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Predictability of Macroeconomic Variables

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# Preliminary Thesis Report

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# Momentum Strategy and Predictability of Macroeconomic Variables

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## 1. Introduction

A well debated and highly interesting topic in finance are the research and the amount of work that is dedicated to explain the source of momentum profit of stock returns. This anomaly contradicts the rational assumptions in asset pricing and the Market Efficiency Hypothesis. After the exploration of short-term momentum profits by Jegadeesh and Titman (1993) and the continuation of the profitability, research has tried explain and predict this anomaly. Several studies have tested the predictability power of firm-specific factors, but has yet to explain the momentum effect. Later findings suggest the relation between business cycle and the behavioral to be possible common factors.

The aim with this paper is to find out if we can predict the momentum effect on the Nordic indices by applying a similar approach done by Chordia and Shivakumar (2002). We have found earlier studies which has proved the momentum effect on some of the Nordic countries. However, we will conduct our own study on the respective countries to get the results and statistics consistent with the regression of macroeconomic variables. As we have discovered differences in the application of the model, we are open to adapt the study to other articles. Previous research has performed the study on different countries, adjusting the model so that the macroeconomic factors are consistent with the respective countries.

### Research question:

*Can the momentum effect in the Nordic countries be explained by common macroeconomic variables?*

The rest of the report consists of 5 parts. The second part summarizes the literature that we have considered relevant, and what discovered so far. Part 3 explains some of the main theory related to the studies. Part 4 is a description of the methodology that we intend to use in our thesis, based on the articles. Part 5 is an explanation of the data. Finally, we will describe how we intend to proceed further with our work.

## 2. Literature Review

The Capital Asset Pricing Model (CAPM) presented by Sharp (1964) and Lintner (1965), has a strong theoretical function in asset pricing theory due to its simplicity of measuring relation between expected return and exposure to systematic risk. However, the underlying assumptions of the model is rather unrealistic and Fama and French (1992) provided clear indications of the failures of CAPM. The CAPM failed to explain factors that were retrieved from previous research done by Basu (1977), Bhandari (1988), Statman (1980) and Rosenberg, Reid, and Lanstein (1985). The factors were earnings-price, debt-equity, book-to-market ratios, respectively. By running a cross-section regression, Fama-French confirmed that firm specific information adds explanatory power to the relation between market beta and the expected return. Findings such as these are referred to as efficient market anomalies in financial theory.

Continuing on their findings from 1992, Fama-French (1993) suggest a model that relates to the expected stock returns with respect to three risk factors. The Fama-French three factor model emphasize three risk factors; firm size, book-to-market ratio (B/M) and market index. This is supported by previous research done on the possibility of explanatory power of firm specific information. Fama-French (1996) finds that the anomalies disappear in the factor model, but fails to explain why the profit from momentum strategies persist, as documented by Jegadeesh and Titman (1993) and Asness (1994). Their conclusion regarding the lack of explanation sums up to three possible reasons. The anomaly is a result of data mining, irrational asset pricing and shortcomings in the model. Carhart (1997) includes a proxy of the momentum effect, calculated by the difference between winner and loser stocks from the previous period. He discovered what appeared to be the alpha, on many mutual funds, could be explained as due to the loadings or sensitivity to market momentum.

Jegadeesh and Titman's (1993) study of U.S. stock returns discovered that short-term momentum strategies generate significant positive returns. They showed that, buying stocks that performed well in the prior period and selling stocks that performed poorly in the prior period, generates positive returns over 3 to 12 month holding period. Furthermore, Rouwenhorst (1998) showed that profits from momentum strategies were significantly positive in 12 other countries, and Jegadeesh and Titman (2001) provided evidence which indicates that payoffs to momentum strategies persisted in the 1990s. In 1999, Moskowitz and Grinblatt investigated whether industry factors could explain the profitability. After controlling for momentum across industries, they showed that only momentum portfolios with a holding period of 12 months, had significant individual stock returns.

Chordia and Shivakumar (2002) uses macroeconomic variables predicting stock returns to explain the payoff from short-term momentum strategies. They find that payoffs to momentum strategies can be predicted by the use of a set of lagged common macroeconomic variables known to predict stock market returns. This approach is motivated by previous research done Chen, Roll and Ross (1986) as they were the first to assess the plausible impact of macroeconomic variables on stock returns. They concluded that unexpected changes in certain macroeconomic variables had a significant impact on security prices. This was supported by the studies of Chan, Chen and Hsieh (1985) in their investigation of the firm size effect, where they discovered that the changing of risk premium explains most of the size effect. Bernanke and Gertler (1989) had a similar conclusion in their model of business cycle dynamics, where the fluctuation in the state of credit markets and the expected returns varies between small and large firms.

The importance of interest rate as a macroeconomic variable is consistent with findings by Berk, Green and Naik (1999). Their research describes the individual firm's decision making based on the cash flow valuation that is affected by, in example, interest rate changes. Hence, affecting the firm's growth possibilities. Furthermore, in the research of momentum factors predictability, Liew and Vassalou (2000) assess the relation between the return on HML, SMB and WML,

and future economic growth. The study showed that HML and SMB had a significant influence on future economic growth. Economic growth was measured by GDP.

Griffin, Ji, and Spencer Martin (2003) performed an international study of the possibility that macroeconomic variables can predict expected returns. The research tested previous study of both Chordia and Shivakumar (2002) with their conditional model, and Chen et al (1986) by using their unconditional model. They concluded that the unconditional model lacked significance to explain momentum profit when testing for both the US market and abroad. However, the conditional model managed to predict momentum profits in the US, but the study lacked predictive power abroad. The results are supportive of the stated theory about predicative power in macroeconomic factors. Lakonishok, Shleifer and Vishny (1994) studied value of growth strategies, where they emphasized in their studies on behavioral pattern during recession, discovering that profitability of momentum strategies clear relations to positive and negative economic states. The result is supportive of earlier findings by Bernanke and Gertler (1989).

Cooper et al. (2004) finds that the state of the market has an important impact on momentum profit. The study explores momentum strategies in both recessions and expansions. However, he concludes that the momentum effect only is present during expansions. By replicate the macroeconomic model of Chordia and Shivakumar (2002), adjusted for market frictions, he fails to explain the momentum effect.

There is a discussion about the use of conditional and unconditional models. The unconditional models predict future expected stock return based on expected changes in the risk factors, while the conditional model estimate expected return using lagged values. Zhang et al (1996) tests a conditional asset pricing model on predictability of the firm specific variables; Market value of equity and Book to market equity-ratio. The results are less predicative than first assumed, their

findings are inconclusive and economic factors that's correlates more likely will be a better factor to predict future expected return.

In studies by Xueping Wu (2002) trying to explain momentum anomaly he applies a conditional Fama-French three-factor model. Wu discovered significant results of explaining short-term momentum and states that the conditional approach might explain the shortcoming of Fama and French 3 Three-factor model. This was supported by Wang (2003) who stated that the conditional approach of the Fama-French three-factor model did improve the results.

Antoniou, Lam and Paudyal (2006) investigates the effect of business cycles on momentum strategies. However, their study of the European market is inconsistent with previous studies on macroeconomic variables ability to explain the momentum anomaly and clarifies this with possible shortcomings in regression procedures. Hence, they conclude that business cycles variables provide significance but finds more prominent with by testing the model by Avramov and Chordia (2006).

Later studies done by Min and Kim (2014) examines momentum profit and downsides risk. Their findings support the previous findings of the relation between positive momentum effect in expansionary periods. However, Min and Kim (2014) finds that during bad states, negative profits becomes clear and evidence of downside risk. The results are, however, inconsistent with the theory of countercyclical risk premiums. The study of Henkel et al. (2010) of the G7 countries finds a robust connection between average return predictability and business cycle, except for Germany.

### 3. Theory and Hypothesis

#### **Efficient Market Hypotheses**

The Efficient Market Hypothesis (EMH), introduced by Eugene Fama in 1970, states that security prices should incorporate and reflect all relevant market information at any time. This implies that new information will affect prices immediately, hence it is impossible for investors to outperform the market without buying more risky securities, since they always trade at their fair value. Fama defines three forms of market efficiency; *weak, semi-strong, and strong form*. The weak form efficiency suggest that stock prices reflect all available historical data, the semi-strong form suggest that stock prices reflect all public information about a company. Furthermore, we say that the market is strong form efficient if stock prices reflect all relevant information.

#### **The Momentum Effect**

Findings from De Bondt and Thaler (1985) documented that there existed patterns in stock prices that challenges the EMH. By examine stock returns on NYSE, they created portfolios sorting poor performers within the past 3-5 year to invest long in. The studies found that by applying this strategy, the poor-performers portfolio achieved greater returns over the next 3-5 years than the best preforms the subsequent years. Applying the strategy by going long in past loser and selling past winners is referred to as the reversal strategy. Jegadeesh and Titman (1993) used 3 and 12 month holding period, their research found that investing in past winners generated short-term abnormal returns for a continuing period. By constructing portfolios with past winners, the strategy shows to outperform other stocks within the same period. The momentum effect is supported by the work of Hong and Stein (1999), where short-term momentum can be described by

The effect has proved to be efficient for short term investing. However, long term holding periods following the same strategy has proven to generate negative returns over time, but remains to be conclusive (Bodie and Kane, p. 345-346). The momentum effect is challenging the EMH and its description of weak and semi-strong theory.

## **Hypothesis**

The aim of the thesis is to find out if the macroeconomic variables in the Nordic countries can predict the abnormal returns of momentum strategies. However, the first manner will be to investigate whether there have been abnormal returns attributed to momentum strategies in the Nordic markets, in the past. We suggest the following hypothesis to assess whether the short-term returns are generated by chance or if they statistically significant.

### *Momentum Strategies*

H0 : Short-term profits are not persistent in the long run.  
(Abnormal returns = 0)

HA : Short-term profits are persistent in the long run.  
(Abnormal Returns  $\neq$  0)

After retrieving the results of momentum strategies we will run the regression of the macroeconomic variables and use lagged values to predict expected return for the next month. Thereafter, test if the prediction model can explain the momentum effect. Hence, we suggest the following hypothesis.

### *Regressed on Macroeconomic Predictor Variables*

H0 : The macroeconomic variables do not explain the momentum effect in the different countries

HA : The macroeconomic variables explain the momentum effect in the different countries

## 4. Methodology

The trading strategy developed by Jegadeesh and Titman (1993) is based on buying stocks that's has shown to perform well in the past and by selling those who has under preformed. The strategy has shown, over time, to earn positive returns and hence violate what is to be the considered the most fundamental hypothesis within financial theory, the Efficiency Market Hypothesis.

By follow the methodology applied in the paper; *Returns to Buying Winners and selling Losers: Implications for stock Market Efficiency* by Jegadeesh and Titman (1993), we will test the strategies on the Nordic indices to explore whether there exists a momentum effect.

The methodology consists of observe and pick stock based on their previous performance the past 3, 6, 9 and 12 months. The model defines the length of the formation period, J, and the holding period, K. The strategy begins in time, t, and selects its stocks based on performance in past months J, and holds them for K months. K defines Holding period. The strategy can be illustrated as following (Table), J-K representing a strategy and the different combinations as specified, representing a total of 16 strategies;

<b>J-K</b>	<b>3</b>	<b>6</b>	<b>9</b>	<b>12</b>
<b>3</b>	3-3	3-6	3-9	3-12
<b>6</b>	6-3	6-6	6-9	6-12
<b>9</b>	9-3	9-6	9-9	9-12
<b>12</b>	12-3	12-6	12-9	12-12

The strategy then ranks the stocks based on their historical performance in J months in an increasing order. Jegadeesh and Titman (1993) creates ten equally weighted decile portfolios based on the rankings of the stocks and places the top ten performing stocks in one portfolio, going long. The bottom ten performers being collected into one portfolio, going short. The strategy buys for each month t, the best performing portfolio and sells the portfolio that's underperforms. Portfolio size will depend on the size of our data. This is based later research by Asness et al. (2013) and Griffin, Ji & Spencer Martin

(2005), were the portfolios have been constructed by a higher percentage of the best (worst) performing stocks. For portfolio weighting, we find it reasonably to apply the equal weight approach supported by earlier works. This is in line with earlier momentum studies performed on the Nordic market.

We use the methodology by Chordia and Shivakumar (2002) to investigate if common macroeconomic variables, that are related to the business cycle, can explain the profits from momentum strategies in Nordic countries. The conditional forecast model, predict expected return for the following month using lagged macroeconomic variables. These variables are: the market dividend yield (DIV), the 3-month T-bill yield (YLD), Difference between average yield of Treasury bonds with more than 10 years and 3-month T-bill yield (TERM), and the difference between the average yield of AAA and BBB-or-lower-rated bonds (DEF). For each stock  $i$  they run the following rolling regression:

$$R_{i,t} = c_{i,0} + c_{i,1}DIV_{t-1} + c_{i,2}YLD_{t-1} + c_{i,3}TERM_{t-1} + c_{i,4}DEF_{t-1} + e_{i,t}$$

The regression considers the prior 60 months of the current period. Hence, the parameters  $c_{i,k}$  will be estimated each month and the output from the regression will vary over time. There will also be specified other conditions related to the input of the model, which will be discussed in chapter 5.

Griffin, Ji and Martin (2003) used the same model on the international market, but due to the less developed bond markets outside the U.S they excluded the DEF factor. However, the results they achieved by replicating the research done in the U.S, did not change. Hence, we might consider excluding this variable depending on our data.

## 5. Data

We do not perform any tests in this preliminary report as we have not retrieved any data. However, we will provide a description of the data we intend to use in our thesis for the assessment of momentum profitability and the underlying predictive power of macroeconomic variables.

To test our hypotheses, we must collect data from the different indices for the respective countries. We have chosen to restrict our research to Nordic countries. More specific; Norway, Sweden, Finland and Denmark. The data will be monthly frequency time-series data of common stock prices, which is similar to recent studies of short-term momentum strategies. To gather enough observations, we will suggest using data that reaches 40 years back in time. Hence, our dataset will consist of 480 observations. However, we probably must add some additional restrictions since all the stocks that are listed on the different indices most likely don't provide enough observations in the estimation period to obtain meaningful statistics. Chordia and Shivakumar (2002) restricts the regression to common stocks that have at least 24 observations in the estimation period, which is 60 months back in time. The number of common shares will vary between countries, but that will not be a problem as the winner (loser) stocks are retrieved from percentiles.

In addition to stock returns we need data for the independent variables in the regression. As stated, these factors are DIV, YLD, TERM and DEF. As previously stated, we found that research have applied the macroeconomic model on other European countries and excluded DEF. We will consider doing the same.

Furthermore, we will use Thomson Reuters Datastream to obtain the monthly prices of equity traded at the different indices, and monthly observations of the macroeconomic risk factors. We will investigate further which indices to use.

Country	Stock Exchanges	Start Period	End Period	Years	Number of Observations
Norway	Oslo Stock Exchange	02.01.1977	30.12.2017	40	480
Sweden	Nasdaq Stockholm	02.01.1977	30.12.2017	40	480
Finland	Nasdaq Helsinki	02.01.1977	30.12.2017	40	480
Denmark	Nasdaq Copenhagen	02.01.1977	30.12.2017	40	480

## 6. How to Proceed

Month	Plan
January	Collect necessary data: Equity prices and macroeconomic variables, and start momentum calculations. Meet supervisor to plan for further meetings and feedback sessions. Decide what analytical tool to use.
February	Continue with our calculations for both the momentum strategy and regression of macroeconomic variables.
March	Calculations for predictability by the use of described method. Start writing process.
April	Continue with the writing process
May	We expect that some difficulties will occur. Hence, we will follow-up calculations and continue the writing of our thesis.
June	Continue writing process
July	Continue writing process
August	Deliver our thesis

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