# United States' Impact in Stock Return Predictability in the Scandinavian Markets

**Sampo Raij**

**School of Business**

Bachelor's thesis

7.12.2023

**Thesis supervisor and advisor:**

Prof. Matthijs Lof

Aalto University
School of Business

AALTO UNIVERSITY
SCHOOL OF BUSINESS

ABSTRACT OF THE
BACHELOR'S THESIS

Author: Sampo Raij

Title: United States' Impact in Stock Return Predictability in the Scandinavian Markets

Date: 7.12.2023 Language: English Number of pages: 4+19

Degree programme: Finance

Supervisor and advisor: Prof. Matthijs Lof

I examine whether lagged US excess returns have had a predictive relationship with excess returns in Sweden, Denmark and Norway from 1996 to 2020. I divide the time frame into three separate groups to see how the potential lead-lag-effect has developed over time. Over the entire 25-year time period, there were no statistically significant effects. However, from Jan 2001 to Dec 2010, the US Granger caused Danish stock market excess returns on statistically highly significant level. I was unable to determine whether the predictive relationship has weakened over time, though continuously smaller $R^2$-values would seem to support this theory. The results indicate that the US would have had a predictive relationship with some of the Scandinavian countries, but that this relationship no longer holds true on a statistically significant level. The predictive strength would seem to be at its highest in times of market shocks originating from the US, implying that the prior predictive relationship stemmed from gradual information diffusion from the US to Scandinavia.

Keywords: Stock market predictability, Scandinavia, Excess returns, Market efficiency

# Contents

# 1 Introduction

Throughout the existence of the stock market, both academics and other finance professionals have always been interested in the possibility of predicting the future of the market. Early results by (Fama and French in 1988) implicate that there is reliable evidence in favor of stock market predictability. More recent research has found evidence both in favor (Lewellen 2004) and against (Goyal and Welch in 2003). (Hjalmarsson 2010) found that there was a degree of predictability in developed countries from 1935 to 2004 and (Rapach, Strauss and Zhou, 2013) found that lagged US excess returns had a significant ability of predicting stock market excess returns in 10 industrialized countries. Despite of the mixed findings around this topic, I have decided to study the effect of the US in the predictability of the Scandinavian markets.

In this paper I examine the relationship between monthly lagged US market excess returns and monthly returns in Sweden, Denmark, and Norway from January 1996 until December 2020. My main interest are in whether the Scandinavian market miss-evaluates the effects of market shocks in the united states, and how has this effect developed over the 25 years. This topic has been researched using other industrialized countries, however the research regarding the Scandinavian markets has been limited, with most attention being focused on Sweden. A considerable part of research has also taken place using data from the 1980s when to Nordic stock markets where not nearly as developed as they have since become.

I have decided to use more recent data to further examine whether any of the relationships previously found by Rapach, Strauss and Zhou (2013) still exist and if, how have they developed over the years and subsequent market shocks over the time period. Prior research (Ibid.) dives deeper into the effect of the US. They conclude that at least some kind of a link between US excess returns and lagged excess returns from 1980 to 2010 in some industrialized countries can be found. They examined 10 industrialized non-US countries, of which the only Scandinavian country was Sweden, for which they found a significant predictive relationship for US excess returns. I aim to find if this relationship also appears in later data, as well as whether a relationship of similar kind also exists for Norway and Denmark.

To better examine the underlying reasons behind the results I have decided to divide the data into three separate groups: 1996-2000, 2001-2010 and 2011-2020. As the effect I am examining is a form of market inefficiency, I am keen on exploring the

development of the effect over time as information technology and the financial markets have developed further, potentially causing the predictive strength of the lagged US excess returns to diminish. The divide of the 25 years into 3 periods allows for cross-examination of the development of this effect. The first group contains the bursting of the dot.com-bubble, the second one its aftermath and the financial crisis of 2007-2008, and the last group the Euro crisis as well as the beginning of the market shock caused by Covid-19. Out of these crises especially the dot.com-bubble and the financial crisis began in the US and subsequently spread to Europe and thus the Scandinavian countries. The US-led shocks are vital to this study, since they can show whether the Scandinavian markets react to globally significant news with a delay. The importance of these shocks is argued further in the results section.

# 2 Data and Methodologies

I conduct a several time-series regressions over the entire time period as well as in separate decades. I regress lagged US excess returns and lagged country specific excess returns over the excess returns of said country to determine the significance of the effect. The market returns as well as the interest rates were compiled from Datastream. Countries and the time period were chosen based on the availability of both general index data and 3-month interest rate data. Each return is a monthly input from a broad market index from each country. As the risk-free rate I have used the 3-month treasury bill in each country's own currency. All data used is from the end of each consecutive month.

The model is a simple linear regression of time-series data, where I regress the T-1 month lagged excess returns over the T-month excess returns using US returns and the country's own T-1 month excess returns and the country's own excess return as T-month value. All of the data is from the last day of each month. Finally, I conduct a series of pairwise Granger causality tests using each countries lagged excess returns as variables to see whether the possible predictive relationship applies to other countries' lagged returns as well. Pairwise Granger causality tests are commonly used when studying lead-lag relationships regarding US portfolio returns and hence can be applied to the examination of international returns as well.

The tables report the results of OLS estimates USL, SEL, DKL and NOL and the $R^2$ values as well the F-statistics. Due to the unpredictability of monthly returns, results indicate very low $R^2$-values. However, as the values are monthly, even results

of 1 percent or larger may signal economic significance (Kandell and Stambaugh, 1996). The regression model takes the form of

$r_{i,t+1,S} = \alpha_S + \beta_{US,t} + \beta_{S,t}$,

where both $\beta$ are excess returns, and S in the country measured.

Appendix 1: Extrapolated Norwegian interest rate data from 1996-1997 From Jan 1996 to Aug 1997 there is only partial data for Norway's 3-month treasury bill. Out of the 20 months, only 6 have yield data due to the treasury bill not being issued. As the central bank interest rates have changed from 0.0567 to 0.0406 over this 20 months, I have decided to not keep the rates constant, but calculate the average difference between the market rate and Norway's central bank rate from Jan 1996 to Dec 1998 and add this average to the central bank's rate to extrapolate market rates.

# 3 Analysis

## 3.1 Regression 1: 1996-2020

The results over the entire time period show that there excluding Norway, there were no statistically significant relationships between these countries' returns and lagged US returns. A statistically highly significant positive relationship between lagged US returns and Norway's returns was found. All of the $R^2$ values found were low, at 0.014 for Sweden, 0.018 for Denmark and 0.029 for Norway. Considering the findings by (Kandell and Stambaugh 1996) regarding the economic importance of even relatively small monthly $R^2$-values, it is worth noting that all of the Scandinavian countries had $R^2$-values over 1 percent, as well as that the US had a massively lower $R^2$ value with its lagged returns than the Nordic countries with their respective lagged returns. On top of this, Denmark also had a statistically highly significant relationship with its lagged returns, implying the presence of autocorrelation in the data.

Table 1: Effect of countries' last month's general index excess returns on next month's excess returns, monthly from Jan 1996 to Dec 2020

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | USL | SEL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| US | 0.005 | 0.019 | −0.115 | 0.231** |
| | (0.058) | (0.102) | (0.080) | (0.107) |
| SE | | 0.106 | | |
| | | (0.082) | | |
| DK | | | 0.166** | |
| | | | (0.071) | |
| NO | | | | 0.003 |
| | | | | (0.078) |
| Constant | 0.005** | 0.006* | 0.007** | 0.003 |
| | (0.003) | (0.003) | (0.003) | (0.003) |
| Observations | 299 | 299 | 299 | 299 |
| $R^2$ | 0.00002 | 0.014 | 0.018 | 0.029 |
| F Statistic | 0.007 (df = 1; 297) | 2.048 (df = 2; 296) | 2.763* (df = 2; 296) | 4.397** (df = 2; 296) |

## 3.2 Regression 2: 1996-2000

There are no statistically significant findings for any of the variables tested during the 1990s. This might be affected by the smaller data sample due to the period being only half of what the other 2 periods are. The results found were slightly positive, with $R^2$ values slightly higher than in the regression table with all of the data. There is nothing indicating a statistically relevant relationship between US excess returns and Scandinavian excess returns.

Table 2: Effect of countries' last month's general index excess returns on next month's excess returns, monthly from Jan 1996 to Dec 2000

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | USL | SEL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| US | −0.160 | 0.112 | 0.162 | 0.185 |
| | (0.130) | (0.182) | (0.136) | (0.189) |
| SE | | 0.155 | | |
| | | (0.149) | | |
| DK | | | −0.063 | |
| | | | (0.153) | |
| NO | | | | 0.047 |
| | | | | (0.162) |
| Constant | 0.010 | 0.012 | 0.011* | 0.006 |
| | (0.006) | (0.008) | (0.006) | (0.007) |
| Observations | 59 | 59 | 59 | 59 |
| $R^2$ | 0.026 | 0.045 | 0.025 | 0.036 |
| F Statistic | 1.507 (df = 1; 57) | 1.329 (df = 2; 56) | 0.726 (df = 2; 56) | 1.044 (df = 2; 56) |

### 3.3 Regression 3: 2000-2010

The US was found to have a positive statistically highly significant relationship with Norway and a statistically very highly significant relationship with Denmark. The $R^2$-values are also very high, with Norway's (0.076) being over twice a large as within the whole sample and with Denmark's (0.118) over 6 times as large as within the whole sample. Out of the results these were by far the most notable findings, and thus need to be investigated further, as I have done in the results section. To determine whether these results truly implicate a predictive pattern, or whether it is a case of spurious correlation, I will do separate pairwise Granger causality tests using only data from this decade.

Table 3: Effect of countries' last month's general index excess returns on next month's excess returns, monthly from Jan 2001 to Dec 2010

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | USL | SEL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| US | 0.131 | 0.055 | 0.476*** | 0.452** |
| | (0.092) | (0.206) | (0.142) | (0.202) |
| SE | | 0.099 | | |
| | | (0.149) | | |
| DK | | | −0.057 | |
| | | | (0.113) | |
| NO | | | | −0.007 |
| | | | | (0.126) |
| Constant | −0.0001 | 0.002 | 0.003 | 0.004 |
| | (0.004) | (0.006) | (0.005) | (0.006) |
| Observations | 120 | 120 | 120 | 120 |
| $R^2$ | 0.017 | 0.017 | 0.118 | 0.076 |
| F Statistic | 2.058 (df = 1; 118) | 1.037 (df = 2; 117) | 7.812*** (df = 2; 117) | 4.825*** (df = 2; 117) |

## 3.4 Regression 4: 2011-2020

The last time interval has no significant results. $R^2$ values are the lowest they have been during any of the time periods analyzed. The absolute values of the coefficients are also smaller. The results are in line with the assumption that the markets become more efficient over time. Data from this decade strongly implies that the effect of predictability across the US and the Scandinavian markets no longer exists.

Table 4: Effect of countries' last month's general index excess returns on next month's excess returns, monthly from Jan 2011 to Dec 2020

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | USL | SEL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| US | −0.074 | −0.053 | 0.118 | 0.091 |
| | (0.091) | (0.155) | (0.121) | (0.160) |
| SE | | 0.013 | | |
| | | (0.145) | | |
| DK | | | 0.065 | |
| | | | (0.109) | |
| NO | | | | −0.134 |
| | | | | (0.133) |
| Constant | 0.009** | 0.007* | 0.010** | 0.003 |
| | (0.004) | (0.004) | (0.004) | (0.004) |
| Observations | 120 | 120 | 120 | 120 |
| $R^2$ | 0.006 | 0.002 | 0.008 | 0.009 |
| F Statistic | 0.662 (df = 1; 118) | 0.099 (df = 2; 117) | 0.484 (df = 2; 117) | 0.536 (df = 2; 117) |

# 4 Results

The theorised predictive ability of US returns stems from the concept of information frictions caused by limited attention. Like large-cap stocks may lead the returns of small-cap stocks as found by Lo and McKinlay in 1990, so too can larger markets lead the returns of smaller markets. As US is the largest capital market by market value, this argument implies that most of the resources for any country are being spent on the US. This leads to the discovery of central economic information originating from the US, which in turn leads to some markets to underreact to relevant economic information, due to limited information processing capabilities (Hong, Stein 1999). As the US is among the most important non-EU trade partners for all of the Scandinavian countries, US-centric shocks may carry over to these countries as well.

Another supporting argument is made by Rizova in 2010, stating that though market movements contain information about the future with trading partners, there is a delay before the markets fully react to their trade partner's market movements. I recognize that the factors I've presented do not fully explain the possible relationships, as there are a myriad of other possible factors. Institutional ownership may also play a role in the relationship of these returns. Gao, Moulton and NG (2017) argue that where as industrial similarities are enough to induce stock return predictability, institutional ownership in common within two markets of unrelated companies can lead to return predictability. The case of industrial linkage holds true in the case of the oil and natural gas industries in the US and Norway. Norway and Sweden in particular have pension insurance companies as well as Norway's Government Pension Fund which have large positions in neighbouring countries. This might increase the predictability between the Scandinavian countries, thus reducing the validity of this reasoning over time.

## 4.1 1996-2020

In 2013 Rapach, Strauss and Zhou found in their 2013 that the US would have a statistically significant role in the prediction of the Swedish market. I was not able to recreate this result using the time frame I did. They have used earlier data, which might be a part of why the results differ. They also compared Sweden to a list of other industrialized countries in Europe and the Commonwealth, where as the peer group in this study is formed by other Scandinavian countries. Rapach, Zhou and Strauss (2013) name market concentration and institutional ownership as two potential factors behind the predictive strength of lagged Swedish excess returns.

When comparing Sweden to the peer group they used, Sweden does seem like an anomaly from both of these perspectives. However, as both Norway and Denmark are also very concentrated and institutional ownership is significant in both countries, Sweden no longer appears as an anomaly.

Finally, in this sample Norway would appear to have a statistically very significant relationship with the US. The cause behind this effect isn't clear, however there are many possible contributors. Besides the information diffusion argument, both countries have been historically dependant on oil and natural gas industries, so changes in oil prices could explain a part of the relationship. In their 2021 study, Joo and Park found that the crude oil volatility index has a "statistically significant negative effect on the stock returns of oil-importing countries". This could in part explain why out of the countries studied only Norway seems to have a statistically significant relationship with lagged US excess returns.

## 4.2 1996-2000

Since this is the oldest data out of the groups, the argument that informational frictions create market predictability (Hong, Stein, 1999) holds best for this decade, and thus, it would make sense for the effect to be strongest during this period. This period also had one of the 2 US-led crises in the sample, the dot.com bubble. Though the downfall began in the year 2000, it continued late into the 2002, limiting the carryover of this shock into the results. The results do not support the hypothesis, as there were no statistically significant findings during this time period.

The results did not support the assumption that the predictability would be highest in this time period. Despite the higher $R^2$-values, this group had no statistically significant findings. The only market shock this time frame had is the initial bursting of the dot.com bubble, and most of this shock's effects were felt later. The results do not offer direct support to the argument of high predictability being a result of information inefficiency and lack of data processing resources.

## 4.3 2001-2010

The results were by far the most significant in this time period. Possible explanations for the strong relationships between Lagged US excess returns and Norway's and Denmark's excess returns are limitless, however one of the most important reasons may be market shocks originating in the US. This decade starts with the aftermath

of the dot.com bubble. Even though the bubble had already burst in 2000, the most drastic market movements were seen afterwards, with the downfall continuing into late 2002.

The second and more influential crisis originating in the US was the Financial crisis of 2007-2008. This crisis lead to the Great Recession that began in the US before it did in Europe, which might be a factor in why US excess returns seem to have a predictive relationship with Danish and Norwegian excess returns. Based on prior theory by Rizova (2010) on why the US could predict other markets, it is intuitive that the results would be the strongest during times of shocks, since these shocks are essentially rapid changes in macroeconomic factors that often lead to rapid increase or decrease of cash flows.

These results are also supported by Cujean and Hasler (2017) findings. Their results implicate that stock return predictability has concentrated during times of market downfall. They were also able to find that time-series momentum was significantly stronger during recessions, which might in part explain the results of this decade. In his 2007 paper John Cochrane finds that generally, economic downturns lead to heightened risk aversion, which leads to demanding higher risk premiums, creating return predictability. This is another possible factor behind the statistically significant results.

The third possible reason for the strong results is interconnectivity. Denmark and the US have relatively close trade relations, with the US being Denmark's most important non-EU trade partner. With Norway, the connection is oil and natural gas, as both the US and Norway have a large sector of their market based around fossil energy. In section 7 I will examine the causal relationships through Granger causality tests specifically for this time period, since it has the most relevant results.

## 4.4 2011-2020

If the assumption of markets developing and becoming more efficient holds, the last decade should be the one where there is least evidence of any sort of predictability related relationship. The decade doesn't have a market shock originating from the US, which might affect results as well. In the early 2020 the market turmoil caused by Covid-19 began, however, the crisis was felt in Europe and the US at the same time. Another reason for the smaller $R^2$-values is the development of information technology. One of the core functions supporting the theory explaining the predictive

power of the US is the concept of limited information processing. While information processing is still limited, the rapid development of algorithms and data processing solutions, as well as processing power may have led to a more equal position in terms of market information regarding the US and the Scandinavian countries.

# 5 Sensitivity Analysis

Intrigued by the substantially high $R^2$-values and statistical significance in the data from 2001-2010, I decided to perform a sensitivity analysis. I removed all of the months with an excess return of $\pm 10$ percent and re-ran my regression model. The new results implicate that the Norwegian market no longer has a statistically significant relationship with the US lagged returns, but the Danish market still does. These results further support the theory by Cujean and Hasler (2017) that predictability increases during times of crisis, as most of the high absolute excess returns during this time period have been related to either the dot.com bubble or the Financial crisis of 2007-2008.

Table 5: Effect of countries' last month's general index excess returns on next month's excess returns, monthly from Jan 2001 to Dec 2010, months with values over absolute 10 percent removed

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | USL | SEL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| US | 0.024 | −0.067 | 0.346** | 0.362 |
| | (0.116) | (0.201) | (0.168) | (0.228) |
| SE | | 0.233 | | |
| | | (0.151) | | |
| DK | | | −0.023 | |
| | | | (0.128) | |
| NO | | | | 0.010 |
| | | | | (0.140) |
| Constant | 0.002 | 0.004 | 0.010** | 0.012** |
| | (0.004) | (0.005) | (0.005) | (0.006) |
| Observations | 76 | 76 | 76 | 76 |
| $R^2$ | 0.001 | 0.038 | 0.065 | 0.050 |
| F Statistic | 0.042 (df = 1; 74) | 1.452 (df = 2; 73) | 2.521* (df = 2; 73) | 1.940 (df = 2; 73) |

# 6 Pairwise Granger Causality tests

To further determine whether this relationship is potentially causal, and to find further insight into the predictability aspect, I perform a series of pairwise Granger causality tests. My initial time frame is the full 25 years, but the latter test is done using only the data from 2001 to 2010, since the results found were the strongest during that time period. I conduct the Granger causality test to determine whether the relationships found in the data are simply a case of spurious correlation or whether there is a causal relationship.

The model can be presented as:

$r_{i,t+1,S} = \alpha_S + \beta_{US,t} + \beta_{N1,t} + \beta_{N2,t}$,
where both $\beta$ are excess returns, and S in the country measured, and $N1$ and $N2$ are the other 2 Scandinavian countries

My primary interest in testing is to find whether the Granger causality tests support my prior findings of US excess returns' from month t relationship with Danish excess returns from month t+1 within the entire 25 year period. My secondary interest relate to the relationship between month t US excess returns and month t+1 Norwegian and Danish excess returns from 2001 to 2010. Though this testing does not provide insight into the reasons behind the relationship, it can be valuable in deciding whether US returns can be considered helpful in the prediction of the Scandinavian markets. The potential reasons for these relationships are gone over further in sections 7.1 and 7.2.

Table 6: Pairwise Granger causality tests, monthly data of excess returns from Jan 1996 to Dec 2020

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | SEL | USL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| SE | | 0.119 | −0.011 | 0.200* |
| | | (0.074) | (0.084) | (0.106) |
| US | 0.086 | | −0.152 | 0.121 |
| | (0.100) | | (0.098) | (0.112) |
| DK | −0.069 | −0.098 | | −0.098 |
| | (0.096) | (0.083) | | (0.101) |
| NO | 0.077 | −0.002 | 0.166** | |
| | (0.088) | (0.069) | (0.074) | |
| Constant | 0.006** | 0.005* | 0.008*** | 0.003 |
| | (0.003) | (0.003) | (0.003) | (0.003) |
| Observations | 299 | 299 | 299 | 299 |
| $R^2$ | 0.011 | 0.010 | 0.021 | 0.041 |
| F Statistic (df = 3; 295) | 1.080 | 1.040 | 2.078 | 4.159*** |

Table 7: Pairwise Granger causality tests, monthly data of excess returns from Jan 2001 to Dec 2010

| | *Dependent variable:* | | | |
|---|---|---|---|---|
| | SEL | USL | DKL | NOL |
| | (1) | (2) | (3) | (4) |
| SE | | 0.305*** | 0.149 | 0.364* |
| | | (0.110) | (0.147) | (0.196) |
| US | 0.183 | | 0.374** | 0.170 |
| | (0.183) | | (0.183) | (0.231) |
| DK | −0.115 | −0.128 | | −0.151 |
| | (0.169) | (0.126) | | (0.173) |
| NO | 0.063 | −0.068 | −0.094 | |
| | (0.144) | (0.102) | (0.111) | |
| Constant | 0.002 | −0.00003 | 0.003 | 0.004 |
| | (0.006) | (0.004) | (0.005) | (0.006) |
| Observations | 120 | 120 | 120 | 120 |
| $R^2$ | 0.018 | 0.070 | 0.125 | 0.103 |
| F Statistic (df = 3; 116) | 0.694 | 2.890** | 5.511*** | 4.439*** |

## 6.1 Granger Causality tests results 1996-2020

The first pairwise Granger causality tests imply that there is no statistically significant result that would support lagged US excess returns to have predictive power over the Scandinavian markets. This undermines the meaning of the prior regressions, as the first regression implied that there was a correlation between lagged US excess returns and Norwegian excess returns from 1996 to 2020, and not finding Granger causality may mean that the results of the first regression were mere spurious correlation.

The most notable findings in this table were that Swedish excess returns Granger cause Norwegian excess returns on a statistically significant level, and Norwegian excess returns Granger cause Danish excess returns on a statistically highly significant level. These findings are very plausible, since the Scandinavian markets, as well as the economies are quite connected trade wise, with each country being one of the most important trade partners for the other two countries (Statistics Sweden, Statistics Denmark, Statistics Norway). Another possible explanation would be the already mentioned large share of institutional ownership across all Scandinavian countries due to government pension funds. Aside from the Scandinavian market interconnectivity, the results over the 25-year time period reject the helpfulness of US excess returns in the prediction of the Scandinavian markets.

## 6.2 Granger Causality tests results 2001-2010

The results of this period indicate that Swedish excess returns would Granger cause US and Norwegian Excess returns. On the behalf of the US, it is more likely that there is a third factor affecting both of these markets, than that the relatively small market of Sweden would be causing drastic changes in returns in the US. One possible explanation would be that both react to the same fundamental factors, but because the Swedish market is more concentrated, with less firms making up more of the total market cap, this concentration would allow for the market to react more quickly to these fundaments impacting both Sweden and the United States. Sweden, like Norway and Denmark also has a substantially high share of institutional ownership (Aggrawal et al, 2011), which might also by itself create market predictability, even across two completely separate markets and industries (Gao, Moulton and NG 2017).

However, when it comes to Sweden Granger causing Norwegian returns, the result is far more sensible. Rapach, Strauss, and Zhou (2013) found Sweden to "display substantial predictive ability" especially when it came to other European countries.

As Sweden is the largest of the Scandinavian countries by population, stock exchange market capitalization and by GDP, as well as being one of Norway's key trading partners, a relationship between Swedish and Norwegian excess returns does not seem unordinary. The results also imply that the US would have statistically high significance in Granger causing Danish excess returns. This result is supported by prior time series analysis from the same time period. The statistically high significance means that from 2001 to 2010, US excess returns could have been considered helpful in the prediction of Danish excess returns.

APPENDIX 2: Rapach, Strauss and Zhou study was based on 1980-2010 data, where as this table was based around 2001-2010 data.

APPENDIX 3: Gao, Moulton and NG studied a time frame from 1980 to 2010. Even though the overlap isn't perfect, it still covers the majority of the data set I've used.

# 7 Conclusions

I conclude that over my time interval of 25 years, there was no sufficient evidence to claim that the US market would have predictive influence over the Scandinavian markets. Despite some findings in the initial regressions, I was unable to find that lagged US excess returns would Granger cause excess returns in any of the Scandinavian countries studied. Comparing the last decade alone to the whole data set, or the first or second decade is sufficient to conclude that the markets have become more informationally efficient. $R^2$-values have diminished compared to those what they were at the beginning of the time frame. The theory that this market predictability is caused by information diffusion (Rizova 2013) would also support the gradual dissipation of the effect due to increasing globalization and the rapid development of information technology, and their positive effect on market efficiency. The most interesting results were found examining the decade of 2001-2010. The results from this decade implied that lagged US excess returns would play a substantial role in predicting Scandinavian excess returns, with a statistically highly significant relationship with Norwegian excess returns and a statistically very highly significant relationship with Danish excess returns. The results of the 2001-2010 Granger causality test also suggest that lagged US excess returns Granger cause Danish returns on a statistically highly significant level. The sensitivity analysis supported the theory by Cujean and Hasler from 2017 implying that stock market predictability tends to concentrate during bad times, as the results were far less significant after months with large absolute excess returns were removed from the data. Finally, the predictive relationship between lagged US excess returns and Scandinavian excess returns isn't strong enough to be of value when considering ways to predict market movements. This finding is not in line with prior research findigs by Rapach, Strauss, and Zhou (2013), which was done using earlier data. However, the relationship has previously been able to provide some insight into Norwegian future market movements in times of economic turmoil and high volatility.

# 8 References

Aggarwal, R., Erel, I., Ferreira, M., & Matos, P. (2011). Does Governance Travel Around the World? Evidence from Institutional Investors. Journal of Financial Economics, 100(1), 154–181. https://doi.org/10.1016/j.jfineco.2010.10.018

Boehmer, E., & Kelly, B. (2009). Dangerous Non-Local Instruments: The Case of the USD/ILS Exchange Rate. Journal of Banking & Finance, 33(8), 1382 1392. https://www.jstor.org/stable/40247670

Cochrane, J. H. (2007). Where Is the Market Going? Uncertain Facts and Novel Theories. NBER Working Paper No. 11193. https://doi.org/10.3386/w11193

Cujean, J., & Hasler, M. (2017). Bond Liquidity Premia. Review of Financial Studies, 30(9), 3082–3133. https://www.jstor.org/stable/26653296

Gao, P., Moulton, P. C., & NG, L. (2018). Social Networks, Information Production, and Security Prices. Journal of Financial Intermediation, 36, 74–87. https://doi-org.libproxy.aalto.fi/10.1016/j.jfi.2016.07.004

Goyal, A., & Welch, I. (2008). A Comprehensive Look at the Empirical Performance of Equity Premium Prediction. Review of Financial Studies, 21(4), 1455–1508. https://www.jstor.org/stable/4133989

Hjalmarsson, E. (2009). Predicting Global Stock Returns. International Journal of Forecasting, 25(2), 374–388. https://www.jstor.org/stable/27801474

Hong, H., & Stein, J. C. (1999). A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets. Journal of Finance, 54(6), 2143–2184. https://www.jstor.org/stable/797990

Kandell, J. L., & Stambaugh, R. F. (1996). On the Predictability of Stock Returns: An Asset-Allocation Perspective. Journal of Finance, 51(2), 385–424. https://www.jstor.org/stable/2329366

Lewellen, J. (2004). Predicting Returns with Financial Ratios. Journal of Financial Economics, 74(2), 209–235. https://doi.org/10.1016/j.jfineco.2002.11.002

Lo, A. W., & McKinlay, C. J. (1999). Non-Parametric Estimation of State-Price Densities Implicit in Financial Asset Prices. Journal of Finance, 54(5), 1799–1730. https://www.jstor.org/stable/2962020

Rapach, D. E., & Strauss, J. K. (2013). Forecasting Stock Return Volatility in the Presence of Structural Breaks. Review of Financial Studies, 26(11), 2822 2863. https://www.jstor.org/stable/42002633

Rizova, S. (2013). Do Individual Investors Learn from Their Mistakes? Journal of International Financial Markets, Institutions & Money, 23, 189–207.

https://doi.org/10.1016/j.intfin.2012.11.008

Statistics Denmark. (n.d.). Retrieved from https://www.dst.dk/en/ (visited on 22.11.2023)

Statistics Norway. (n.d.). Retrieved from https://www.ssb.no/en/ (visited on 22.11.2023)

Statistics Sweden. (n.d.). Retrieved from https://www.scb.se/en/ (visited on 22.11.2023)

Young C. Joo, Sung Y. Park (2021). The impact of oil price volatility on stock markets: Evidences from oil-importing countries, 101, 105413.

https://doi.org/10.1016/j.eneco.2021.105413