibit earnings momentum, makes the case for a closer relation between the two anomalies. Indeed, Chordia and Shivakumar (2006) showed that the US price momentum manifests in earnings momentum from 1972 to 1999.

Novy-Marx (2015) argues that fundamental momentum is a better predictor of future stock prices than past performance. Instead, arguing that price momentum is simply a weak expression of earnings momentum. The paper provides evidence to support the claim that price momentum is driven by fundamental momentum, reflecting the tendency of stocks that have recently announced strong earnings to outperform those that have recently announced weak earnings. Novy-Marx argues that the findings of previous studies, including Chan, Jegadeesh, and Lako Nishok's (1996) conclusion that past returns and past earnings surprises each predict large drifts in future returns, provide weak evidence for the independent power of price momentum.

To support this claim, Novy-Marx performs cross-sectional and time-series regressions of firms' returns onto past performance and earnings surprises measured using Standardized Unexpected Earnings, SUE. The results show that earnings surprises subsume the power of past performance

to predict cross-sectional variation in expected returns. In addition, price momentum strategies do not have a positive alpha relative to earnings momentum strategies, while earnings momentum strategies have large, highly significant alphas relative to price momentum strategies. Novy-Marx argues that these findings are consistent with Chordia and Shivakumar's (2006) conclusion that "the price momentum anomaly is a manifestation of the earnings momentum anomaly."

Moreover, Novy-Marx demonstrates that price momentum in earnings momentum strategies is detrimental to performance. Price momentum contributes to the volatility of earnings momentum strategies and drives the strategies' largest drawdowns. Earnings momentum strategies that explicitly avoid price momentum have lower volatility and none of the negative skew of traditional earnings momentum strategies. These strategies generate average returns comparable to their traditional counterparts, but with significantly higher Sharpe ratios. Overall, Novy-Marx's analysis challenges the conventional wisdom about the importance of price momentum in financial markets and suggests that earnings momentum may be a more reliable and robust factor in predicting stock returns.

2.5 Conclusion of Literature Review

In summary, the literature review has provided an overview of price momentum, earnings momentum, and their relationship. The studies mentioned emphasize the importance of understanding the impact of these factors on stock returns and their potential for improving investment performance.

Moving forward, this study will expand on the findings of previous research to provide additional insights into the effectiveness of price and earnings momentum strategies in the Nordic market. This study aims to contribute to the literature by providing valuable information for making more informed decisions by comparing the performance of different momentum strategies. We also hope to extend the current literature on momentum and provide a better understanding of the factors that drive stock returns in the Nordic market.

3 METHODOLOGY AND RESEARCH DESIGN

3.1 Scientific Perspective

This study is based on quantitative data and employs the hypothetical deductive method. Bryman and Bell (2013) define quantitative research as the analysis of structured data that can be categorized or represented as numerical values. One key assumption of this approach is the expectation that results will be generalizable, which serves as a primary motivation.

The hypothetical deductive method, a strategy designed for investigating measurable phenomena, is used in conjunction with quantitative research in this study (Bryman and Bell, 2005). This method enables a consistent progression from theoretical underpinnings to hypothesis development, data collection, and data analysis, thus promoting the production of generalizable findings.

In the following sections, we will outline the methodology of the study, including data selection, portfolio construction, and regression analysis. Our aim is to provide readers with a thorough understanding of the methods used, as well as a critical reflection on the study's limitations.

3.2 Data Collection

The purpose of this study is to test whether momentum in firm fundamentals, specifically earnings momentum, explains the performance of price momentum strategies. To put this to the test, we look at three different investment strategies for Nordic stocks, focusing on the five all-share indexes called SAX, KAX, OSEAX, HEX, and ICEXI. Our sample includes all current index members as well as all members that have been included in these indexes for the 81 quarters, between January 2003 and March 2023, for a total of 1,540 unique members.

Bloomberg provided the data for this study. We collected reported earnings per share (EPS) for every quarter. We also gathered Bloomberg Estimates Earnings Per Share (EPS), which represents the consensus estimate for earnings per share. The consensus estimate is the average of sell-side analyst estimates as they stand just before the company's quarterly results are released. Finally, we gathered the quarterly report dates for the 1,540 stocks.

To calculate the portfolio returns, we used Bloomberg's total return field which includes dividends. For each individual stock's return, we calculated the relative index return of the stock's home market. An aggregate of the relative excess return was used in the portfolios.

The monthly total return for MSCI Nordic and the running average Swedish Three-Month Interbank Rate were then gathered for each month as proxies for the market return and the risk-free rate. We calculated the monthly market excess return as the difference between the two.

3.3 Portfolio Construction and Methodology

SUE is defined as the most recent year-over-year change in earnings per share, scaled by the standard deviation of the earnings innovations over the last eight announcements, subject to a requirement of at least six observed announcements over the two-year window. Novy-Marx (2015) uses SUE as a measure for earnings momentum. We calculate it as:

$$SUE = \frac{(E_{q0} - E_{q-4})}{\sigma((E_{q-1} - E_{q-5,}) \ldots, (E_{q-9} - E_{q-13}))}$$

Equation 1 : SUE

Where;

SUE = Standardized Unexpected Earnings

E = Reported Earnings Per Share

σ = Standard Deviation

q = Quarters from Trade Date

Our second measure, SES, represents the difference between the actual reported EPS and the consensus EPS estimate. We then divide the difference by the standard deviation of earnings over the last eight announcements, subject to a requirement of at least six observed announcements over the two-year window. We calculate it as:

$$SES = \frac{(E_{q0} - CEE_{q0})}{\sigma(E_{q-1,} \ldots, E_{q-9})}$$

Equation 2 : SES

Where,

SES = Standardized Earnings Surprise (based on EPS Consensus Estimates)

E = Reported Earnings Per Share

CEE = Consensus Earnings Estimate

σ = Standard Deviation

q = Quarters from Trade Date

The third measure, 11MPM, reflects price momentum, which we calculate using the total 11-month return beginning a year before the trade date, accounting for short-term reversals. We calculate it as:

$$11MPM = \frac{(P_{m-1} + Div_{m-12 \rightarrow m-1})}{P_{m-12}}$$

Equation 3: 11MPM

Where,

11MPM = 11 Month Price Momentum

P = Share Price

Div = Distributed Dividends

m = Months from Trade Date

On the first day of each month, we constructed our portfolios, and we divided the stocks into deciles based on their signal, buying the top 10% long and selling the bottom 10% short. The max number of stocks in a sub-portfolio was 91, making the strategies feasible in practice.

We used a rank-based portfolio weighting approach, which determines the weights based on the rank of each stock within the cross-section decile. This method gives stocks with higher signal strength more weight while still ensuring that the weights within the decile add up to 1. We calculate the weights as:

$$W^i = \left(R^i \, \Sigma R^{(i, \ldots, n)}\right) \cdot (n + 1 - i)$$

Equation 4: Weights

Where,

W^i = Weight of stock *i*

n = Total number of stocks in the portfolio

i = The rank of the stock based on its signal strength, with *1* being the strongest and *n* being the weakest

R^i = Rank of Stock *i*

We held each portfolio for a half-year period before divesting, which meant we had six portfolios open at the same time, for a total of twelve sub-portfolios (including the long and short legs) for each strategy. We then calculated the returns net of financing costs (i.e., excess returns). The excess stock returns are calculated as the difference between each individual stock's total return and the return of that stock's relative index. Each month, we computed the average excess returns of the six long sub-portfolios and the six short sub-portfolios. Finally, we calculated the total monthly excess return for each of the three strategies by adding the average excess return of long positions to the average excess return of short positions.

It is important to note that in terms of data availability in our stock universe, the three measures are not equal. The dataset is extensive for the 11MPM measure, which only uses total returns; it is less extensive for SUE, which uses actual reported earnings figures; and it is even less extensive for SES, which uses consensus earnings estimates. This influences the number of stocks available for the portfolios of the three different strategies, just as it would in a real-world setting.

Finally, we created a 50/50 portfolio by equally combining the SES and 11MPM portfolios. In the appendix, we also present robustness test results for three-month holding periods for the three strategies. There we also include results for the SUE and SES strategies using "adjusted" EPS figures.

3.4 Regression Analysis

Regression analysis is a statistical analytical technique that calculates the estimated relationship between a dependent variable and one or more independent variables (Berk & DeMarzo, 2017). The equity portfolios' excess returns are regressed against the excess return of the MSCI Nordic Index. *Microsoft Excel* is used to perform simple linear regression, using a significance level of 5%.

3.5 Reliability and Validity

Strengths of the study:

Comprehensive Data: The analysis covers a wide range of stocks across various Nordic indexes, including 1,540 unique index members over 81 quarters, providing a robust sample for the study.

Multiple Measures: The study considers three measures (SUE, SES, and 11MPM) to investigate the relationship between earnings momentum and price momentum. This approach allows for a more nuanced understanding of the factors driving momentum-based strategies.

Portfolio Construction Methodology: The use of decile portfolios and a cross-sectional regression approach allows for a granular examination of the effects of the three measures on portfolio performance. The long- and short-leg portfolios also enable the analysis of momentum strategies from both perspectives.

Real-World Relevance: The analysis acknowledges the data availability limitations in the real world, which strengthens the external validity of the results.

Weaknesses of the study:

Data Limitations: The different availability of data for the three momentum measures varies, with 11MPM having the most extensive dataset and consensus earnings estimates being the least comprehensive. This disparity may affect the comparison between the strategies based on these variables and limit the generalizability of the results.

Time Frame: The study uses data from January 2003 to March 2023 for the momentum analysis, which may not capture the full range of market conditions and economic cycles that could influence the performance of momentum strategies.

Lack of Control Variables: The analysis does not include potential control variables such as firm size, book-to-market ratios, or industry classifications, which might also affect the performance of momentum strategies.

Trading Costs: We do not account for or adjust for trading costs, which would influence results in a real-world setting.

Single-Region Focus: The study focuses solely on the Nordic region, which might limit the generalizability of the results to other markets.

To improve the analysis further, it would be beneficial to address these weaknesses by expanding the dataset, considering additional control variables, and potentially analysing momentum strategies in other regions or markets.

3.6 Source Critical Consideration

The articles for this study's literature review were gathered from a variety of sources and financial journals such as the Journal of Finance and the Journal of Financial Economics. These are well-known and highly regarded journals. As a result, the literature can be assumed to be trustworthy. All data is retrieved from Bloomberg, a well-known and established financial data platform. As a result, we assume that there is few errors in the data.

3.7 Research Ethical Reflection

The research in this study is quantitative and no people are directly concerned. This implies that there are no issues regarding ethical aspects such as confidentiality and anonymity.

All articles and other resources used in this study are collected, described, and referred to within ethically accepted standards. References to authors of previous work are correctly presented. Further, the quantitative data that is collected is not considered as sensitive information but is available for anyone to gather. Hence, the data collection method is in line with ethical regulations.

3.8 Ensuring Rigor and Replicability in Our Study

Recognizing the concerns in financial research about 'p-hacking' or 'data mining' (Harvey, 2016 & 2017), as well as the'replication crisis' (Jensen, Kelly, & Pedersen, 2021), we designed our study to ensure its rigor and replicability. Before starting the empirical investigation, we pre-specified our analysis plan to a large extent. This pre-specification included our performance metrics, methodologies, and portfolio construction criteria. This method reduces the possibility of 'p-hacking' and overfitting our data, thereby increasing the credibility of our findings.

We conducted several tests to assess the robustness of our findings, the results of which are detailed in the Appendix. We specifically ran robustness tests for three-month holding periods across all three strategies. We also included results for the SUE and SES strategies using "adjusted" EPS

figures. These analyses confirmed the consistency of our findings under different conditions and assumptions.

In acknowledging the'replication crisis,' our study places an emphasis on transparency. We provide a detailed account of our methodologies and data sources. Furthermore, because there are no privacy or confidentiality concerns, we are willing to share our data and codes with other researchers upon request.

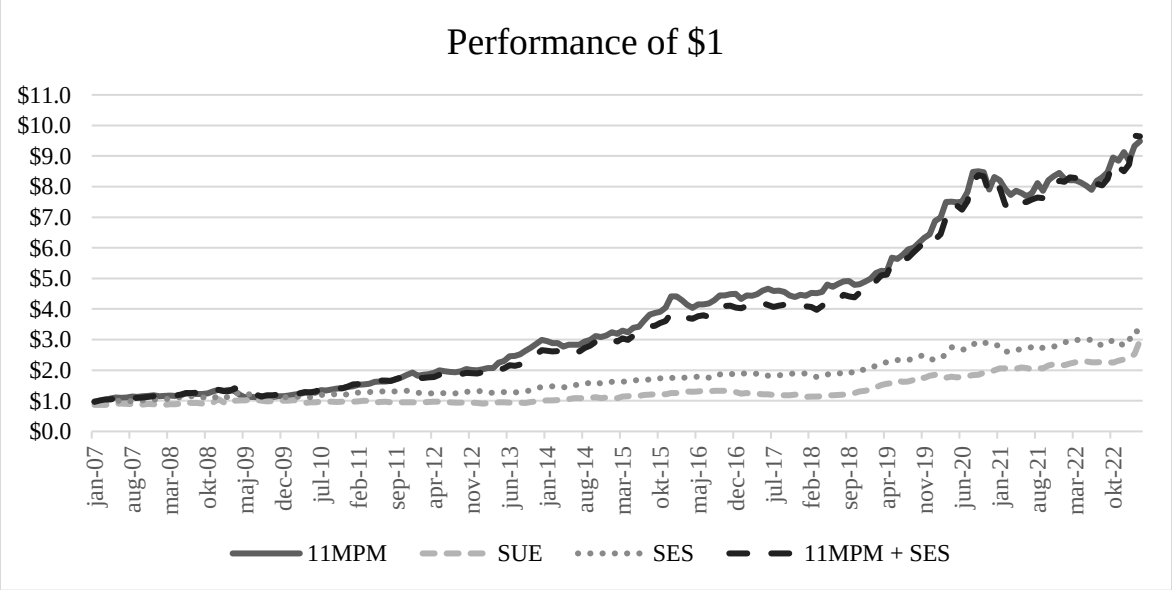
By following these guidelines, we hope to contribute to a culture of rigorous, transparent, and replicable finance research, in line with the principles advocated by Harvey (2016 & 2017) and Jensen, Kelly, and Pedersen (2021). Such practices, we believe, are critical not only for deepening our understanding of financial markets, but also for preserving the credibility of financial research.

4 RESULTS

This section summarizes the performance of the portfolios over time. The graphs show the return on one dollar invested in the portfolios over the studied period, as well as the cumulative excess return. In the appendix, we also present *validating* robustness results for strategies in which we hold each sub-portfolio for three months, as well as when we use "adjusted" earnings figures.

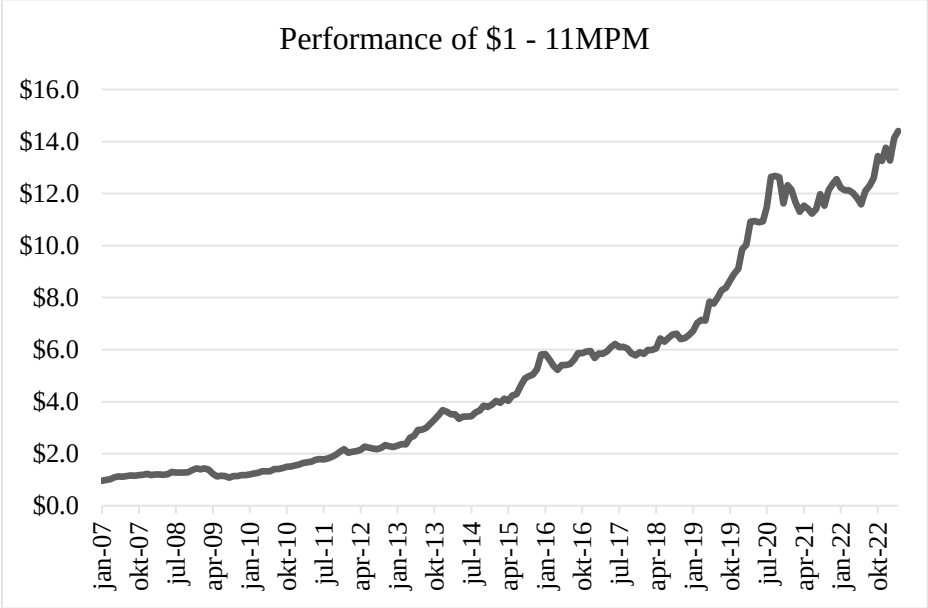
4.1 Excess Returns

The performance of the three momentum strategies, 11MPM, SUE, and SES, is illustrated in graph 1. The graph depicts the growth of one dollar invested in each strategy at the beginning of 2007, net of financing costs (i.e., financed by selling each stock's relative index). To make comparisons easier, the strategies are leveraged to run at a 10% sample volatility. It is clear that the price momentum strategy outperforms the earnings momentum strategies by a wide margin, implying that price momentum strategies have significantly higher Sharpe ratios than earnings momentum strategies.

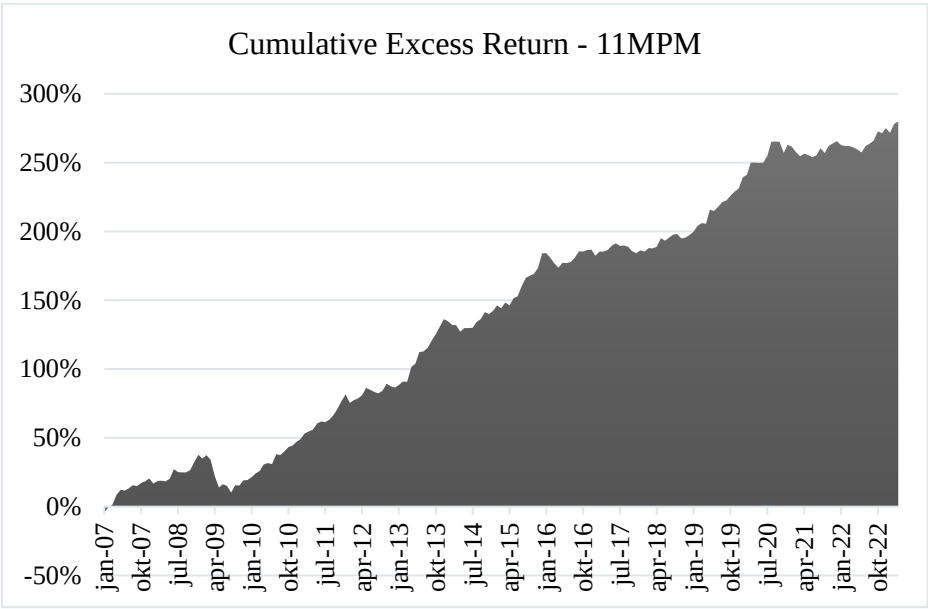


Graph 1 shows a comparison of the performance of momentum strategies. The graph depicts the value of one dollar invested in the price momentum factor, 11MPM (solid line), and the earnings momentum factors, SUE (dashed line) and SES (dotted line), at the start of 2007. The dark dashed line represents the combination portfolio 11MPM + SES. Returns are calculated after deducting financing costs (i.e., excess returns over each stock's relative index). Returns are scaled to have sample volatilities of 10% to facilitate comparison. The sample period runs from January 2007 to March 2023, as determined by the data needed to calculate the SUE and SES.

4.1.1 Excess Returns for the 11MPM Portfolio



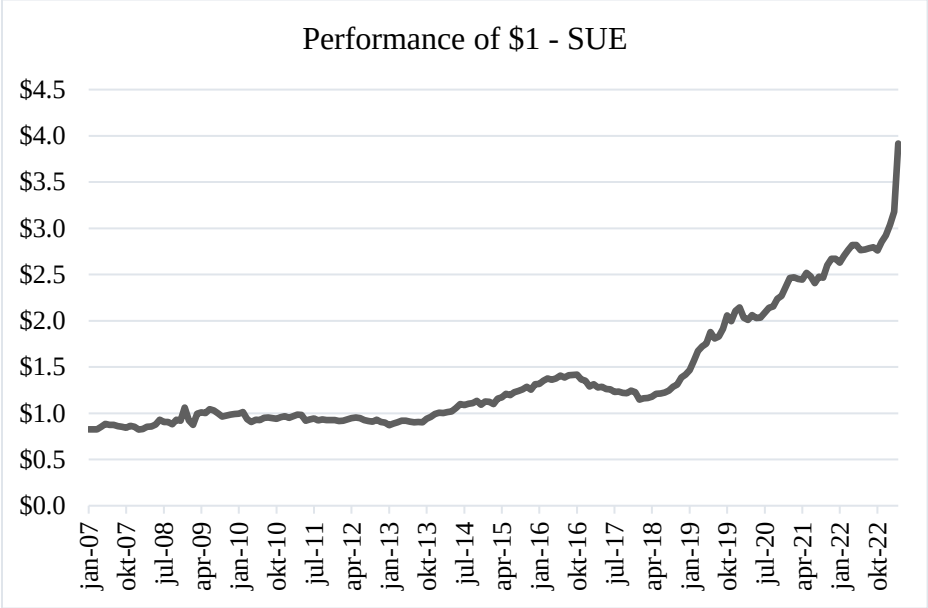
Graph 2: Performance of $1 - 11MPM Portfolio



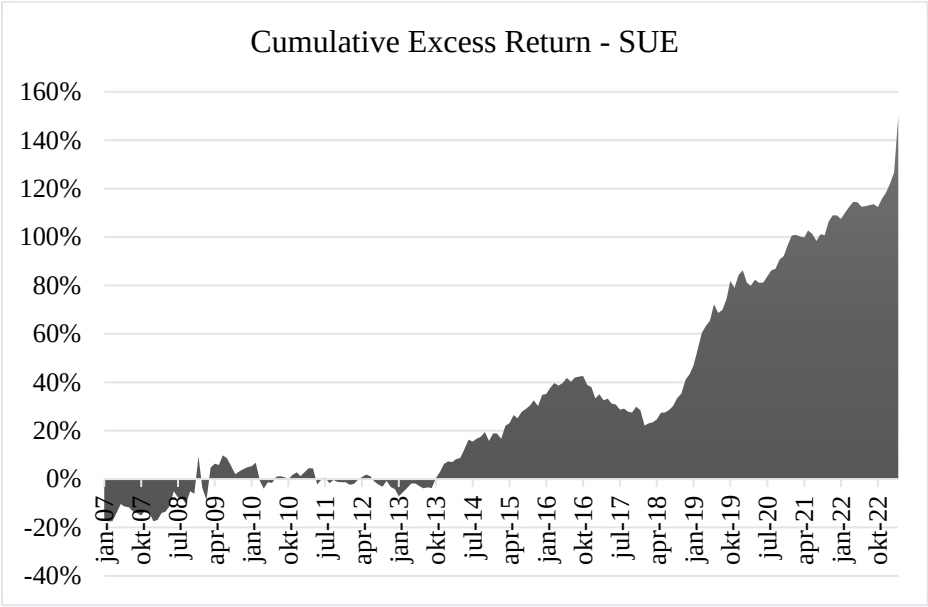
Graph 3: Cumulative Excess Return - 11MPM Portfolio

Comment: As illustrated by the two graphs above, the 11MPM price momentum portfolio has clearly generated significant excess returns over the measured years. A dollar invested through the strategy was by the end of the period worth $14.4.

4.1.2 Excess Returns for the SUE Portfolio



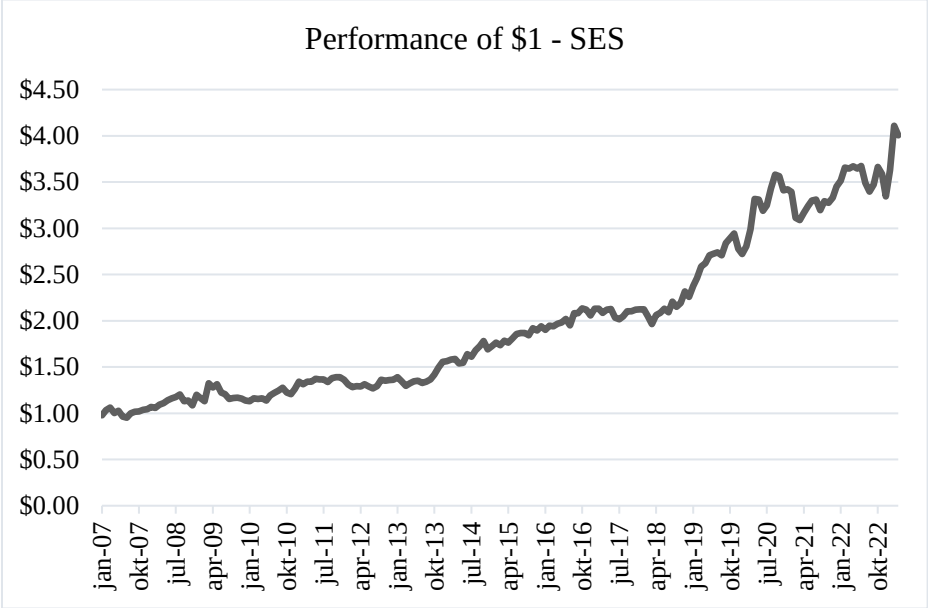
Graph 4: Performance of $1 – SUE Portfolio



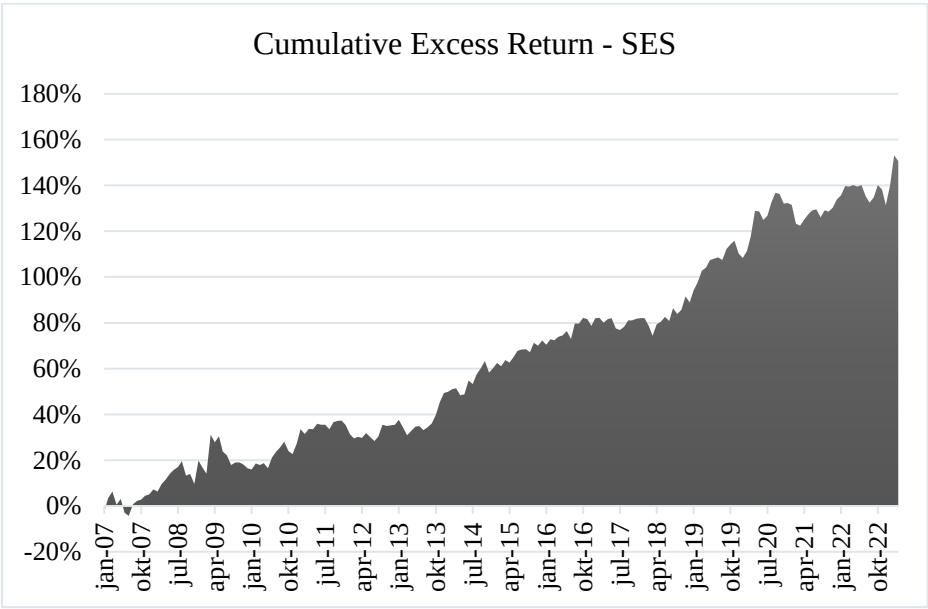
Graph 5: Cumulative Excess Return – SUE Portfolio

Comment: In graphs 4 and 5, we see that the SUE earnings momentum portfolio outperformed the market over the period studied. However, it does not perform as well as the price momentum strategy. A dollar invested using the strategy was worth $3.9 by the end of the period.

4.1.3 Excess Returns for the SES Portfolio



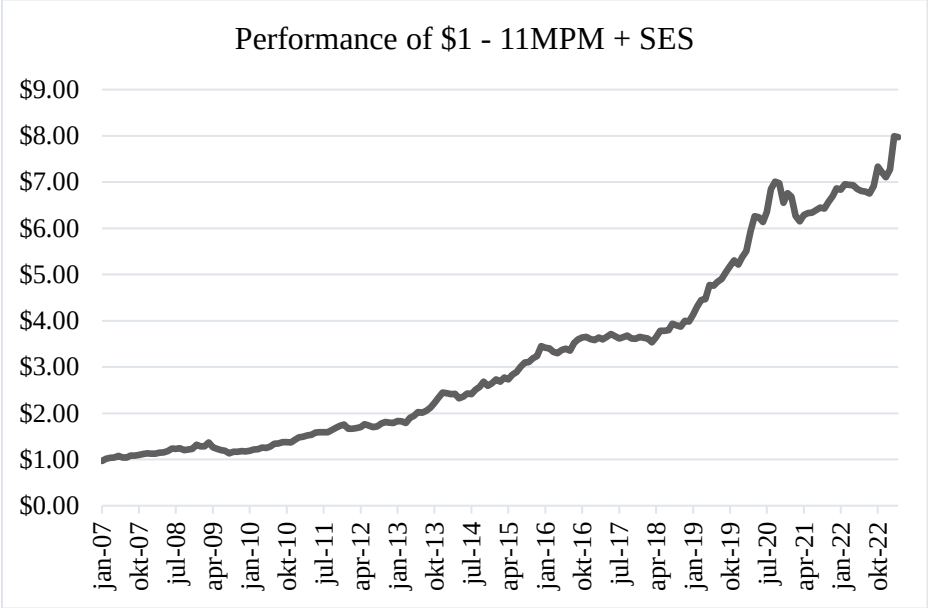
Graph 6: Performance of $1 – SES Portfolio



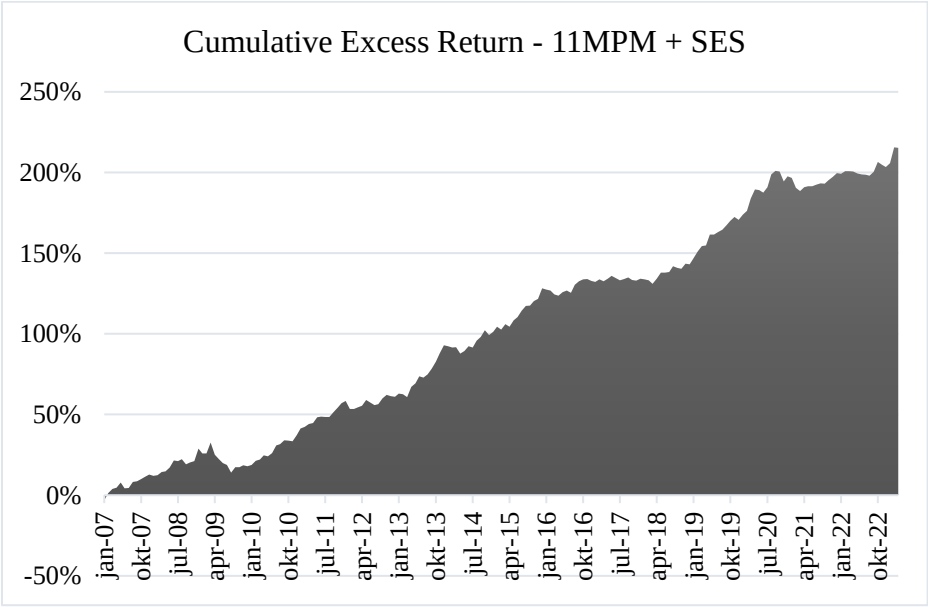
Graph 7: Cumulative Excess Return - SES Portfolio

Comment: As shown in graphs 6 and 7, the SES earnings momentum portfolio outperformed the market and had more consistent returns than the SUE portfolio. However, neither of the earnings momentum portfolios performed as well as the price momentum portfolio. A dollar invested using the strategy was worth $4.0 by the end of the period.

4.1.4 Excess Returns for the Combination 11MPM + SES Portfolio



Graph 8: Performance of $1 – Combination Portfolio, 11MPM + SES



Graph 9: Cumulative Excess Return - Combination Portfolio, 11MPM + SES

Comment: The 11MPM + SES portfolio, which combines price and earnings momentum strategies 50/50, also generated significant excess returns while having the most consistent returns (lowest volatility) of the four strategies. A dollar invested using the strategy was worth $8.0 by the end of the period.

4.2 Performance Measures

Table 1 summarizes our results for the evaluated portfolios, all of which had a holding period of the sub-portfolios of six months. The Sharpe Ratio for the 11MPM portfolio and the combination portfolio both reached 1.49, which was significantly higher than the Sharpe Ratio for either of the earnings momentum strategies. The appraisal ratio, which is the portfolio's alpha divided by the standard deviation of the regression residuals (the portfolio's unique risk), is also higher for the price momentum strategy and the combination portfolio than the earnings momentum strategies.

Maximizing the Sharpe Ratio for various weights of 11MPM and SES in the combination portfolio, we were able to achieve a Sharpe Ratio of 1.60 using weights of 72% 11MPM and 18% SES. Although it is not part of our core research question, it is interesting that the best results are obtained when using both price momentum and earnings momentum in tandem.

Measure	11MPM	SUE	SES	11MPM + SES
Yearly Excess Return:	17.8%	8.8%	8.9%	13.6%
Yearly Volatility	12.0%	12.8%	12.0%	9.1%
Sharpe Ratio	1.49	0.68	0.74	1.49
Annualized Alpha	19.3%	9.6%	9.5%	14.3%
Beta	-0.09	0.01	0.02	-0.03
Appraisal Ratio	0.43	0.21	0.22	0.43

Table 1: Performance measures of the four momentum strategy portfolios

- The Sharpe Ratio for the 11MPM Portfolio was 1.49, with annual excess returns of 18% and volatility of 12%. The alpha, beta, and appraisal ratios of the portfolio were 19.3%, 1-0.09, and 0.43, respectively.
- The SUE Portfolio generated 9% annual excess returns and 13% volatility, yielding a Sharpe Ratio of 0.68. The alpha, beta, and appraisal ratios of the portfolio were 9.6%, 0.01 and 0.21, respectively.
- The SES Portfolio produced yearly excess returns of 9% and volatility of 12%, yielding a Sharpe Ratio of 0.74. The portfolio's alpha, beta, and appraisal ratios were 9.5%, 0.02, and 0.22, respectively.
- The Sharpe Ratio for the 11MPM + SES Portfolio was 1.49, with annual excess returns of 14% and volatility of 9%. The portfolio's alpha, beta, and appraisal ratios were 14.3%, -0.03, and 0.43, respectively.

4.3 Summary regression statistics

We used regressions of our excess monthly portfolio returns to calculate the performance evaluation measures described in the previous section. The regression analysis was used to understand the relationship between the monthly excess return of the different portfolios and the market excess return (MSCI Nordic – Swedish Three-Month Interbank Rate), as well as the relationship between price momentum and earnings momentum strategies. At a 5% significance level, simple linear regression was performed six times. The price momentum strategy 11MPM has the highest intercept B0 (monthly alpha). The 11MPM strategy also generates a higher alpha versus the SES strategy than the reverse, further demonstrating that earnings momentum does not "subsume the power of past performance to predict cross sectional variation in expected returns". The results are summarized in the table below, where Y is the dependent variable and X is the independent variable:

Y	X	α	β	R^2	T Stat	P-Value
11MPM	Market	1.48%	-0.09	0.02	-1.85	0.07
SUE R	Market	0.77%	0.01	0	0.13	0.90
SES	Market	0.76%	0.02	0	0.51	0.61
11MPM + SES	Market	1.12%	-0.03	0	-0.87	0.39
11MPM	SES	1.31%	0.16	0.03	2.3	0.02
SES	11MPM	0.54%	0.16	0.03	2.3	0.02

Table 2: Summary regression statistics

5 DISCUSSION AND CRITICAL REFLECTION

As shown in the previous section of the study, the momentum portfolios outperformed the Nordic market. The price momentum portfolio, 11MPM, and the combined price momentum and earnings momentum portfolio, 11MPM + SES, delivered the best risk-adjusted outperformance, both with Sharpe Ratios of 1.49.

Furthermore, when we examined other evaluation measures as well as regression output, we saw that the price momentum strategy outperformed in terms of alphas and appraisal ratio. All the momentum portfolios produced positive alphas, outperforming the market. Earnings momentum strategies had a slight positive beta, whereas the price momentum strategy generated a negative beta, indicating that strategies based on past performance are negatively correlated with market movements.

We want to note that the earnings momentum strategies did deliver relatively strong returns. However, not nearly as good as the price momentum strategy. An annualized alpha of 19% compared to the market is a remarkable result. By the results shown in the appendix, decreasing the sub-portfolios' holding period in half to three months, the annualized alpha for the price momentum strategy reached 26% - equaling nearly 2% per month.

The primary goal of this thesis was to test Novy-Marx's conclusions in order to determine whether momentum in firm fundamentals truly explains the performance of price momentum strategies. The results presented in section four satisfy the study's requirements for answering the main questions of interest as well as rejecting or failing to reject the null hypothesis. The following were the main hypotheses, as stated in the paper's introduction:

Null Hypothesis, H0: Price momentum is independent from fundamental momentum. Price momentum strategies have significantly higher excess risk-adjusted returns compared to earnings momentum strategies.

Alternative Hypothesis, H1: Price momentum is fundamental momentum. Earnings momentum strategies have significantly higher excess risk-adjusted returns compared to price momentum strategies.

Our findings indicates that there is insufficient evidence to reject the null hypothesis, implying that price momentum may be an independent phenomenon and that it is not solely dependent on fundamental momentum.

6 CONCLUSION

The study investigated the relationships between price momentum, earnings momentum and stock returns in the Nordic region, comparing the risk-adjusted performance measures of a set of momentum strategy portfolios.

Our findings reveal that there is no strong evidence to support the notion that price momentum is merely a weak expression of fundamental momentum. The empirical results presented in the fourth section of the paper provide insights into our questions of interest, but we do not have enough evidence to reject the null hypothesis of the study. Consequently, we cannot conclude that earnings momentum is a better predictor of future stock prices than price momentum.

Our regression data show only a very slight correlation between the returns of the 11MPM and SES portfolios. The low correlation of the two strategies explains the potential for the combination portfolio's high risk-adjusted performance through diversification.

To further advance this research, we suggest considering additional control variables to test for the momentum strategies' factor loadings. Investigating the drivers of momentum in greater detail would enhance the study's insights. Moreover, future research could explore different time periods and geographical regions to provide a more comprehensive understanding of the relationship between price momentum and earnings momentum.

In conclusion, we offer valuable insights into the relationships between price momentum, earnings momentum, and stock returns in the Nordic region. While we do not find conclusive evidence to reject the null hypothesis, our results have practical implications for investment professionals and highlight potential avenues for future research.

7 REFERENCE LIST

Asness, C. S., Moskowitz, T. J., & Pedersen, L. H. (2013). Value and momentum everywhere. The Journal of Finance, 68(3), 929-985.

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. Journal of Accounting Research, 6(2), 159-178.

Barberis, N., Shleifer, A., & Vishny, R. (1998). A model of investor sentiment. Journal of Financial Economics, 49(3), 307-343.

Berk, J., & DeMarzo, P. (2017). Corporate finance (4th ed.). Pearson.

Bernard, V. L., & Thomas, J. K. (1989). Post-earnings-announcement drift: Delayed price response or risk premium? Journal of Accounting Research, 27, 1-36.

Bryman, A., & Bell, E. (2013). Business research methods (4th ed.). Oxford University Press.

Bryman, A., & Bell, E. (2005). Social research methods (2nd ed.). Oxford University Press.

Chan, L. K. C., Jegadeesh, N., & Lakonishok, J. (1996). Momentum strategies. The Journal of Finance, 51(5), 1681-1713.

Chordia, T., & Shivakumar, L. (2006). Earnings and price momentum. Journal of Financial Economics, 80(3), 627-656.

Daniel, K., Hirshleifer, D., & Subrahmanyam, A. (1998). Investor psychology and security market under- and overreactions. The Journal of Finance, 53(6), 1839-1885.

De Bondt, W. F. M., & Thaler, R. (1985). Does the stock market overreact? The Journal of Finance, 40(3), 793-805.

Fama, E. F., & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. The Journal of Finance, 51(1), 55-84.

Griffin, J. M., Ji, S., & Martin, J. S. (2003). Momentum investing and business cycle risk: Evidence from pole to pole. The Journal of Finance, 58(6), 2515-2547.

Griffin, J. M., Ji, S., & Martin, J. S. (2005). Global momentum strategies: A portfolio perspective. Journal of Portfolio Management, 31(2), 23-39.

Harvey, C. R. (2016). Presidential Address: The Scientific Outlook in Financial Economics. The Journal of Finance, 71(4), 1399-1440.

Harvey, C. R. (2017). A checklist for evaluating empirical research in finance. Financial Analysts Journal, 73(4), 21-40.

Hong, H., & Stein, J. C. (1999). A unified theory of underreaction, momentum trading, and overreaction in asset markets. The Journal of Finance, 54(6), 2143-2184.

Hong, H., Lee, C. M. C., & Swaminathan, B. (2003). Can book-to-market, size and momentum be risk factors that predict economic growth? Journal of Financial Economics, 68(2), 221-247.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. The Journal of Finance, 48(1), 65-91.

Jegadeesh, N., & Titman, S. (2001). Profitability of momentum strategies: An evaluation of alternative explanations. The Journal of Finance, 56(2), 699-720.

Jensen, T. I., Kelly, B. T., & Pedersen, L. H. (2021). Is there a replication crisis in finance? (No. w28432). National Bureau of Economic Research.

Novy-Marx, R. (2015). Fundamentally, momentum is fundamental momentum. The Review of Financial Studies, 28(1), 222-265.

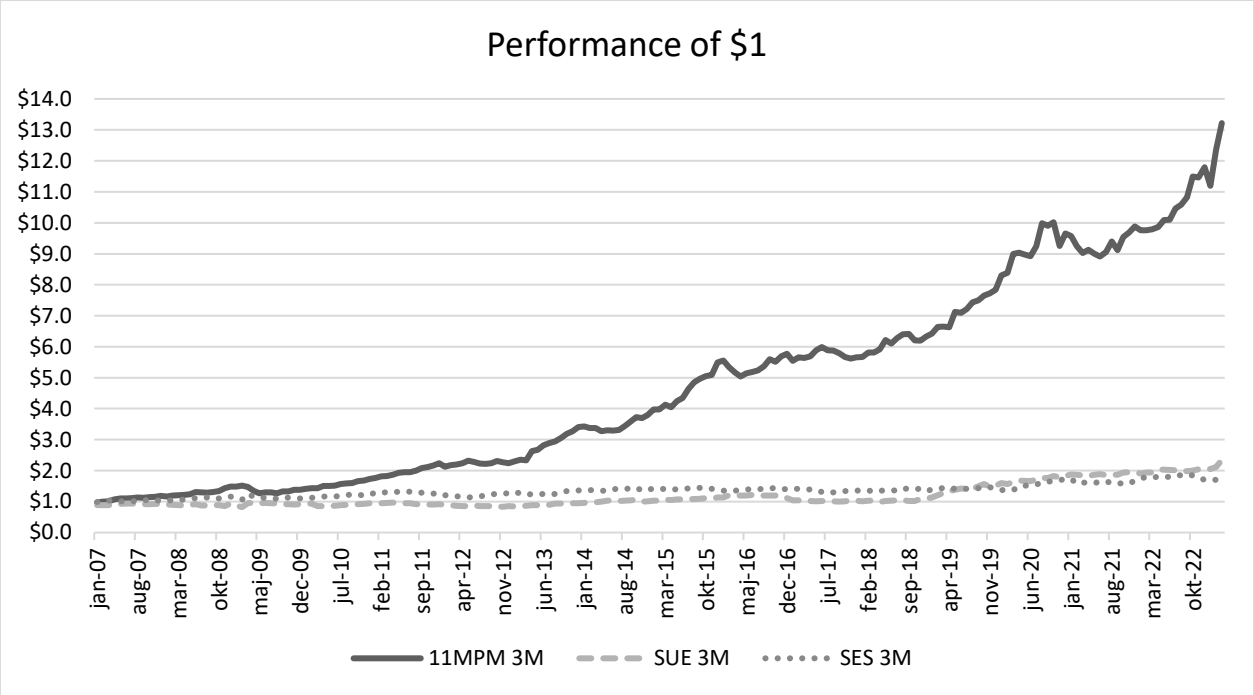
Pastor, L., & Stambaugh, R. F. (2003). Liquidity risk and expected stock returns. Journal of Political Economy, 111(3), 642-685.

Rouwenhorst, K. G. (1998). International momentum strategies. The Journal of Finance, 53(1), 267-284.

8 APPENDIX

8.1 Performance – Three Month Sub-Portfolio Holding Period

Please see the results below from the performed robustness test using a holding period of three months instead of six for the sub-portfolios:



Graph 9 shows a comparison of the performance of momentum strategies using three month holding periods. The graph depicts the value of one dollar invested in the price momentum factor, 11MPM (solid line), and the earnings momentum factors, SUE (dashed line) and SES (dotted line), at the start of 2007. Returns are calculated after deducting financing costs (i.e., they are excess returns). Returns are scaled to have sample volatilities of 10% to facilitate comparison.

Measure	11MPM	SUE	SES
Yearly Excess Return:	23.7%	7.9%	4.7%
Yearly Volatility	13.6%	15.3%	16.0%
Sharpe Ratio	1.75	0.52	0.29
Annualized Alpha	25.8%	8.9%	5.5%
Beta	-0.13	0.04	0.07
Appraisal Ratio	0.50	0.16	0.10

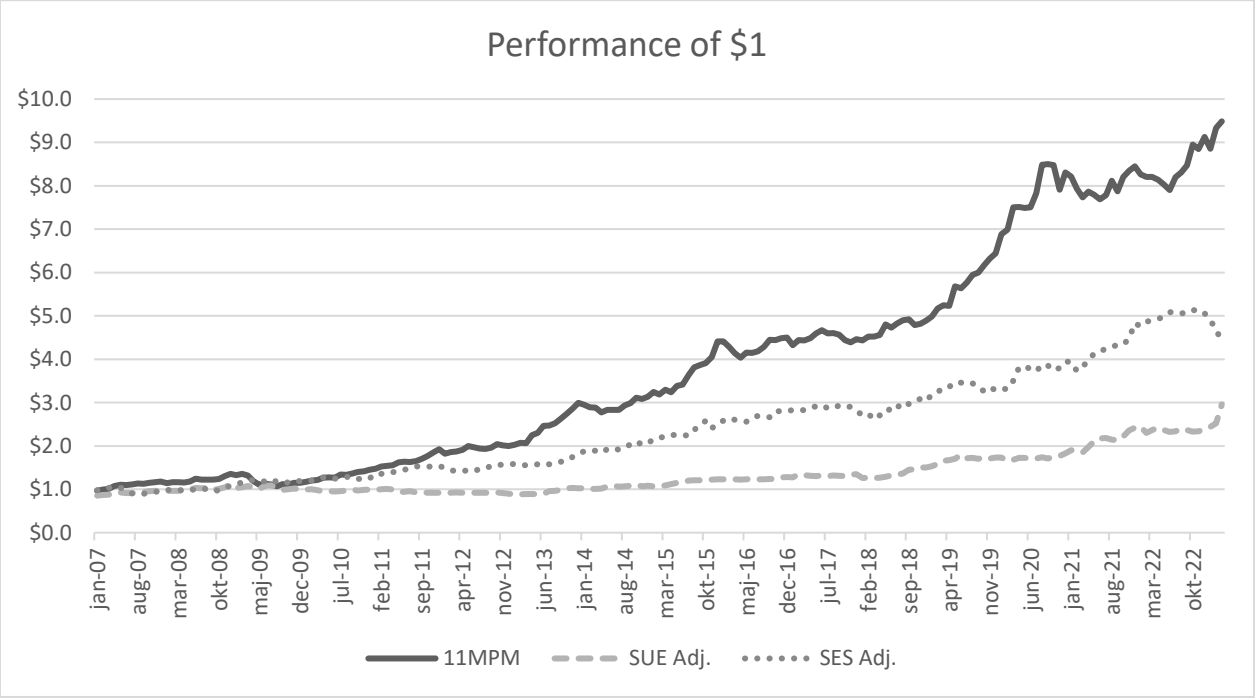
Table 3: Performance measures of the three momentum strategy portfolios using three month holding periods.

Y	X	α	β	R^2	Standard Error	T Stat	P-Value	Lower 95%	Upper 95%
11MPM R	Market R	1.93%	-0.13	0.03	0.05	-2.42	0.02	-0.24	-0.02
SUE R	Market R	0.71%	0.04	0.00	0.06	0.72	0.47	-0.08	0.17
SES R	Market R	0.45%	0.07	0.01	0.06	1.16	0.25	-0.05	0.20

Table 4: Summary regression statistics using three month holding periods.

8.2 Performance – "Adjusted" Earnings Per Share

Please see the results of the performed robustness test using adjusted earnings figures for the earnings momentum measures SUE and SES instead of actual reported figures. Adjusted earnings seek to present a more accurate representation of a company's core earnings power and profitability by excluding the impact of non-recurring items such as restructuring costs, asset write-downs, legal settlements, asset sale gains or losses, accounting principal changes, and other extraordinary or non-operating items. Adjusted figures have previously been used in the literature, for example, Novy-Marx (2015):



Graph 10 shows a comparison of the performance of momentum strategies using adjusted earnings figures. The graph depicts the value of one dollar invested in the price momentum factor, 11MPM (solid line), and the earnings momentum factors, SUE (dashed line) and SES (dotted line), at the start of 2007. Returns are calculated after deducting financing costs (i.e., they are excess returns). Returns are scaled to have sample volatilities of 10% to facilitate comparison.

Measure	11MPM	SUE	SES
Yearly Excess Return:	17.8%	8.1%	10.3%
Yearly Volatility	12.0%	11.9%	10.9%
Sharpe Ratio	1.49	0.68	0.94
Annualized Alpha	19.3%	8.9%	11.1%
Beta	-0.09	-0.01	-0.03
Appraisal Ratio	0.43	0.21	0.28

Table 5: Performance measures of the three momentum strategy portfolios using adjusted earnings figures for SUE and SES.

Y	X	α	β	R^2	Standard Error	T Stat	P-Value	Lower 95%	Upper 95%
11MPM R	Market R	1.48%	-0.09	0.02	0.05	-1.85	0.07	-0.18	0.01
SUE R	Market R	0.72%	-0.01	0.00	0.05	-0.22	0.83	-0.10	0.08
SES R	Market R	0.88%	-0.03	0.00	0.04	-0.62	0.53	-0.11	0.06

Table 6: Summary regression statistics using adjusted earnings figures for SUE and SES.