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**Does IT investment announcements generate abnormal returns on
OSE-listed firms?**

An event study addressing market reactions and the Efficient Market Hypothesis

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ABSTRACT

In our thesis we intend to examine how IT investment announcements affect the stock returns, of firms listed at the Oslo Stock Exchange. We plan to conduct an event study, using the CAPM and Fama French models to estimate expected returns, and evaluate these with respect to the actual historical returns in the market. Previous studies suggest that we should expect abnormal returns following announcements of IT investments, due to a positive reception in the market. Moreover, the Efficient Market Hypothesis suggests that the announcements should only cause a potential correction, not a persistent trend.

1. INTRODUCTION AND MOTIVATION

Over the past few decades, we've been witness to an increasing willingness to invest in Information Technology systems. Many companies have shown ability to invest largely in Electronic Data Interchange (EDI) and adapt new technology, hoping for a competitive advantage. No matter your industry, you've been expected to keep track of and adapt to the technological developments. The "dot-com bubble" may have affected the valuation of IT investments in the late 90's, early 2000's (Carr, 2003; Shea, Vincent J., Dow, Kevin E., Chong, Alain Yee-Loong & Ngai, Eric, W. T., 2017). Alongside this increased awareness of IT as an important part of the business, several researchers have tried to investigate whether such investments are profitable or not, and if IT investments are actually creating a competitive advantage. Some researchers are claiming evidence for IT as an important contributor to increased productivity. However, investments in IT systems have not always proven to be successful, as one may experience a certain "time lag" between implementation and the positive result (measured in productivity growth), often referred as the "productivity paradox" (Brynjolfsson & Hitt, 1996). Perhaps a better way to measure the effects of IT investments can be to compare announcements about such upcoming in (Benco & Prather, 2008; Bodie, Kane, & Marcus, 2014; Brynjolfsson & Hitt, 1996; Carr, 2003; Chatterjee, Pacini, & Sambamurthy, 2002; D., Han, & Sapan, 2014; Hayes, Hunton, & Reck, 2001; Hendricks, Singhal, & Stratman, 2007; Koller, Goedhart, & Wessels, 2010; Ranganathan & Brown, 2006; Santos, Peffers, & Mauer, 1993; Shea, Dow, Chong, & Ngai, 2017; Wooldridge, 2015) investments, with movements in stock prices. This way, we can investigate whether IT investment announcements have created increased stock returns, and allows us to disregard the potential issues in relation to the studies that evaluate productivity growth. More recent studies has shown that firms that announce IT investments will, in general, experience increased stock returns (Shea et al., 2017).

The purpose of this thesis is to examine whether IT investment announcements of firms listed on Oslo Stock Exchange can be linked to positive abnormal stock returns. An increase in the stock price after the announcement of the IT investment would indicate that investors expect positive net cash flows following the implementation (Hayes, David C., Hunton, James E. & Reck, Jacqueline L., 2001).

If we assume a semi-strong form of the Efficient Market Hypothesis, stock prices should reflect all available information in the market. An announcement of an IT investments represents new information to the market that must be reflected in the stock price. For that reason we expect a quick correction to the firms' stock prices. However, there should not be a prolonged trend according to the Efficient Market Hypothesis (Bodie, Zvi, Kane, Alex & Marcus, Alan J., 2014).

We have formulated the following research question;

Does firm-level IT investment announcements create positive abnormal stock returns for firms on the Oslo Stock Exchange? How does the results match the Efficient Market Hypothesis?

Given this research question, we aim to state whether IT investment announcements actually are beneficial, and whether the Efficient Market Hypothesis is violated or not. To do so we will rely on historical data of IT announcements and stock returns, as well as other possible correlating factors. We aim to contribute to existing literature by conducting a similar experiment to previous work, but in a new environment. Most of the previous literature is conducted in the US economy. We want to evaluate the Norwegian economy. Our plan is to use an event study methodology on IT investment announcements, run regression analyses and try to explain potential market reactions. We will use data that shows how the stock market reacts to announcements, and estimate how it would have looked without the announcement. By this, we may be able to state whether firms that are announcing IT investments are experiencing statistically significant abnormal stock returns.

The structure of this report includes a review of the existing theory. This part will look at some developments in the studies on the topic over the years. Additionally you will find the approach and results of more recent literature, similar to the study we intend to conduct. The following section will introduce relevant theory for our study, before we go into the methodology of our research. The methodology section will include the basic approach, some argumentation for why this seems to be reasonable, as well as some potential issues we will need to control for. Towards the end we present the data we need to conduct our study, where and how we plan to collect it.

2. LITERATURE REVIEW

Studies evaluating the business value of information technology have yielded mixed results over the years. Early studies such as Bynjolfsson & Hitt (1996) tried to explain “the productivity paradox”. This is the idea that IT investments in the 1980’s did not yield significant improvements in productivity at the time. Following studies showed that such investments took time to affect productivity, supported by the substantial increase in firm value for many after 1991 for firms who made substantial IT investments in the 80’s. Later studies focus more on firm and technology specific characteristics to determine the effect of the investments on firm value. (Shea et al., 2017)

Many studies evaluating the business value of IT investments have used accounting matrices to measure the firms’ performance. The early studies often looked at return on assets (ROA), return on equity (ROE) and return on investment (ROI). Generally they looked at changes in these parameters to evaluate the effect of the adoption. It turned out that the early studies failed to find significant changes in these measures at the industry level. The studies focusing on firm and technology specific characteristics started to see positive changes in these measures (Shea et al., 2017).

The latest study we found on the topic was conducted by Shea et al. (2017). They used Regression Discontinuity Design to analyse the effect of IT investment announcements on stock returns. They found that press releases could positively affect the value of a firm, by providing investors with information about the current and future operations and strategy of the company. They also suggest that the press releases attracts investors who believe the investment is a good indication of belief in growth and expansion potential of the firm.

Ajit, D., Donker Han & Patnak Sapan (2014) also conducted a the study of how IT investment announcements affect stock returns. They studied ERP (Enterprise Resource Planning) vendors in the US between 1990 and 2010. They calculated abnormal returns using the Fama - French three - factor model and the Fama - French - momentum four - factor model. Their findings suggest that there is a positive relationship between ERP implementation and cumulative abnormal returns.

Hayes et al. (2001) studied how the market reacted to announcements of ERP implementations, using an event study approach with abnormal market returns. They found an overall positive reaction to ERP announcements, especially among small healthy firms. They also found that announcements of implementation of well renowned suppliers like SAP or PeopleSoft, yielded a significantly more positive response than those with smaller vendors.

Ranganathan & Brown (2006) estimated the Cumulative Average Abnormal Returns (CAAR's), examining stock market reactions to ERP-announcements. They used a sample including 116 firms and an event window of three days in the period 1997-2001. The researchers found abnormal stock returns, and a CAAR equal to 1.49%, which empirically supports benefits of ERP-systems and IT investments in general.

Benco & Prather (2008) did a quite similar examination as Ranganathan and Brown (2003), with some slight adjustments. Their sample included 111 firms, while the period of study stretched from 1982-1999. In this study, they found CAAR's equal to 0.78%, and they are arguing that only healthy firms announcing ERP-investments are experiencing statistically significant abnormal returns.

Hendricks, Kevin B., Singhal, Vinod R. & Stratman, Jeff K. (2007) documented the effect of investing in several IT enterprise systems (ERP, SCM - Supply Chain Management & CRM - Customer Relationship Management), by measuring the firm's long-term stock price performance and profitability (ROA & ROS). The sample size was quite large, including a total of 406 implementations across the three different systems. The researchers gained mixed results, suggesting the following; ERP-implementations can improve profitability but not stock returns, CRM-implementations cannot improve neither profitability nor stock returns, while SCM-implementation seems to improve both profitability and stock returns.

Chatterjee, Debabroto, Pacini, Carl & Sambamurthy. Vallabh (2002) used the event study in order to examine the stock market reaction to 112 IT investment announcements (infrastructural). They found statistically significant positive abnormal stock market returns (ranging from 0.5%-0.84%) and rises in trading volume, as a result of IT investment announcements.

A paper by Dos Santos, Brian L., Peffers, Ken & Mauer, David C. (1993) used event study methodology to empirically analyse the effect of announcements

of IT investments on the market value of the firm's included in the study. They used a sample of 97 firms, in the finance and manufacturing industries, between 1981 and 1988. Their study fails to find any significant evidence to support their theory of abnormal returns for firms with IT investment announcements. They do however find that the market reacts positively to innovative investments, as opposed to follow up or non-innovative investments. They conclude that the average IT investments is a zero net present value investment, but innovative investments can generate positive abnormal returns. A problem is that ex post determination of the effects of IT investments on firm performance tend to undervalue the investment.

As we can see, there has been extensive studies on the impact of IT investments on firm value and performance. The general findings suggest that investments in IT results in positive abnormal stock returns (Shea et al., 2017; (D. et al., 2014); Hayes et al., 2001; Chatterjee et al., 2002; Ranganathan & Brown, 2006). Most of these studies are, however, limited to the United States and focused on large public companies listed at the largest stock exchanges. We have not found any similar studies firms listed on the Oslo Stock Exchange. This is the gap in the literature that we want to fill.

3. THEORY

One of the main theories applicable to our study is the Efficient Market Hypothesis. In this thesis, we will concentrate the investigation around the semistrong-form, which states that all publicly available information regarding the firm should be immediately reflected in the stock price. This includes absolutely all available information, except from information only available to insiders in the companies (Bodie et al., 2014). Such that new information should give an immediately response in stock price, and that “good news” should cause a jump in the stock price. However, price should stabilize after the announcement, as the price is now already reflecting this new information. With that in mind, we may suspect that announcements of IT investments should affect the firm’s stock price, even before the IT investment is implemented, and that the stock prices should not experience a further “drift” after the new information is implemented in the stock prices (Bodie et al., 2014).

If the relationship between intrinsic value and market prices were perfect, there would be no point in trading, as all prices would reflect full information at all times. This is however, not realistic, and the relationship is generally imperfect. These price deviations are not enough for the general intuition to deviation from the idea of efficient markets. A normal approach is to set a bandwidth on prices as to where you consider markets to be efficient. The Fischer black suggests a bandwidth of 0.5 to 2 times intrinsic value (Koller, T., Goedhart, M. & Wessels, D., 2010). This might, however, be a little drastic. Koller et. al. (2010) suggest a bandwidth of plus or minus 20% of intrinsic value.

So far, we have formed two main hypotheses:

Q1: How does the market react to IT investment announcements? Do such announcements create positive abnormal stock returns?

H0: IT investment announcements does not create positive abnormal stock returns

H1: IT investment announcements creates positive abnormal stock returns

Q2: Does the Cumulative Abnormal Returns trend upward/downward after the announcements, so that we can suggest anomalies to the Efficient Market Hypothesis?

H0: Cumulative Abnormal Returns trends after the event

H1: Cumulative Abnormal Returns do not trend after the event

Valuations in the stock market clearly reflect the performance of the firms in the real economy. Given that firms have a ROIC (return on invested capital) greater than their cost of capital, higher ROIC and growth are reflected in higher stock prices. Studies show that share prices reflect the markets' best estimate of intrinsic value. For that reason, managers can keep making decisions based on DCF (discounted cash flow) and economic profit (Koller et al., 2010).

High profile companies often face headlines when their quarterly earnings are announced, but there is evidence to support the idea that investors put more emphasis on long term fundamentals than short-term earnings. One study show that earnings surprises only accounts for 2% of the share price volatility (Koller et al., 2010).

Eugene Fama and Kenneth French believed that risk premiums determined by market to book ratio and size could explain long term reversals. This is the idea that the high performing stocks over the last few years tend to become the low performing stocks over the following years. Another well known mispricing idea is short term momentum. It suggests that the performance over the last few months is a good indication of the months to come. Behavioural finance still struggle to explain why investors over- and underreact in certain situations. Fama suggests that this is another indication why markets are efficient, as there is no systematic way to predict when these reactions will occur. Thus, the expected value of abnormal returns across all studies is likely to be zero (Koller et al., 2010).

Initially, an IT investment should be recorded as an expense and asset acquisition in the firm's financial statements. It can also be noticed as a decrease in cash flows. If no other information is provided, the market should be unable to assess the possible future benefit of the investment, hence result in a decrease in firm value on the stock price. However, by announcing the intent of the investment, investors can form an opinion of the future benefits of the investment. Accounting research on the area suggests that non financial information is connected to the market valuation of the firm (Hayes et al., 2001).

A wide body of literature supports the notion that markets reflect the beliefs of the most informed traders. The idea is that these traders will accumulate more profits, which will increase their influence in the markets and eventually help intrinsic value and stock price to converge. Informed investors form a view of the intrinsic value of a company, based on the underlying fundamentals such as return on capital and growth (Koller et al., 2010). With that reasoning, the most informed traders must view IT investments as a value adding investment, in order for the stock price to increase.

4. METHODOLOGY/MODEL

We will conduct an event study, evaluating the effect of a company's IT investment announcement on the stock returns. The event study refers to a specific empirical technique, widely used in financial research, where the aim is to assess the impact of a particular event on firm's stock prices (Bodie et al., 2014). The event, in this case, refers to the particular announcements, and the aim is to quantify the relationship between the event (announcements) and stock returns. Given the Efficient Market Hypothesis, a potential short-term stock price increase (given by an announcement) should not continue increasing post-announcement (Bodie et al., 2014).

We're aware of the fact that analyzing the effect of a particular event is quite challenging, as stock prices do react to a lot of different macroeconomic news. In order to do this properly, we compare actual stock returns after IT investment announcements, to an estimate of the stock return without the announcement. In order to measure the impact of the specific event (announcement), we will examine the returns on stocks at the moment when the information is becoming publicly known. We look for abnormal returns around the announcement dates and assess the statistical significance and magnitude to the typical abnormal return, in order to determine the impact of the announcements (Bodie et al., 2014).

We will base our research on the event study methodology presented by Bodie et al. (2014). They use a market model to infer about abnormal returns.

$$R_t = a + br_{m,t} + e_t \quad (\text{Equation } a)$$

$$e_t = r_t - (a + br_{m,t}) \quad (\text{Equation } b)$$

(Bodie et al., 2014)

Where $r_{m,t}$ = market's rate of return at time t,

e_t = the part of a security's return from firm specific events (disturbance term with the usual OLS properties),

b = the parameter that captures the sensitivity to the market return

a = the average rate of return of the stock if the market return was equal to zero

A possibility we are looking into, is to use the CAPM and/or Fama French models to estimate expected stock returns without announcements. This is widely used in

previous research and are well known theories within economics and finance in general.

In order to calculate expected return, we assume the CAPM describes the expected normal market returns.

$$E(R_i) = r_f + \beta[E(r_m) - r_f] \quad (\text{Equation 1})$$

(Bodie et al., 2014)

Where $E(R_i)$ = Expected rate of return for firm i

r_f = Risk free return

$E(r_m)$ = Expected rate of return of the market portfolio

β = Measure of the risk contributed by the security to the market portfolio

The abnormal returns are then calculated as follows:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (\text{Equation 2})$$

(Ranganathan & Brown, 2006)

Where $AR_{i,t}$ = Abnormal return for firm i at time t

$R_{i,t}$ = Actual return for firm i at time t

$E(R_{i,t})$ = Expected return for firm i at time t

However, a typical problem related to announcements is leakages. This refers to leaking information spread some days in advance of the announcement date. This might start an increase/decrease in the stock price before the actual event date (Bodie et al., 2014). Hence, in order to take the total impact of the information release into consideration, we will use an indicator named the Cumulative Abnormal Returns (CAR). This denotes the sum of all abnormal returns for the entire period following the markets total reaction to new information (announcements):

$$CAR = \Sigma (AR_{i,t}) \quad (\text{Equation 3})$$

(Ranganathan & Brown, 2006)

Immediately after the event date, the CAR should no longer increase/decrease significantly, as we are assuming that the Efficient Market Hypothesis holds. One of the key findings might be potential upward/downward patterns the days

following an announcement. This would be key findings in order to either keep or reject the null hypothesis in Q2.

We intend to test whether any findings of CAR are statistically significant at the 95% significance level. Subsequently, we will test the robustness of our findings.

Methodological issues

This methodology face several different challenges. There is the possible issue of causality. In order to claim causality we must be able to hold everything else constant. This is difficult when we are looking at economic events where we are only able to run an “experiment” once, and are not able to control the surroundings. There can be company specific, industry or economy wide events around the same time of the announcement that can distort the value of the stocks drastically (Wooldridge, Jeffrey M., 2009).

There can also be uncertainty about the announcements of the investments. Using announcements to evaluate the effect of IT investments excludes all the firms that invest in IT without announcing it first. This presents the issue of sample selection bias. Bodie et al. (2014) presents the selection bias issue in relation to the efficient markets’ view. They state that investors who find superior investment techniques are more likely to keep their technique a secret and make money of it, as opposed to investment techniques that fail to make abnormal profits. The idea is that the techniques that we are presented are preselected to fail, thus we cannot fairly evaluate portfolio managers true ability to generate abnormal returns. In this study we might face selection bias when it comes to our test sample. If we want to evaluate all large norwegian firms’ value after an IT investment, but only include firms that announced their investment beforehand, we would systematically exclude a part of the real sample and thus have a sample selection bias problem. A solution to this problem may simply be to alter our goal of the study to only look at the value of firms that announce their IT investment.

5. DATA

It seems like earlier studies on this topic have struggled with data collection, having a hard time trying to find sufficient and proper data. Our study is focused on firms listed on the Oslo Stock Exchange, as opposed to the existing literature. We will study the period from right after the dotcom-bubble, until 2016. Using news articles and press releases, we will determine the date of the firms' IT investments announcement. To acquire announcements/press releases, we're going to use several databases and websites as; Bloomberg, YahooFinance, Mynewsdesk and company firm-sites. To acquire historical financial data (stock prices and stock exchange announcements) we will search Oslo Stock Exchange website. We've already found some data, and will use the upcoming weeks to finish the data gathering process. The similar studies in the US have generally had samples of around 90 firms announcing their investments. Considering the relative size of the US economy and their stock exchanges to the norwegian counterpart, we believe it is unreasonable to expect a similar number in our sample. We will do our best to locate all the announcements within our chosen time horizon, however many that is.

In order to exclude big outliers, we have to set some constraints for the sample. First, the announcements has to come from firms which are traded at the Oslo Stock Exchange. The chosen firms has to be a certain age. This way we exclude startups that might grow very quickly or not at all. The announcements can come from the same firm, provided they are at least 1 year apart. This to avoid mixing effects, where we might be unable to determine which of the announcements are creating the potential abnormal returns. Moreover, as we're able to find exact dates for the announcements, the next move is to acquire stock prices for the same periods. We are planning to gather stock prices from each of the firms for a certain period before and after the announcements. This will allow us to conduct reliable estimates of the firms' stock prices at the date of the announcement, as if the announcement didn't occur. It will also help us evaluate the effect of the announcement over some time after the event, such that we can assess the validity of the Efficient Market Hypothesis.

The acquired data will be used in the previously mentioned event study, when we're investigating the potential relationship between announcements and stock prices.

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