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The Risk-Return Relationship on Macroeconomic Announcement Days

An empirical study of the Norwegian stock market

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Abstract

On days when macroeconomic news in Norway is scheduled to be announced, we find a significant and linear relationship between the market beta and average daily excess return. Using Fama-Macbeth regressions, we estimate a negative market risk premium of -1.02% per month (-11.68% annualized). During our sample period from 2001-2015, the realized market risk premium is negative, amounting to -0.20% per month (-2.46% annualized). As a consequence, stocks with higher sensitivity to the market, measured by beta, will earn negative excess return. Hence, our estimate of the implied risk premium turns negative. Using ten beta-sorted portfolios and individual stocks as test assets, we provide empirical evidence of market beta as an important determinant of average excess return in the Norwegian stock market. This risk-return relationship holds on announcement days, while there is no significant relationship on all other trading days. In addition, we test this relationship on different types of announcement days separately, and find no significance. This indicates that it is the aggregated effect of all announcements that cause the significant relationship between market beta and average excess return. Further, we find that our test assets are more affected by Norwegian announcements than announcements from the US, as market beta does not relate significantly to average excess return on US announcement days.

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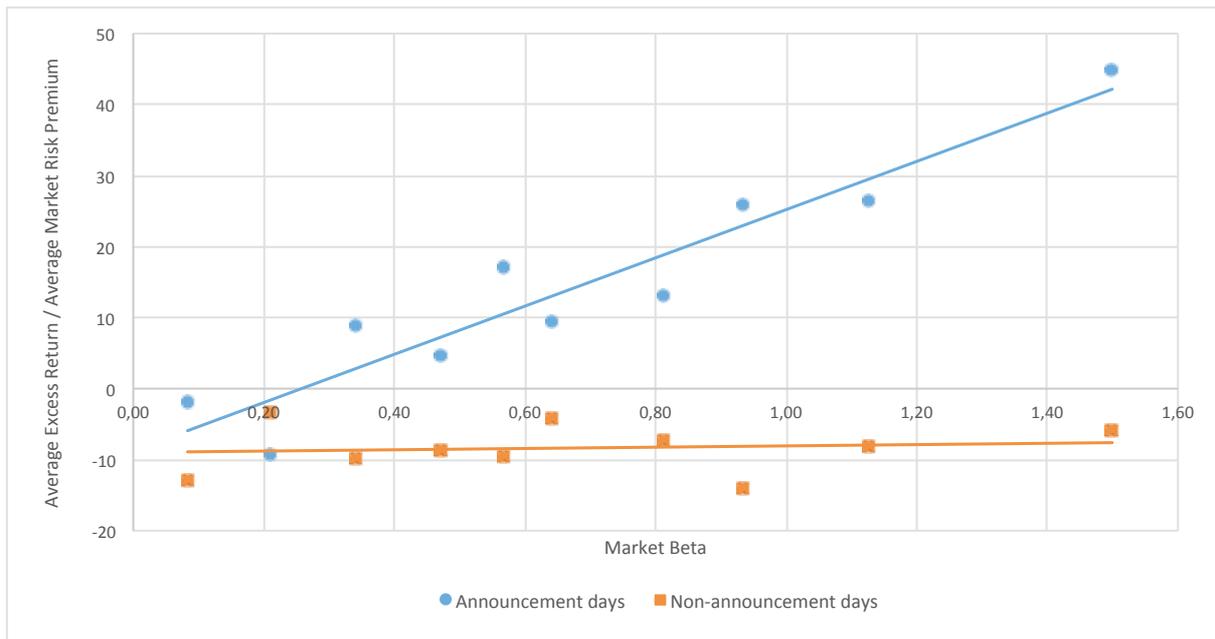
1. Introduction

The capital asset pricing model (CAPM) explains asset return with their exposure to the market, expressed by stock market beta. The CAPM has little empirical support, and the implication that higher market beta results in higher excess return, is rejected by multiple studies. For instance, Fama and French (1992, 1993) show that when controlling for additional factors, such as book-to-market value and size, the market beta is not able to capture all of the spread in returns across stocks. Despite the empirical failure of CAPM, Savor and Wilson (2014) provide supporting evidence of market beta being significantly related to average excess return on days with macroeconomic news announcements in the U.S.. They find a daily estimated price of risk of 9.2 bps on days with macroeconomic news announcements, and -1.0 bps on all other trading days.

In this thesis we apply the same model on the Norwegian stock market. On days with important Norwegian macroeconomic news announcements (a-days), we show that there exists a significant relationship between the market beta and average excess return for Norwegian assets. We also show that this relation does not hold on all other trading days (n-days). The macroeconomic announcement days we use are days with changes in key interest rate, unemployment rate, gross domestic product, the consumer price index and the wage index.

Figure 1 plots the ratio between average excess return and average market risk premium for ten beta-sorted portfolios against their respective market betas. On n-days the slope of the security market line (SML) is insignificant with a coefficient of 0.92 and a t-statistic of 0.32. In contrast, there is on a-days a significant slope coefficient of 33.88 with a t-statistic of 9.3. This means that an increase in beta of one will result in an increase in the ratio between the average excess return and the average market risk premium by 33.88. Further, the R^2 for the SML representing n-days is only 1.3%, while the R^2 on a-days is 89.6%, when directly regressing portfolio average excess return on portfolio betas. This indicates that 89.6% of the variation in average excess returns on a-days is explained by the variation in their market beta. These results show that on announcement days the market beta is significantly related to the ratio between average daily excess return and average market risk premium, while this does not hold for all other trading days.

Figure 1: Ratio of average excess return over average market risk premium using ten beta-sorted portfolios



The figure plots the ratio between average excess return and average realized market risk premium against beta for ten beta-sorted portfolios, separately for announcement days and non-announcement days. On the X-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the ratio of average excess return over average market risk premium. The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period. .

The CAPM assumes a positive market risk premium, and consequently a positive linear relationship between market beta and excess return. Our sample period is from January 2001 to December 2015, and on average there is a negative realized market return in this period. The negative market risk premium is likely a result of two large economic recessions in the sample period, and this causes an average excess return that is inversely proportional to the market beta. When we examine the relationship between the market beta and average excess return instead of the ratio presented in *Figure 1*, the slope is negative due to the negative market return. The empirical results from the Fama-MacBeth regression show a clear linear relationship between market beta and average excess return. On a-days the slope coefficient is -23.2 basis points (bps) with a significant t-statistic of -1.81. On n-days the relation is insignificant with a slope coefficient of -0.6 bps and a t-statistic of -0.15. This shows that on days with macroeconomic announcements the implications from the CAPM hold, and the market beta is an essential determinant of average excess return, given a negative market risk premium. This relationship holds for both equal- and value-weighted beta-sorted portfolios, as well as for 90 individual stocks.

The significant results for the beta-sorted portfolios and individual stocks rest on the combined effect from all announcement days. We perform a Fama-MacBeth regression using ten beta-sorted portfolios, separately for each type of announcement. The only significant relationship between market beta and average excess return exists on days when changes in the key interest rate are announced. On these days the slope coefficient is -33.9 bps with a t-statistic of -1.84, while on days with changes in the unemployment rate, consumer price index, wage index and the gross domestic product, the market slope coefficient is insignificant.

As Norway is a small, open economy, we test if the Norwegian stock market is influenced by macroeconomic news from the United States, which is a larger and more influential economy. We do not find a significant difference in returns between U.S. a-days and n-days, and the Norwegian stock market seems to be more influenced by Norwegian announcements than announcements from the U.S. Further, we expand our analysis and examine if the market beta captures the anomalies of the CAPM. We use portfolios sorted on industry, size, book-to-market, momentum characteristics. These results do not provide empirical support that market beta explains the spread in average excess return on a-days for these portfolios.

Our methodology clearly follows Savor and Wilson (2014), by examining the risk-return relationship on macroeconomic announcement days for ten beta-sorted portfolios and other test assets. They examine the US stock market, with a sample period stretching from 1964-2011. They show that asset prices behave very differently on days with macroeconomic announcements, relative to all other trading days. Specifically, they show that on days when news about unemployment, interest rate, and inflation is scheduled to be announced, stock market beta is positive and significantly related to average excess return. On all other trading days they show a negative and/or insignificant relationship. If the market beta increases by one, the average excess return increases by 9.2 bps on a-days, while on all other trading days there is a negative slope coefficient of -1.0 bps. This relationship is consistent for individual stocks, 25 Fama-French size and book-to-market portfolios, industry portfolios, and other assets than equities, such as government bonds and currency carry-trade portfolios. They show that there exists a robust and positive risk-return trade-off on a-days for multiple test assets and portfolios.

The contribution of this thesis with regards to Savor and Wilson (2014) is that we focus on a different and smaller market. In addition, we examine the relationship between market beta and average excess return on both domestic and international macroeconomic announcement days, as well as looking at the impact of different types of announcements individually.

Even though there exists evidence on the empirical failure of CAPM, several studies including Savor and Wilson (2014) find significant relationship between market beta and average excess return on days when investors expect to learn important information about the economy or a given company. These studies provide empirical support of the implications of the CAPM by differentiating between days when investors expect to learn information that might affect the risk-return relationship, and all other days. In the period from 1994-2001, Cieslak et.al (2015) document that all equity premiums in the US and the rest of the world is earned entirely in weeks 0, 2, 4, and 6 of the Federal Open Market Committee (FOMC) cycle. The FOMC cycle starts on the day before a scheduled FOMC meeting and resets at each of the eight times the FOMC meets per year (Cieslak et al., 2015). The FOMC is responsible for the monetary policy in the US. They find that average excess return of stocks is positive and significant in even weeks, and not significantly different from zero in odd weeks of the cycle. Using beta-sorted portfolios they find that this “bi-weekly” pattern in stock returns is most prominent for high-beta portfolios with a positively sloped SML in even weeks, and negatively sloped in odd weeks of the cycle.

Savor and Wilson (2016) examine the risk-return relationship on days when earnings announcements for companies are released. They find that companies who report earnings on average experience increasing returns when these reports are scheduled to be announced. Further, they calculate an announcement risk premium, based on going long in announcement stocks, and shorting non-announcement stocks, in a given week. This premium is quite persistent, which means that stocks that previously have announced high or low earnings continue to announce high or low earnings. They sort their announcement stocks into beta-sorted announcement portfolios. They find that higher beta generates higher average excess return overall, but the difference between the highest beta portfolio and the lowest beta portfolio is 24.0 bps in weeks when stocks report their earnings, and only 9.0 bps outside these weeks. These results are both economically and statistically significant.

2. Modern Portfolio Theory

Modern portfolio theory is built on Harry Markowitz's (1952) mean-variance portfolio theory and the efficient frontier. Markowitz argues that investment decisions should be based on the tradeoff between risk and return of an overall portfolio, as opposed to constructing a portfolio simply based on securities with individual high risk-return characteristics (H. Markowitz, 1952).

2.1 Mean-variance portfolio theory

According to mean variance portfolio theory, the optimal portfolio for an investor is the portfolio that minimizes the variance (risk) for a given expected return, or the portfolio that provides maximum expected return for a given variance.

There are multiple assumptions about investors and markets in the framework of modern portfolio theory:

1. All investors are rational.
2. All investors are risk averse.
3. Financial markets are frictionless.
4. Homogenous expectations.

The first assumption describes how investors seek to maximize return on their investment, while minimizing the risk. Investors will always invest their funds in a portfolio that provides higher expected return relative to another portfolio with lower return, given the same level of risk. The second assumption states that all investors will chose the portfolio with the lowest level of risk, given the same level of expected return. The third assumption states that all markets are frictionless, indicating that there are no restrictions or costs associated with financial transactions. It also implies that investors can buy and sell securities as they see fit, with no short-selling restrictions. The last assumption refers to the idea that all investors have the same investment opportunities, access to the same information and the same expectation about market and securities. (H. M. Markowitz, 1959).

2.1.1 Minimum-variance and the efficient frontier

For an investor the optimal portfolio provides the best tradeoff between expected return and risk. By rejecting portfolios that are clearly inferior to other portfolios, investors are left with only the efficient portfolios. Efficient portfolios provide the highest level of expected return at a given level of risk, and are referred to as minimum-variance portfolios. The market consists of several minimum-variance portfolios and all of them put together create what Markowitz (1959) refers to as the efficient frontier. As investors are assumed to be rational and risk averse, all investors will choose to invest their funds in a portfolio on the efficient frontier (H. M. Markowitz, 1959, pp. 6-7).

2.1.2 Systematic and unsystematic risk

Modern portfolio theory assumes that all individual securities consist of both systematic and unsystematic risk. Markowitz (1959) argues that if securities' returns are not correlated, you can eliminate all risk by diversification. Diversification means having multiple securities in each portfolio so company-specific risk cancels out. It is possible to reduce risk by diversification, but not eliminate risk, due to the fact that securities' returns are highly correlated, but not perfectly correlated.

The unsystematic risk is risk that is directly linked to the company. Since unsystematic risk only affects a certain security and not the entire market it can be eliminated by diversification. Systematic risk is directly linked to the market and will affect all securities. Hence, diversification will not be able to eliminate this type of risk. Systematic risk factors are macro-level, such as changes in interest rates, unemployment levels, GDP and even effects from war. Systematic risk is often referred to as beta (β), calculated as the covariance between the market and an asset, divided by the market's volatility, and reflects securities sensitivity to the market (Mangram, 2013; H. M. Markowitz, 1959).

2.1.3 Capital market line and the tangency portfolio

In the previous sections we explain that the optimal portfolio consists of only risky assets. In the real market there also exists a risk-free asset. The risk-free asset has a variance equal to zero. A portfolio only consisting of the risk-free asset represents the global minimum-variance portfolio. Since the risk-free asset represents the highest possible return with regards

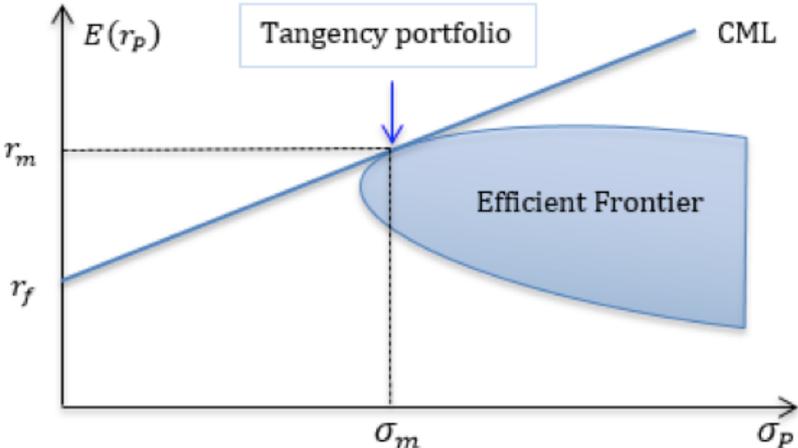
to zero risk, it follows that a portfolio only consisting of the risk-free asset is efficient, and is therefore a part of the efficient frontier. A linear relationship between risk and return appears when the risk-free rate is included. This linear relationship is shown with the capital market line (CML) in *Figure 2*. All combinations of the risk free-asset and risky assets are plotted along the capital market line. The X-axis reports the level of risk and the Y-axis reports the expected return. All combinations of assets found along this line are minimum-variance portfolios, as they minimize variance for various levels of expected return (H. M. Markowitz, 1959, p. 149)

The CML intercepts the Y-axis in the risk-free rate and is tangent to the efficient frontier. The market’s minimum-variance portfolio is located in the point where the CML is tangent to the efficient frontier, and is called the tangency portfolio. All other points on the CML are located above the efficient frontier. This indicates that the portfolios on the CML dominate the efficient frontier, since the expected return is higher given the same level of risk (Bodie, Kane, & Marcus, 2014). Investors will invest all their available funds in a combination of the risk-free asset and the tangency portfolio. This combination depends on their level of risk aversion. The fundamental equation for the CML is the following:

$$(1) \quad E(r_p) = r_f + \sigma_p \left(\frac{r_m - r_f}{\sigma_m} \right)$$

The slope of the CML is always positive, meaning that, $r_m - r_f > 0$. This follows from the idea that investors are compensated with a premium above risk free return for taking on risky assets.

Figure 2: Capital market line and the efficient frontier



2.2 Capital Asset Pricing Model

The capital asset pricing model is an asset-pricing model first developed by William Sharpe (1964). Additional improvements to this model were later introduced by John Lintner (1965) and Fischer Black (1972). The capital asset pricing model, usually referred to as the CAPM, is central to modern financial economics. The CAPM is based on the same assumptions and simplified world as Markowitz (1959) mean-variance theory describes. The CAPM also assumes that an investor can borrow and lend as much as they like at a risk-free rate.

The CAPM introduces the market portfolio, M , which is defined as the efficient portfolio employing all available risky assets. The market portfolio is equal to the mean-variance theory's tangency portfolio on the efficient frontier. The weight of each asset in the market portfolio is equal to its market value relative to the total market value of all assets (Bodie et al., 2014).

The market portfolio has a systematic risk factor (market beta) equal to one. The market beta of a risky asset is determined by the relationship between the covariance of the market and the asset (i), and the volatility of the market, as shown in equation (2).

$$(2) \quad \beta = \frac{COV_{m,i}}{Var_m}$$

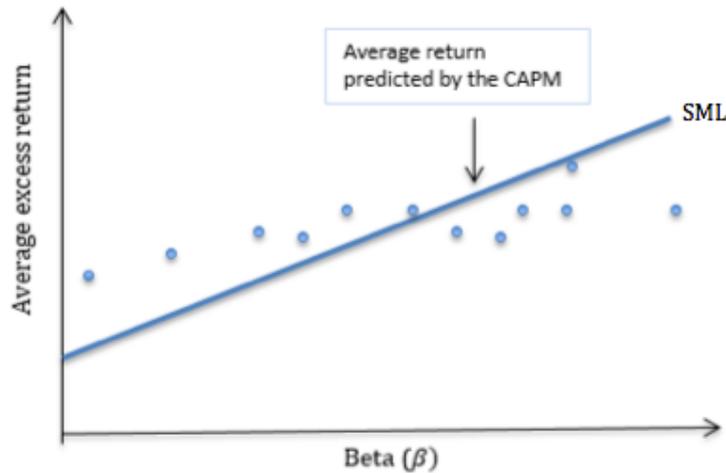
Since assets with higher beta value reflects higher covariance with the market, this implies that the asset is more exposed to the overall market risk, and will react more to macroeconomic risk factors. This type of risk is directly related to expected return (Sharpe, 1964), and any rational investor will expect to be rewarded for holding assets with higher beta.

The CAPM demonstrates that the expected excess return of any risky asset is positive and directly related to its beta. The market risk premium is derived as the market return subtracted with the risk-free rate ($E(r_m) - r_f$), and the CAPM provides a linear relationship between expected excess return and market beta multiplied with the market risk premium, shown in equation 3.

$$(3) \quad E(r_i) - r_f = \beta(E(r_m) - r_f)$$

This linear relationship is reflected in the security market line (SML) presented in *Figure 3*.

Figure 3: Security market line



2.2.1 Anomalies of the CAPM

All return spread not captured by the market beta is an anomaly of the capital asset pricing model. Empirical evidence shows that CAPM and the assumptions it relies on does not hold entirely. Basu (1977) argues that the market suffers from weak market efficiency, which contradicts one of CAPM central assumptions. Market inefficiency occurs when investors do not have access to all information regarding the market; hence assets are not priced correctly. Basu (1977) finds that price/earnings-ratios are not fully reflected in stock prices, and that the risk-adjusted return for securities with low P/E-ratios tends to outperform securities with a higher P/E-ratio. Further, several studies find that spread in returns is explained by other factors than market risk. Rosenberg et.al (1985) find that book-to-market ratio is positively related to expected returns, and that this is not captured by the market beta. They show that companies with higher B/M-ratio expect higher returns than companies with lower B/M-ratios. Chen et.al (1986) introduce a set of variables describing the state of the economy, such as industrial production and changes in the yield curve. When they examine the risk-return relationship including these variables as systematic risk factors, the market exposure loses its significance. Bhandari (1988) finds that expected stock return is positively related to the ratio of debt, even when controlling for beta and firm size. The size effect refers to companies with low market capitalization outperforming companies with high market capitalization, is an anomaly of the CAPM. Banz (1981) was one of the first to provide empirical evidence of the size effect in the cross section of returns.

In the CAPM the market beta is constant. Harvey (1989) shows that by using constant betas, the CAPM is unable to capture the dynamic behavior of asset returns. He proposes a conditional CAPM that allows for both time-varying expected returns and time-varying betas. Nagel and Lewellen (2006) provide empirical evidence of the conditional CAPM performing almost as poorly as the unconditional CAPM, and that the conditional CAPM does not explain anomalies, such as book-to-market, momentum and size.

The most prominent empirical work that contradicts the CAPM is published by Fama and French (1992, 1993). They show that when controlling for additional factors, such as size, book-to-market equity and earnings/price ratios, the market beta is not able to capture all of the spread in returns across stocks. Fama and French (1993) expand the CAPM equation to a three factor model, including size and book-to-market equity as risk factors:

$$(4) \quad E(r_i) - r_f = \alpha_i + \beta_i(E(r_m) - r_f) + \beta_S SMB + \beta_H HML$$

In equation four, β_i is the market beta for an asset or portfolio (i), β_S is the factor loading on the SMB (small minus big) factor, and β_H is the factor loading on the HML (high minus low) factor. They find that companies with low market capitalization tend to outperform larger companies (SMB factor). They also find that value companies with high book-to-market value outperform growth companies with lower book-to-market values (HML factor). Fama and French (1993) show that market beta, SMB and HML together provide higher explanatory power of the difference in expected excess return across stocks.

3. Empirical Methodology

3.1 Constructing beta-sorted portfolios

Based on Fama and French's (1992) approach, we construct ten equal- and value weighted beta-sorted portfolios, using 90 individual stocks. We sort all stocks in our sample selection into ten portfolios, from smallest to largest estimated betas. The betas are estimated by regressing daily stock returns on daily market return. We use the MSCI Europe Index as proxy for the market.

First we use one year of daily stock returns, from July of year $t-1$ to June of year t to estimate pre-ranking betas for all stocks. From the pre-ranking betas, we place the stocks with the 10% lowest beta estimates in the first portfolio, $P1$, ascending to stocks with the 10% highest beta estimates in the tenth portfolio, $P10$. We estimate individual stock betas every year, allowing stocks to move between portfolios from year to year, if the beta estimates change.

After assigning stocks into ten beta-sorted portfolios in June of year t , we use individual stock returns and calculate the equal- and value-weighted returns for each portfolio for the next 12 months, from July _{t} to June _{$t+1$} . We use daily stock returns from July _{t} to June _{$t+1$} to accommodate for the effect of companies' fiscal year (Fama & French, 1992). In Norway, the fiscal year ends on the 31st of December, but the deadline for publishing financial statements and tax reports is not until the second quarter of the following year (Altinn, 2015). This is information that investors expect to learn about a given company in a given year, and if not adjusted for, this information would not be reflected in the stock price. By taking this into consideration we are able to capture all information and accounting variables that are used to explain stock returns.

The daily return for the equal-weighted portfolios is calculated as the average of daily stock returns for every stock within each portfolio:

$$(5) \quad r_{P,t}^{EW} = \sum_{i=1}^N r_{i,t} w_{i,t}^{ew}$$

Where $r_{i,t}$ is stock i 's excess return at time t and $w_{i,t}^{EW}$ is the equal weight of each stock, i , at time t . $r_{P,t}^{EW}$ is the equal weighted return of portfolio, P , at time t .

The daily return for the value-weighted portfolios is calculated as the sum of each individual daily stock return within each portfolio multiplied with the market value weight of each individual stock:

$$(6) \quad r_{P,t}^{VW} = \sum_{i=1}^N r_{i,t} \frac{MC_{i,t}}{\sum_{i=1}^N MC_{i,t}}$$

Where $r_{i,t}$ is stock i 's excess return at time t and $MC_{i,t}$ is the market capitalization of stock i at time t . The denominator is the sum of all stocks market capitalization at time t .

These calculations provide us with post-ranking daily excess returns from 2001-2015 for the ten equal- and value-weighted beta-sorted portfolios. To estimate full-sample betas for each portfolio, we regress the full-sample post-ranking daily excess return of each portfolio on the daily market risk premium. To control if our beta estimates are stable and coherent with the mean of true betas, we also estimate sorting betas. Every year we calculate the average beta of stocks within a portfolio, and then calculate the average beta for each portfolio.

Table 1: Ten equal- and value-weighted beta-sorted portfolios

	Low β P1	P2	P3	P4	P5	P6	P7	P8	P9	High β P10
Value-weighted										
Total mean excess return	7.84	2.68	5.15	4.85	4.25	1.60	3.14	6.32	2.65	-0.21
Mean excess return A-days	1.26	6.22	-6.04	-3.09	-11.64	-6.45	-9.06	-17.60	-18.14	-30.65
Mean excess return N-days	8.77	2.18	6.72	5.97	6.48	2.74	4.86	9.68	5.57	4.07
β - mrk	0.08	0.21	0.34	0.47	0.57	0.64	0.81	0.93	1.13	1.49
Equal-weighted										
Total mean excess return	10.97	3.93	6.29	3.94	4.42	6.83	4.30	5.04	1.26	-3.11
Mean excess return A-days	9.98	4.62	3.48	-4.64	-10.50	-4.11	-3.60	-14.04	-14.67	-27.04
Mean excess return N-days	11.11	3.84	6.69	5.15	6.52	8.37	5.41	7.72	3.51	0.26
β - mrk	0.09	0.22	0.35	0.48	0.55	0.66	0.80	0.94	1.12	1.46
β - sort	-0.06	0.22	0.36	0.48	0.59	0.72	0.84	0.97	1.16	1.54
# stocks per portfolio	7.1	7.0	7.0	6.9	6.9	6.7	6.6	6.5	6.4	5.4

The table reports the total average excess return, and the average excess return on announcement days and non-announcement days for ten equal- and value-weighted beta-sorted portfolios. Excess return is reported in basis points. The table also reports each portfolios estimated full-sample beta, the sorting betas and the average number of stocks in each portfolio.

Table 1 reports the post-ranking average excess return for each portfolio, the average excess return on announcement days and the average excess return on non-announcement days. The table also reports full-sample market beta, the sorting beta, and the average number of stocks in each portfolio. We have approximately equal number of stocks in each portfolio, with a yearly average of 7.1 stocks in portfolio one (P1) and 5.4 stocks in portfolio ten (P10). The sorting betas are the same for both equal- and value-weighted portfolios. The sorting betas show a large spread from -0.06 in P1 to 1.54 in P10. The estimated betas also show a similar spread from the lowest beta portfolio to the highest beta portfolio. The value-weighted beta estimates increase from 0.08 for P1 to 1.49 for P10. The equal-weighted beta estimates for the portfolios increase from 0.09 for P1 to 1.45 for P10. There are decreasing returns between the lowest beta portfolio and the highest beta portfolio, as a result of the negative realized market risk premium in our sample period. We show full-sample average return spread between P10 and P1 of -8.1 bps for the value-weighted portfolios, and -14.1 bps for the equal-weighted portfolios. On days with macroeconomic news announcements the average return spread between P10 and P1 is -31.91 for the value-weighted portfolios and -37.02 for the equal-weighted portfolios. The highly decreasing returns with increasing beta on a-days indicate that beta is related to average excess returns.

3.2 Fama-MacBeth two-stage regression

This thesis studies if the risk-return relationship for Norwegian stocks can be explained by the market beta, on days with macroeconomic announcements relative to all other trading days. To test this empirically we apply a Fama-MacBeth two-stage regression model.

The CAPM describes excess return of assets as a result of the market risk premium and the market beta for an asset or portfolio:

$$(7) \quad R_i = \beta r_m$$

Where R_i is excess return of an asset, r_m is the market premium and β (the market beta) is the factor loading on the market risk premium. When testing the CAPM empirically, early studies by Douglas (1969), Black and Scholes (1973), and Black, Jensen and Scholes (1972) do not account for the cross-sectional correlation of stock returns. The correlation is a result of market shocks that affect multiple assets at the same time, which is not accounted for when

looking at assets individually. This can cause the estimated standard errors to be downward biased, resulting in overweight of the statistical power. Eugene Fama and James MacBeth (1973) test the tradeoff between average return and risk for common stocks on the NYSE, and derived a two-stage regression model that deals with the problem of the cross-sectional correlation in returns.

The two-stage regression model makes it possible to examine if some factors can explain portfolio returns. We apply a Fama-MacBeth regression model to test if higher market beta actually drives average excess return, and how much investors can expect to be rewarded for a particular beta exposure on announcement days, relative to all other trading days.

We first estimate portfolio betas to determine each portfolio's exposure to the market as the risk factor. We run a time series regression of portfolio excess return on the market risk premium, separately for each portfolio. This means that we run a set of regressions equal to the total number of test assets (Fama & MacBeth, 1973). This is shown in function (9). Fama and MacBeth (1973) use 5-year rolling regressions, we apply a technique using the full-sample period.

$$\begin{aligned}
 R_{1,t} &= a_1 + \beta_1 r_{m,t} + \epsilon_{1,t} \\
 R_{2,t} &= a_2 + \beta_2 r_{m,t} + \epsilon_{2,t} \\
 R_{i,t} &= a_i + \beta_i r_{m,t} + \epsilon_{i,t}
 \end{aligned}
 \tag{8}$$

The $R_{i,t}$ is the excess return of portfolio i at time t . The $r_{m,t}$ is the market risk premium and represents the risk factor, and the β_i is the portfolios exposure to this risk factor. The a_i represent the constant, and $\epsilon_{i,t}$ is a noise factor. The estimated beta ($\hat{\beta}$) obtained from the time-series regression represent the empirically estimated beta of each portfolio, which can differ from the true β for each individual stock in the portfolio.

Further, we perform a set of cross-sectional regressions. We regress each portfolio's excess return on the empirically estimated beta from the first step, for each point in time. The estimated beta for each portfolio remains constant throughout the regression; the only factors that change are the dependent variables, which are different for each time period. These regressions provide us with the implied market risk premium each portfolio is rewarded for a

unit of exposure to the market ($\hat{\beta}_{i,r_m}$), at each point in time. This implied market risk premium is expressed by lambda ($\gamma_{i,t}$) (Fama & MacBeth, 1973).

$$\begin{aligned}
 R_{i,1} &= a_1 + \gamma_{1,1}\hat{\beta}_{i,r_m} + \epsilon_1 \\
 R_{i,2} &= a_2 + \gamma_{1,2}\hat{\beta}_{i,r_m} + \epsilon_2 \\
 R_{i,T} &= a_T + \gamma_{1,T}\hat{\beta}_{i,r_m} + \epsilon_T
 \end{aligned}
 \tag{9}$$

The second stage in the Fama-MacBeth procedure is to calculate the mean of the implied market risk premium, separately for days with announcements and all other trading days. This results in two coefficients on beta, one for announcement days and one for all other trading days. The coefficients describe the reward for one unit of beta exposure on the different types of days.

Finally we calculate the statistical significance of these means, expressed by a t-statistic. The t-statistic is calculated using the following equation:

$$t - stat = \frac{\bar{\gamma}_i}{\frac{\sigma_{\bar{\gamma}_j}}{\sqrt{obs}}}
 \tag{11}$$

Where $\bar{\gamma}_i$ is the average daily implied market risk premium, the $\sigma_{\bar{\gamma}_i}$ is the standard deviation of the $\bar{\gamma}_i$ term, and obs is the number of observations. The t-statistic explains how significant our regression results are. We use the t-statistic to test if market beta is significantly related to average excess return on announcement days and non-announcement days. T-statistics above/under ± 1.64 is significant at the 10% level, and t-statistics above/under ± 1.96 is significant at the 5% level.

In addition to reporting the statistical significance expressed by a t-statistic, we present the estimated value of R-squared (R^2). R^2 is the explanatory power of how much of the variance in the dependent variable is explained by the variance in independent variables. In a cross-sectional regression there are more test assets used, and the R^2 will consequently be lower. There are several studies that try to explain why R^2 is lower in the cross-section of expected returns. Sanchez (2015) find that R^2 estimated from cross-sectional regressions is lower than

estimated R^2 from time-series regressions. One explanation Sanchez (2015) provides is that cross-sectional regressions use estimated betas, which leads to an error in variable (EIV) problem. In this case, the EIV problem is that these estimated betas include sampling errors from the time-series data.

3.3 Single pooled regression model

We perform a single pooled regression using panel data. We perform a regression of each portfolio's excess return on their respective market beta, an a-day dummy, and an interaction term between market beta and the a-day dummy. This regression directly tests whether the implied market risk premiums are different on a-days and n-days, and can be expressed by the following equation:

$$(12) \quad R_{i,t} = \gamma_0 + \gamma_1 \hat{\beta}_{i,t} + \gamma_2 A_t + \gamma_3 \hat{\beta}_{i,t} A_t$$

The γ_0 term is the constant on days with no announcements, and $\gamma_1 \hat{\beta}_{i,t}$ is the implied market risk premium on n-days. The $\gamma_2 A_t$ term express the increase of the constant on a-days relative to n-days, and the increase in the implied market risk premium on a-days, relative to n-days, is expressed by the $\gamma_3 \hat{\beta}_{i,t} A_t$ term.

4. Data Description

Our sample period is from January 2001 to December 2015, including data for a total of 15 years. There are approximately 250 trading days each year in this period. The sample period starts in 2001, as the specific date of announcements is not available for all types of Norwegian macroeconomic news, prior to this. We use daily return data from the Norwegian stock market.

4.1 Stock market data

We obtain individual stock data from the Oslo Stock Exchange (OSE) using the financial database "Børsprosjektet" at NHH. This data includes daily stock prices, daily stock returns, and daily market capitalization. The returns are adjusted for capital changes such as stock splits and dividends. The stocks we use are from a broad range of industries, such as energy,

materials, finance, consumer goods and health care. We use the most liquid stocks with a requirement of few missing values in their daily return data. All of the selected stocks are traded on the OSE as of December 31, 2015.

We use daily return data since the macroeconomic news we focus on in this thesis, is announced on specific days of the year. To capture the effect beta has on average excess return on these days, it is important that the data is as complete as possible. We have certain criteria for the data we use. We only use stocks that are listed on the OSE as of December 31, 2015, excluding stocks that have been delisted during the period from 2001-2015. This leaves us with 180 stocks. We include the 40 most liquid companies on the OSE, as these companies represent the most traded stocks and have continuous movement in their returns. Several of the 140 remaining stocks were excluded due to an extensive amount of missing values in their daily return data. Out of the 140 stocks remaining stocks we include the 50 stocks with the least number of missing values, resulting in a sample selection of 90 individual stocks. This is 50% of the total number of stocks listed on the OSE at the end of 2015 (Oslo Børs, 2016).

During the construction of the ten beta-sorted portfolios, we encountered some flaws with the daily return data for some of the individual stocks. More specifically, we had nine observations of extreme values. These observations varied with daily returns from 105% to 3100% and were spread across six individual stocks. To deal with these extreme values we used a winsorizing technique, which makes it possible to reduce the effect of spurious outliers in statistical datasets (Tukey, 1962). We do not delete the outliers when using the winsorizing technique, but we limit their effect. By using winsorizing we replace the extreme values with the trimmed mean of the highest 5% of return observations for the respective stocks. The trimmed mean is the average of the 5% highest or lowest daily returns in the sample period, calculated after excluding the spurious outliers.

4.1.1 Market proxy

The market portfolio in the CAPM consists of all available risky assets. We use the MSCI Europe Index as a proxy for the market portfolio, using daily return data. This index consists of 446 companies with middle and large market capitalization (mid- and large-cap). Mid-cap companies have a market capitalization between \$2 billion and 10\$ billion, and large-cap companies have a market capitalization above \$10 billion. These companies cover

approximately 85% of the free float-adjusted market capitalization across the developed markets in Europe (MSCI, 2016). Free float-adjusted market capitalization is calculated as the stock price multiplied with all available shares, excluding shares that are not traded in the market.

Norway is a small, open economy, which means that they take part in international trade. With an increasing globalized world, investors have the opportunity to trade across financial markets, and Stulz (1995) argues that the cost of capital in small countries is determined globally and not locally. Norwegian investors can easily access foreign capital markets and foreign investors can access the Norwegian stock market (Andersen, 2007). In a global market the risk of each portfolio held by investors can be determined by their exposure to a global market index (Stulz, 1995). The MSCI Europe Index can be considered a global market index, as it correlates 88.82% with the global MSCI World Index in our sample period. The MSCI Europe index is more diversified than smaller local indices, since it is composed of a larger spread in industries and stocks across countries. Comparing the benchmark index of the OSE (OSEBX) and the MSCI Europe Index we find that 40.3% of all companies in the OSEBX are either in the oil, energy or industry sector, whilst for the MSCI, these sectors only constitute 20.09% (MSCI, 2016).

This thesis examines the risk-return relationship for both Norwegian and U.S. announcements. To capture the effect beta has on average excess return on both domestic and international announcement days, we find it appropriate to use an international market proxy to estimate market betas that reflect international risk.

4.1.1.1 Negative market risk premium

The market risk premium is expected to be positive, both historically and based on financial theory. The market risk premium is calculated using long-term historical average equity returns, and is normally positive (Graham & Harvey, 2001). In this thesis we calculate the average market risk premium using daily equity returns for the MSCI Europe Index from 2001-2015. This results in a negative realized daily market risk premium of -0.68 bps.

We find two possible explanations for the average market risk premium being negative. During the 15 years of our period, the returns in the Norwegian, European and global markets were influenced by two major economic recessions: the burst of the dotcom bubble in 2000-2001 and the financial crisis in 2007-2008. The dotcom bubble is the dramatic increase in stock prices for technological companies in the period from 1995-2000. The crisis emerged when the stock prices increased more than the fundamental value of the tech-companies, and in 2001 the result was a major collapse in stock prices (Fox, 2014). The financial crisis is the collapse of the financial sector in 2007-2008, as a direct result of the subprime mortgage bubble in the US (Friedman & Posner, 2011). *Figure 5* shows the effect from these recessions on the market return and the market risk premium.

Figure 4: Semi-annual market return movements from 2001-2015



The figure plots the average daily realized market return, risk-free rate and market risk premium, presented semiannually. The graph plots returns for the period of 2001-2015. The numbers are in basis points.

We use a simple t-test to check for differences in average market risk premiums in non-recession and in recession periods. We do this to determine if there is a significant difference in the market risk premium in non-recession periods and in recession periods. We find that the average daily market risk premium in recession periods is equal to -15.23 bps. The average daily market risk premium for the rest of sample period is equal to 3.59 bps. We show a significant difference of 18.81 bps with a t-statistic equal to 2.87.

Table 2: Market risk premium in recession and in non-recession periods

	Market risk premium (bps)	Standard deviation (%)	Observations
Total	-0.68	1.27	3763
Non-recession	3.59* (1.82)	1.06 -	2909 -
Recession	-15.23*** (-2.44)	1.83 -	854 -
Non-recessions - Recession	18.81*** (2.87)	- -	- -

The table reports the average market premium, the standard deviation and the number of observations for the total sample period, the non-recession periods and the recession periods. The sample period is from 2001-2015. The fourth row reports the differences in market risk premiums between non-recession and recession periods. T-statistics are reported in parentheses.

Table 2 shows that the daily market risk premium is significant in both recession periods and in non-recession periods, with t-statistics of -2.44 and 1.82 respectively. Normally one would expect the daily returns in non-recession periods to be more significant than in recessions. The reason for this is that the standard deviation in non-recession periods is expected to be lower than in recessions, as well as the number of observations for non-recession periods are expected to be higher. These expectations hold in our thesis, but due to the low average returns in our non-recession period, we get a lower t-statistic in non-recession times. This is in contrast to recession periods where the highly negative return, leads to a more significant t-statistic.

4.1.2 Different types of portfolios and risk free rate

We use portfolios sorted on book-to-market, size, momentum and industry characteristics, as part of a supplementary analysis. We test if market beta is able to capture the spread in average excess return using portfolios sorted on anomalies of the CAPM. The portfolios are retrieved from Bernt Arne Ødegaard's (2016a) publicly available financial database. Ødegaard (2016b) constructs the portfolios by sorting stocks from the OSE according to specific criteria. The industry portfolios are sorted based on the Global Industry Classification Standard. Size portfolios are sorted by ranking companies on their increasing equity size. B/M portfolios are sorted by increasing B/M ratio. The portfolios sorted on momentum, refers to

the observed tendency of companies performing well in previous periods are expected to do well in subsequent periods.

The daily risk free rate is also gathered from Ødegaard's database (2016a). We use the risk-free rate to calculate excess return for individual stocks, portfolios and the risk premium for the market portfolio. The daily risk-free rate is estimates of forward-looking interest rate.

4.2 Announcement days

The Norwegian macroeconomic news announcements we use in this thesis are changes in the key interest rate, the unemployment rate, the consumer price index, the gross domestic product and the wage index. On these days investors expect to learn information describing the current state of the economy. Systematic risk represents macro-risk, and multiple studies (Huang, 2015; Savor & Wilson, 2013, 2014) argue that times with announcements of macroeconomic news are periods with higher systematic risk. According to CAPM, expected excess return on risky assets should be higher during periods with higher risk. We use the same types of announcements as in Savor and Wilson (2014), in addition to announcements regarding the wage index.

We gather the Norwegian macroeconomic announcement days from Statistisk Sentralbyrå (SSB) and the central bank of Norway, *Norges Bank*.

- Key Interest Rate (KIR): The key interest rate is the interest rate Norwegian banks receive on deposits up to their individual quotas in Norges Bank, also referred to as the sight deposit rate. Announcement days in this category are all key interest rate decisions from 2001-2015 (Norges Bank, 2016).
- Labour Force Survey (LFS): This survey provides information about the development in employment and unemployment. These statistics are published quarterly (SSB, 2016a).
- Consumer Price Index (CPI): The CPI measures the actual changes in the prices for household goods and services including charges and fees. These statistics are published monthly (SSB, 2016b).
- Gross Domestic Product (GDP): The National Accounts statistics are designed to provide a comprehensive survey of the overall national economy, such as GDP, as

well as transactions between Norway and the rest of the world. These statistics are published quarterly (SSB, 2016c).

- Wage Index (WI): The purpose of this index is to show changes in average monthly earnings and basic salaries throughout the year for the Norwegian labor force. These statistics are published quarterly (SSB, 2016d).

Table 3: The distribution of Norwegian and U.S. announcements

Norway		USA	
Type of announcement	# Announcements	Type of announcement	# Announcements
Labor Force Survey	61	Fed Interest Rate Decision	99
Wage Index	61	US. Unemployment Rate	180
Consumer Price Index	180	Consumer Price Index	180
Key Policy Rate	120	Gross Domestic Product	181
National Accounts	61	Salary	180
Total announcement days*	464		789
Ann. in % of the sample period	12,33 %		20,97 %

The table shows the different type of announcements and the number of observations for each announcement in Norway and the United States. * Adjusted for days with more than one announcement.

Table 3 shows the distribution of the different Norwegian and U.S. announcement days. There is a total of 464 Norwegian announcement days, which constitute 12.33% of all days in our sample period. This means that macroeconomic news on average are announced every eight trading day in Norway. The same frequency of announcements is shown in Savor and Wilson (2014), which had announcement days constituting 13% of their sample period.

For our supplementary analysis of the Norwegian stock market's reaction to announcements from a bigger economy, we retrieve the same type of announcements from the U.S. as in Norway. Consumer Price Index (CPI) and unemployment announcement dates (LFS) are retrieved from the Bureau of Labor Statistics' website. Gross Domestic Product (GDP) and salary (WI) announcement dates are retrieved from the Bureau of Economic Analysis. The announcement dates for the Federal Open Market Committee (FOMC) key interest rate decisions (KIR) is retrieved from the FOMC's website. There is a total of 789 announcement days in the U.S., which constitute 20.97% of all days in the sample period. This implies more frequent announcements in the U.S. relative to Norway, with announcements on average every fifth trading day.

5. Empirical Results

5.1 Beta-sorted portfolios

Table 4 shows the main result from a Fama-MacBeth regression and a single pooled regression, using ten beta-sorted portfolios as test assets. We focus on the relationship between average excess return and market beta, separately for announcement days and non-announcement days. The Fama-MacBeth regression results show a clear difference between a-days and n-days. On a-days there is a significant relationship between the market beta and average excess return, while on n-days there is no significant relationship. This holds for both equal- and value-weighted portfolios. The estimated coefficient on beta represent the implied market risk premium, in other words the slope of the security market line. On both a-days and n-days the slope coefficient is negative due to the negative realized market return in our sample period.

Table 4: Regression results for ten beta-sorted portfolios

Panel A: Fama-MacBeth regressions									
	Value-weighted				Equal-weighted				
	Intercept	Beta	R ²		Intercept	Beta	R ²		
A-day	6.0 (0.92)	-23.2* (-1.81)	0.260		10.9* (1.87)	-25.4** (-2.23)	0.276		
N-day	6.1*** (2.84)	-0.6 (-0.15)	0.256		9.0*** (4.40)	-5.2 (-1.24)	0.260		
A-Day - N-day	-0.1 (-0.02)	-22.5 (-1.68)			1.9 (0.31)	-20.3* (-1.67)			

Panel B: Single pooled regression										
	Value-weighted				Equal-weighted					
	Intercept	Beta	Announcement	Ann.*Beta	R ²	Intercept	Beta	Announcement	Ann.*Beta	R ²
	6.1*** (2.84)	-0.6 (-0.15)	-0.1 (-0.02)	-22.5* (-1.68)	0.001	9.0*** (4.42)	-5.2 (-1.24)	1.9 (0.31)	-20.3* (-1.67)	0.001

Panel A reports the results from Fama-MacBeth regressions, using ten beta-sorted portfolios. The estimates for the value-weighted portfolios are reported on the left hand side, and equal-weighted estimates are reported on the right hand side. We report the intercept, the average coefficient on beta and the average R² separately for announcement days and non-announcement days. The third row reports the results from a t-test on the difference between average excess return on announcement days and non-announcement days. Panel B reports the results from a single pooled regression using the same portfolios, where we add an a-day dummy and an interaction term between beta and the dummy (Ann.*Beta). The t-statistics are reported in parentheses. For the Fama-MacBeth regressions they are calculated using robust standard errors. For the single pooled regressions they are calculated using clustered standard errors.

Panel A reports the results from the Fama-MacBeth regression. The left hand side of Panel A presents the result for the value-weighted portfolios. On a-days the intercept is 6.0 basis

points (bps), and insignificant with a t-statistic of 0.92. The slope coefficient is -23.2 bps with a significant t-statistic of -1.81. This indicates that an increase in the market beta of one will decrease excess returns by 23.2 bps on days with macroeconomic announcements. On n-days the intercept is 6.1 bps and significant with a t-statistic of 2.84, but the slope coefficient is -0.6 bps and insignificant with a t-statistic of -0.15. The same relationship also holds for the equal weighted portfolios, which is reported on the right hand side of Table 4. On a-days the intercept is 10.9 bps with a t-statistic of 1.87. The slope coefficient is -25.4 bps and significant with a t-statistic of -2.23. On n-days the intercept is 9.0 bps with a t-statistic of 4.40, and the slope coefficient is -5.2 bps with an insignificant t-statistic of -1.24.

The R^2 estimates in Panel A are the average R^2 estimates from the first stage of the Fama-MacBeth regression. On a-days the R^2 is 26.0% for the value-weighted portfolios and 27.6% for the equal-weighted portfolios. On n-days the R^2 is 25.6% for the value-weighted portfolios, and 26.0% for the equal-weighted portfolios. From Savor and Wilson's (2014) Fama-MacBeth regression results they report R^2 estimates for the value-weighted portfolios of 51.4% on a-days and 49.2% on n-days. The R^2 estimates are lower than in a time-series regression, due to the cross-sectional regressions in the Fama-Macbeth procedure.

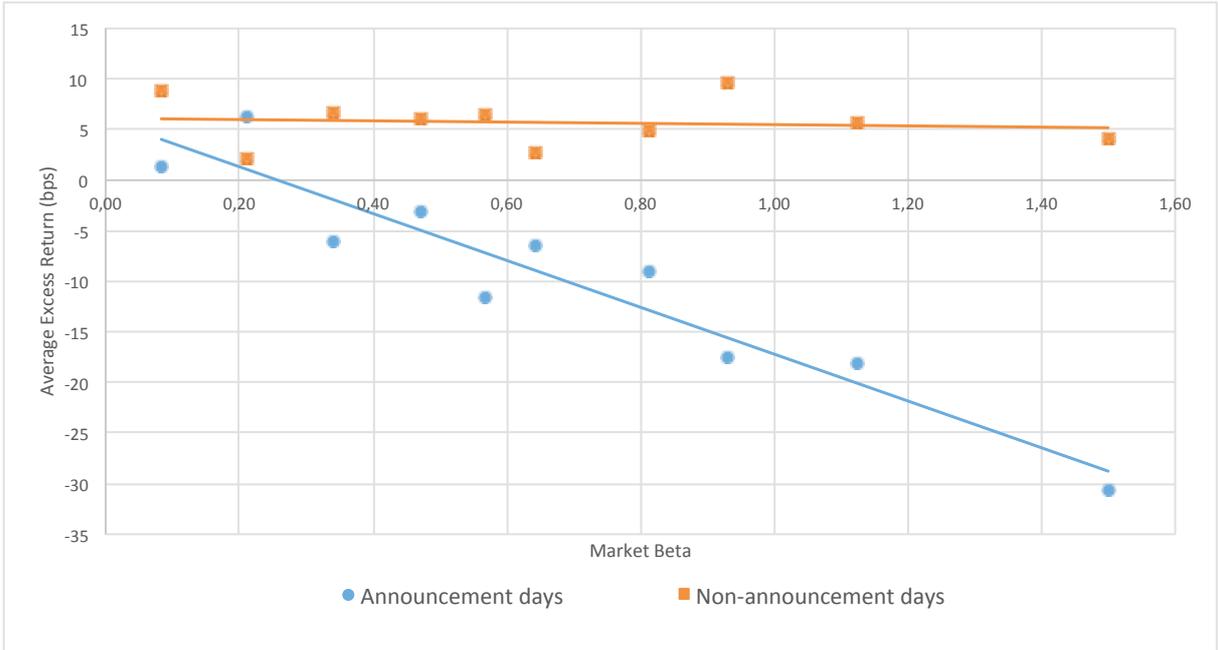
In addition to examine a-days and n-days separately, we perform a two-tailed t-test to test if there is a significant difference in means between the a-days and n-day samples. In the third row of panel A we report a significant difference in slope coefficients between a-days and n-days. We find that the slope coefficient is -22.5 bps lower on a-days than n-days for the value-weighted portfolios (t-statistic of -1.68), and -20.3 bps lower on a-days than n-days for the equal-weighted portfolios (t-statistic of -1.67). We conduct this t-test using Satterthwaite's (1946) approximation formula for degrees of freedom, as the data for a-days and n-days are assumed to have unequal variances.

In Panel B we report the results from a single pooled regression using all days. Using this method we directly examine if the intercept and slope coefficient are different on a-days and n-days. We regress panel data of portfolio excess returns directly on their market betas, an a-day dummy, and an interaction term between the market betas and the a-day dummy (Ann.*Beta). We report an n-day intercept of 6.1 bps with a t-statistic of 2.84, while the a-day intercept is 0.1 bps lower, though not significant, with t-statistic of -0.02. The slope coefficient on n-days is -0.6 bps with a t-statistic of -0.15, while the slope coefficient on a-

days is 22.5 bps lower with a significant t-statistic of -1.68. The result shows that it is the interaction between a-days and betas that directly influence average excess return, while the announcement-day indicator is not significant on its own. This implies that the spread in average excess return for the ten beta-sorted portfolios on a-days is explained by their betas, and not by announcement days alone. We find similar results for the equal-weighted portfolios. The n-day intercept is 9.0 bps with a t-statistic of 4.42, while the intercept on a-days is 1.9 bps higher with an insignificant t-statistic of 0.31. The n-day slope coefficient is -5.2 bps (t-statistic=-1.24), while the slope coefficient on a-days is 20.3 bps lower with a significant t-statistic of -1.67.

In *Figure 5* we plot the average excess return for each of the ten value-weighted beta-sorted portfolios against their full-sample beta, separately for a-days (circle shaped points) and n-days (square shaped points), adjusted with robust standard errors.

Figure 5: Average daily excess return for ten beta-sorted portfolios



The figure plots average excess return against beta for ten value-weighted beta-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio’s full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

This figure shows the relationship between market beta and average excess return for ten beta-sorted portfolios, separately for a-days and n-days. On the X-axis we report the market

beta, and on the Y-axis we report the average excess return measured in basis points. We show a linear relationship between market beta and average excess return, but given the negative realized market risk premium in our sample period, the slope of the security market line is negative. The negative and significant slope coefficient on a-days implies that an increase in beta of one will result in a decrease in average excess return of 23.2 bps. The important insight from this result is not the negative slope coefficient, but rather the significant relationship. This relationship shows that on days when macroeconomic news, such as changes in interest rates, consumer price index, gross domestic product, unemployment and wage index are scheduled to be announced, the systematic risk of a portfolio is significantly related to average excess returns of that portfolio.

We regress the average excess return of the ten portfolios on the portfolios market betas to estimate the statistics of the security market line in figure 5. The slope coefficients are the same as in the Fama-MacBeth regression, while the t-statistics and R^2 are higher on a-days, and lower on n-days. The slope coefficient on a-days for the value-weighted portfolios is -23.2 bps with a t-statistic of 9.3. On n-days the slope coefficient is insignificant with a value of -0.6 bps and a t-statistic of -0.32. The R^2 on n-days is only 1.3%, while on a-days the variation in average excess return is highly explained by the variation in betas, with a R^2 of 89.6%.

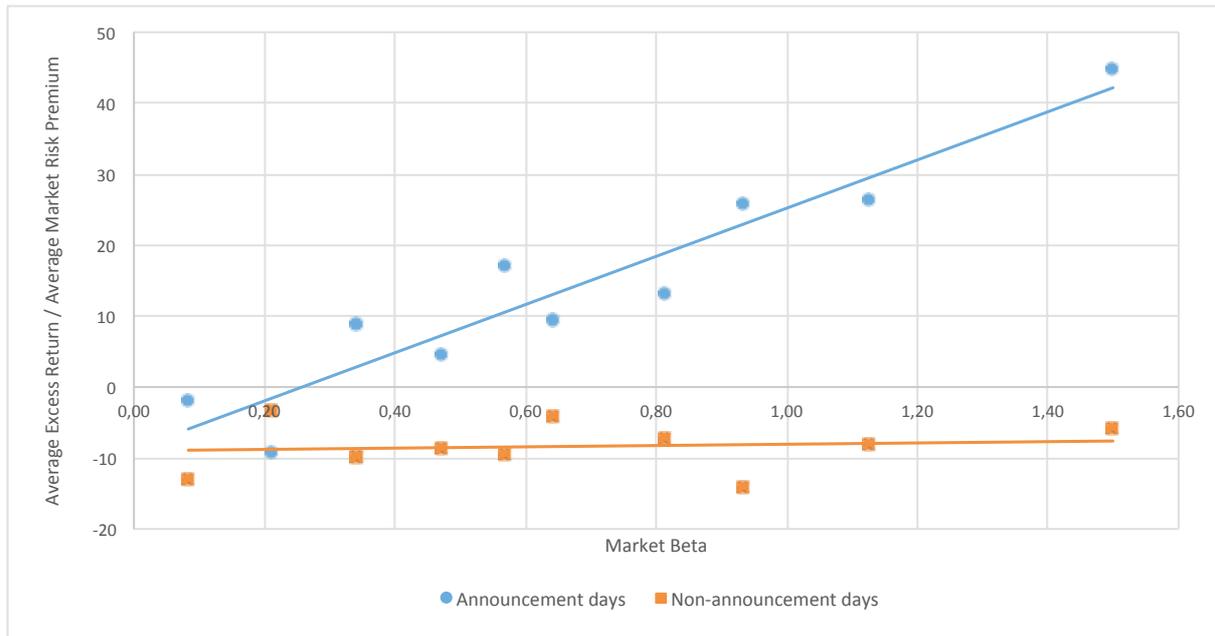
The CAPM assumes a positive market risk premium, and consequently increasing excess return with increasing beta. From equation 13 we see that CAPM explains that expected excess return for assets (R_i), is equal to the market beta (β) multiplied with the market risk premium (r_m^e).

$$(13) \quad CAPM = R_i = \beta r_m^e$$

To eliminate the effect of the realized negative market risk premium in our sample period, and decreasing average excess returns between the lowest and the highest beta-portfolio, we manipulate the CAPM equation. By using simple equation rules (dividing market risk premium on both sides of the equation) we show that the market beta is equal to the ratio between excess return and the market risk premium $\left(\frac{r_p^e}{r_m^e}\right)$.

$$(14) \quad CAPM = \frac{r_p^e}{r_m^e} = \beta$$

Figure 1: Ratio between average excess return and market risk premium



The figure plots the ratio between average excess return and average realized market risk premium against beta for ten beta-sorted portfolios, separately for announcement days and non-announcement days. On the X-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the ratio of average excess return over average market risk premium. The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period. .

The figure shows the relationship between market beta and the ratio of average excess return over average realized market risk premium, using ten beta-sorted portfolios, separately for a-days and n-days. On the X-axis we report the market beta, and on the Y-axis we report the ratio of average excess return of the ten beta-sorted portfolios over the average market risk premium. The figure shows that on a-days an increase in the market beta of one will result in a positive and significant increase of the ratio between average excess return and the average market risk premium by 33.88. On n-days an increase in beta of one will result in a positive though insignificant increase of this ratio by 0.92.

5.2 Individual stocks

We run a Fama-MacBeth regression using 90 individual stocks to evaluate if market beta has the ability to explain average excess returns on announcement days for individual stocks. By examining stocks individually, we test if our main results are affected by the beta sorting.

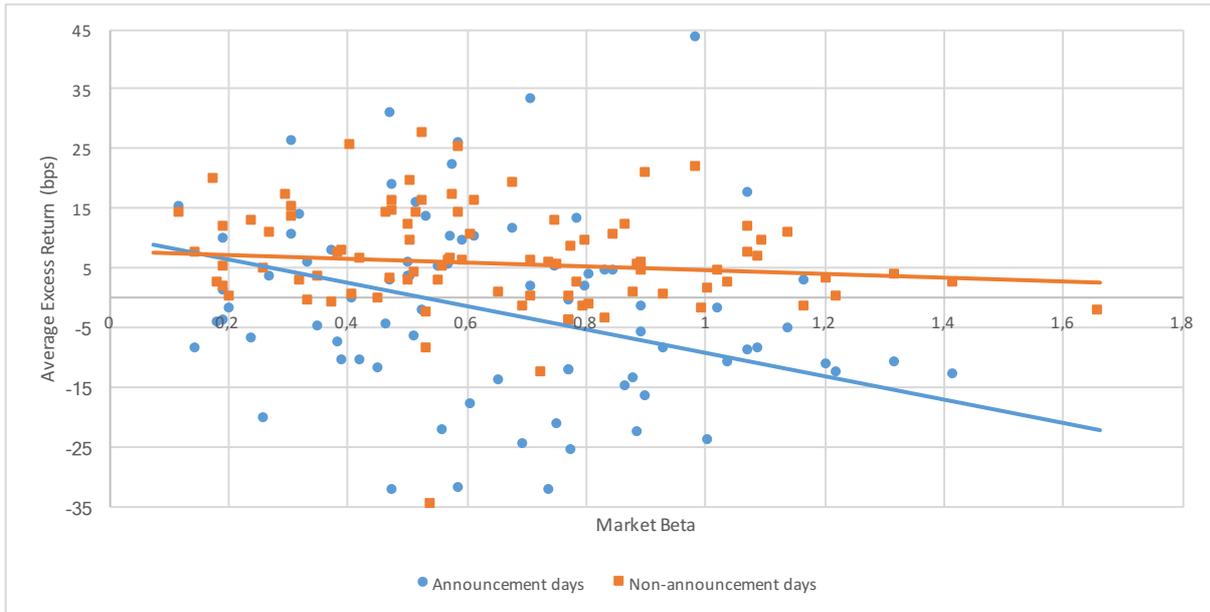
Table 5: Fama-MacBeth regression results using individual stocks

Fama-MacBeth regression				
Type of day	Intercept	Beta	R ²	Observations
A-day	9.1* (1.89)	-20.1* (-2.15)	0.045	464
N-day	8.0*** (4.09)	-3.3 (-0.89)	0.256	3299
A-day - N-day	1.1 (0.20)	-16.8* (-1.67)	-	-

The table reports the results from Fama-MacBeth regressions, using 90 individual stocks. We report the intercept, the average coefficient on beta, the average R² and the number of observations separately for announcement days and non-announcement days. The third row reports the results of a t-test on the difference between average excess return on announcement days and non-announcement days. The t-statistics are reported in parentheses and are calculated using robust standard errors.

On a-days, Table 5 shows a significant relationship between average excess return and market beta for 90 individual stocks. The intercept is 9.1 bps with a t-statistic of 1.89, and the slope coefficient is -20.1 bps with a significant t-statistic of -2.15. On n-days there is no significant risk-return relationship. The intercept is 8.0 bps with a significant t-statistic of 4.09, and the slope coefficient is -3.3 bps with an insignificant t-statistic of -0.89. When we test for difference in means we find a significant difference in slope coefficients between a-days and n-days of -16.8 bps with a t-statistic of 1.67. The average R² on a-days is 4.5% and 25.6% on n-days.

Figure 6: Average daily excess return for 90 individual stocks



The figure plots average excess return against beta for 90 individual stocks, separately for announcement days and non-announcement days. On the x-axis, we report the individual stock's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

In figure 6 we plot average daily excess return for the 90 individual stocks against their respective market betas, separately for a-days and n-days. On the X-axis we report the market beta and on the Y-axis we report the average excess return measured in basis point. The figure shows that market beta relates significantly to average excess return on a-days, while this relationship is insignificant on all other trading days. We report a negative slope coefficient for both a-days and n-days due to the negative market risk premium. These results are consistent with the results from the Fama-MacBeth regression using ten beta-sorted portfolios, on both a-days and n-days.

5.3 Individual Norwegian announcement days

The individual announcements we use in this thesis are changes in the unemployment rate (LFS), Consumer Price Index (CPI), wage index (WI), gross domestic product (GDP), and the key interest rate (KIR). Up to this point, announcement days have included all types of individual announcements. In order to differentiate between these days and examine if some announcement days are more important than others, we analyze the risk-return relationship on each type of announcement day separately. We repeat a Fama-MacBeth regression using the

ten beta-sorted portfolios, separating between the individual announcement days. We also examine days with no announcements.

Table 6: Fama-MacBeth regression results using ten beta-sorted portfolios on individual announcement days

Fama-MacBeth regressions					
Type of day	Equal-weighted		Value-weighted		Number of days
	Intercept	Beta	Intercept	Beta	
No announcements	9.0*** (4.40)	-5.2 (-1.32)	6.1*** (2.84)	-0.6 (-0.16)	3299
LFS	31.1*** (9.01)	-53.9 (-1.52)	24.3* (1.73)	-38.4 (-1.15)	61
CPI	15.7*** (5.00)	-27.0 (-1.33)	9.2 (0.69)	-32.1 (-1.22)	180
WI	1.1 (0.45)	9.2 (0.34)	-3.1 (-0.23)	9.4 (0.35)	61
GDP	-1.9 (-0.51)	-23.0 (-0.75)	-13.8 (-1.00)	5.9 (0.23)	61
KIR	11.0*** (4.18)	-30.1* (-1.65)	11.1 (1.12)	-33.9* (-1.84)	120

The table reports the results from Fama-MacBeth regressions, using ten beta-sorted portfolios. The equal-weighted results are reported on the left hand side and the value-weighted results on the right hand side. We report the intercept and the average coefficient on beta and the number of observations separately for labor force survey announcement days (LFS), consumer price announcement days (CPI), wage index announcement days (WI), gross domestic product announcement days (GDP), key interest announcement days (KIR) and non-announcement days. The t-statistics are reported in parentheses and are calculated using robust standard errors.

Table 6 reports the results from a Fama-MacBeth regression using ten beta-sorted portfolios, separately for each individual announcement day and for days with no announcement. On the left hand side we report the results for the equal-weighted portfolios, and we reports results for the value-weighted portfolios on the right hand side. On days with announcements regarding the key interest rate the slope coefficient is -30.1 bps with a significant t-statistic of -1.65 for the equal-weighted portfolios, and -33.9 bps with a significant t-statistic of -1.84 for the value-weighted portfolios. This shows that on days with key interest rate announcements, beta relates significantly to average excess return. The market beta seems to capture more of the spread in average excess return on days with announcements regarding the unemployment rate and the consumer price index, relative to days with announcements regarding the wage

index and gross domestic product. Even so, the t-statistic is too low to show a significant risk-return relationship on any of these announcement days. The slope coefficient for the LFS announcements is -53.9 bps (t-statistic = -1.52) for the equal-weighted portfolios and -38.4 bps (t-statistic = -1.15) for the value-weighted portfolios. The announcements regarding CPI show a slope coefficient of -27.0 bps (t-statistic = -1.33) for the equal-weighted portfolios and -32.1 bps (t-statistic = -1.22) for the value-weighted portfolios. The slope coefficient for WI announcements is 9.2 bps and 9.4 bps with t-statistics of 0.34 and 0.35 for the equal- and value-weighted portfolios respectively. On days with GDP announcements the equal-weighted slope coefficient is -2.3 bps (t-statistic = -0.75) and the value-weighted slope coefficient is 5.9 bps (t-statistic = 0.23). On days with no announcements the slope coefficient for the equal-weighted portfolios is -5.2 bps with a t-statistic of -1.32. For the value-weighted portfolios the n-day slope coefficient is -0.6 bps with a t-statistic of -0.16, which indicates a lower t-statistic than all other types of announcements viewed individually.

The only significant relationship between market beta and average excess return exists on days with announcements regarding changes in the key interest rate. We have two large recessions in our sample period, which results in periods of increased market risk. Key interest rate is one of the main instruments the government uses to stimulate the economy in the presence of economic crises (Nicolaisen, 2016). In the period from 2001-2003 the key interest rate in Norway dropped from 7% to 2.25%, and during the financial crisis from 2007 to the end of 2009 the interest rate dropped from 5.25% to 1.75% (Norges Bank, 2016). The large drop in the key interest rate in periods with higher market risk can be a part of the reason for the significant risk-return relationship on these types of days.

An important notion is that the number of days for each announcement type is limited. There are only 61 observations of announcements regarding the LFS, WI and GDP, 180 observations for CPI and 120 observations for KIR announcements. The observations of individual announcement days are relatively small compared to the 3299 observations of days with no announcements. The small sample of individual announcement days might be the reason for the majority of insignificant results. If the average daily excess return and volatility on these days stay the same, while the number of observations was higher, the t-statistic would increase.

We compute the average excess return, standard deviation and the Sharpe ratio for ten beta-sorted portfolios, separately for each type of announcement day. The Sharpe ratio shows the increase in excess return per unit of asset risk. It is calculated by dividing the excess return of a portfolio on the portfolio's standard deviation (Sharpe, 1994). Portfolio one (p1) describes the portfolio with the lowest beta (lowest risk) and portfolio ten (p10) describes the portfolio with the highest beta (highest risk). In Panel A of Table 8, we report the results for the equal-weighted portfolios, and in Panel B we report the results for the value-weighted portfolios. Both panel A and B reports higher average excess return for portfolio one than the average excess return for portfolio ten. The standard deviation of the same portfolios increases from the lowest beta portfolio to the highest beta portfolio. This holds on all individual announcement days except for announcements regarding the wage index and gross domestic product, which shows increasing average excess return from portfolio one to portfolio ten.

Table 7: Average excess return, standard deviation and Sharpe ratio on individual announcement days

Panel A: Average excess return, standard deviation and sharpe ratio for portfolio 1 and 10 (EW)						
	No announcements	LFS	CPI	WI	GDP	KIR
řp,1 (%)	0.11	0.23	0.05	0.14	0.30	0.10
řp,10 (%)	-0.01	-0.58	-0.42	0.19	-0.02	-0.25
σ p1 (%)	1.64	1.65	1.67	1.34	3.33	2.03
σ p10 (%)	3.84	5.0	4.4	3.42	3.62	3.04
Sharpe ratio p1	0.067	0.141	0.034	0.104	0.090	0.049
Sharpe ratio p10	-0.003	-0.116	-0.095	0.056	-0.005	-0.082

Panel B: Average excess return, standard deviation and sharpe ratio for portfolio 1 and 10 (VW)						
	No announcements	LFS	CPI	WI	GDP	KIR
řp,1 (%)	0.09	0.24	-0.08	0.11	0.05	0.06
řp,10 (%)	0.04	-0.31	-0.64	0.16	0.33	-0.29
σ p1 (%)	1.82	1.73	2.42	2.13	1.66	1.68
σ p10 (%)	3.74	4.53	6.40	3.42	3.17	2.83
Sharpe ratio p1	0.050	0.139	-0.033	0.052	0.030	0.036
Sharpe ratio p10	0.011	-0.069	-0.100	0.047	0.104	-0.102

This table reports average daily excess return, standard deviation and Sharpe ratio for the lowest beta-portfolio (P1) and the highest beta-portfolio (P10), separately for different announcement days. The Sharpe ratio is determined by the average excess return over standard deviation.

Panel A reports the average excess return, standard deviation and the sharpe ratio for equal-weighted portfolios. On days with key interest rate announcements the equal-weighted average excess return is 0.10% for portfolio one and decreases in accordance to the increasing beta to -0.25% for portfolio ten. Average daily volatility for the same days increase from

2.03% to 3.04% for portfolio one and ten, and the Sharpe ratio is 0.049 for portfolio one and -0.082 for portfolio ten. The result of decreasing returns with increasing risk holds for all equal weighted portfolios on all individual announcement days, except on days with announcements regarding the wage index. The average excess return for the wage index increases from 0.14% to 0.19%, and the standard deviation increases from 1.34% to 3.42% from portfolio one to ten. The Sharpe ratio decreases from 0.052 to 0.047 due to a 155% increase in the standard deviation relative to a 36% increase in average excess returns. From the Fama-MacBeth regressions we show that the slope coefficient is significant on days with key interest rate announcements, while the slope coefficient on days with announcements regarding the wage index show the lowest t-statistic of all individual announcement days.

Panel B reports the average excess return, standard deviation and the Sharpe ratio for value-weighted portfolios. On days with announcements regarding key interest rates, unemployment and the consumer price index, average excess return decreases with increasing risk. For instance, on days with CPI announcements the average excess return decrease from -0.08% to -0.64%, and the standard deviation increase from 2.42% to 6.4%. As a result of this, the Sharpe ratio decrease from -0.033 to -0.100. In contrast to this, on days with wage index and GDP announcements average excess return increase with increasing risk. On days with GDP announcements the average excess return increase from 0.05% in portfolio one to 0.33% in portfolio ten, and the standard deviation increase from 1.66% to 3.17%. The Sharpe ratio increases from 0.030 to 0.104.

By examining the average excess return, volatility and Sharpe ratio for each announcement type separately, the results show that there is an indication of risk being related to average excess return. Given a negative risk premium, our results show that average excess return will decrease in accordance to increasing risk, even though we are not able to prove this with statistical significance for any other days than days with key interest rate announcements.

5.4 US Announcement days

Norway is a small, open economy (Norman & Orvedal, 2010), which means that they take part in international trade, without the possibility to cause large economic impact. The Norwegian economy is much smaller than the economy of many of its trading partners. Larger economies, such as the US, play an important role in the global economy.

Macroeconomic changes in the US may cause repercussions for other smaller economies, such as the Norwegian. Based on this, we test if macroeconomic announcements in the US affect the risk-return relationship in the Norwegian stock market.

We use the same types of US announcements as Norwegian announcements. We perform a Fama-MacBeth regression using the ten beta-sorted portfolios, on days when US macroeconomic news is scheduled to be announced, and for all other trading days. We perform a regression for both equal- and value-weighted portfolios.

Table 8 reports the Fama-MacBeth regression results on the different types of US announcement days separately. We do not find any significant relationship between market beta and average excess return on any of the individual announcement days. This holds for both equal- and value-weighted portfolios. Days with announcements regarding the consumer price index, provides the highest t-statistic for the risk-return relationship, though this is too low to be significant. The slope coefficient is -22.9 bps with a t-statistic of -1.49 for the equal-weighted portfolios and for the value-weighted portfolios the slope coefficient is -20.6 bps with a t-statistic of -1.37. The days with no announcements show a significant result for the equal-weighted portfolios with a slope coefficient of -9.9 and a t-statistic of -2.24. This does not hold for the value-weighted portfolios.

Table 8: Fama-MacBeth regression results using ten beta-sorted portfolios on individual US announcement days

Fama-MacBeth regressions					
Type of day	Equal-weighted		Value-weighted		Number of days
	Intercept	Beta	Intercept	Beta	
No announcements	8.7*** (4.04)	-9.9** (-2.24)	6.2*** (2.79)	-5.4 (-1.25)	2994
LFS	10.2 (0.98)	1.6 (0.90)	-9.3 (-0.76)	18.1 (0.94)	176
CPI	4.7 (0.61)	-22.9 (-1.49)	1.6 (0.23)	-20.6 (-1.37)	179
WI	21.0** (2.13)	-5.2 (-.028)	12.7 (1.30)	2.4 (0.14)	171
GDP	23.7*** (2.99)	8.3 (0.54)	18.3** (2.31)	13.3 (0.95)	176
KIR	2.4 (0.15)	21.8 (0.74)	15.8 (0.73)	-1.2 (-0.03)	98

Table 8 reports the results from Fama-MacBeth regressions, using ten beta-sorted portfolios. The equal-weighted results are reported on the left hand side and the value-weighted results are reported on right hand side. We report the intercept, the average coefficient on beta and the number of observations separately for US labor force survey announcement days (LFS), US consumer price announcement days (CPI), US wage index announcement days (WI), US gross domestic product announcement days (GDP), US key interest announcement days (KIR) and US non-announcement days. t-statistics are reported in parentheses and are calculated using robust standard errors.

Announcements are published more frequently in the US than in Norway, resulting in more observations for each type of announcement. Despite almost doubling the number of observations, there is no significant relationship between the market beta and average excess return on either of the individual type of US announcement days. To capture the aggregated effect of all US announcement days, we repeat the Fama-MacBeth regression using the ten beta-sorted portfolios on all US announcement days together.

Table 9: Fama-MacBeth regression results using ten beta-sorted portfolios on US announcement days

Panel A: Fama-MacBeth regressions						
	Value-weighted			Equal-weighted		
	Intercept	Beta	R ²	Intercept	Beta	R ²
A-day	5.5 (1.11)	4.5 (0.48)	0.240	11.4*** (2.60)	1.3 (0.15)	0.247
N-day	6.2*** (2.79)	-5.4 (-1.25)	0.260	8.7*** (4.04)	-9.9** (-2.24)	0.265
A-Day - N-Day	-0.7 (0.13)	9.9 (-0.97)		2.8 (-0.56)	11.2 (-1.19)	

This table reports the results from Fama-MacBeth regressions, using ten beta-sorted portfolios. We report the intercept, the average coefficient on beta and the average R² separately for US announcement days and US non-announcement days. The third row reports the results of a t-test on the difference between average excess return on announcement days and non-announcement days. The t-statistics are reported in parentheses and are calculated using robust standard errors.

Table 9 reports the result from the Fama-MacBeth regression using ten beta-sorted portfolios, separately for US announcement days and all other trading days. The results for the equal-weighted portfolios are reported on the right hand side. On a-days the intercept is 11.4 bps with a t-statistic of 2.6, and the slope coefficient of 1.3 is insignificant with a t-statistic of 0.15. On n-days the intercept is 8.7 bps with t-statistic of 4.04, and the slope coefficient is -9.9 bps with a significant t-statistic of -2.24. On the left hand side we report the results for the value-weighted portfolios. On a-days the intercept is 5.5 bps with a t-statistic of 1.11, and the slope coefficient is 4.5 bps and insignificant with a t-statistic of 0.48. On n-days the intercept

is 6.2 bps with a significant t-statistic of 2.79, the slope coefficient is -5.4 bps with an insignificant t-statistic of -1.25. The difference in average excess return on a-days and n-days is insignificant for both the equal- and value-weighted portfolios.

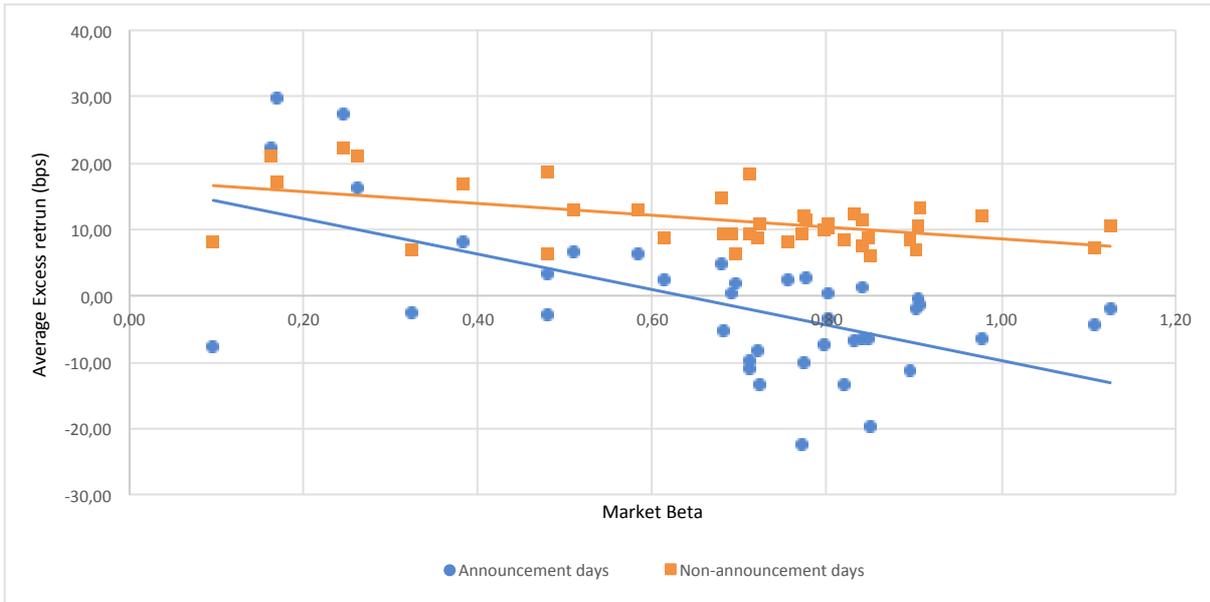
On days with no US announcements we report a significant risk-return relationship for the equal-weighted portfolios. By a closer examination of the Norwegian and US announcement days, we find that 75.4% of all Norwegian announcements occur on days with no announcements in the US. We omit 350 observations of Norwegian a-days from the US n-day sample in order to remove the effect from the Norwegian announcements. We find that there no longer exists a significant risk-return relationship on US n-days. The slope coefficient is -6.88 bps and the t-statistic is -1.46. This implies that the significant relationship between market beta and average excess return on US n-days is influenced by Norwegian announcements.

The market beta captures the spread in average excess returns for the ten beta-sorted portfolios on Norwegian announcement days, but not on days with announcements from the US. With regards to this we argue that the Norwegian stock market reacts more to domestic news than international news. The Norwegian investors might be influenced by home country bias. Home country bias means that investors mainly invest in domestic markets, and can cause investors to be indifferent and/or ignore information about foreign markets, and overvalue information about their home markets (Van Nieuwerburgh & Veldkamp, 2009).

5.5 Portfolios sorted on different characteristics

Empirical evidence show that the market beta is not able to capture all the spread in returns across stocks when controlling for additional risk factors, such as book-to-market, size and momentum (Carhart, 1997; Fama & French, 1993). Previous research also show that CAPM is unable to explain the cross-section of returns on industry portfolios (Lewellen, Nagel, & Shanken, 2010). We merge ten book-to-market-sorted portfolios, ten momentum portfolios, ten size portfolios and ten industry portfolios, and repeat the Fama-MacBeth regression using all these different portfolios together. These portfolios are sorted according to different types of characteristics, and by testing for all of these together we examine the robustness of our main results. We perform a Fama-MacBeth regression using value-weighted portfolios, separately for a-days and n-days.

Figure 7: Average daily excess return for ten book-to-market-, ten size-, ten momentum- and ten industry portfolios



The figure plots average excess return against beta for ten book-to-market-sorted portfolios, ten momentum portfolios, ten size portfolios and ten industry portfolios separately for announcement days and non-announcement days. On the x-axis, we report the portfolio’s full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 7 plots average excess return against market betas for the ten book-to-market-sorted portfolios, ten momentum portfolios, ten size portfolios and the ten industry portfolios separately on a-days and n-days. On the X-axis we report market beta, and on the Y-axis we report the average excess return measured in basis points. The figure shows that for the 40 test assets, market beta relates significantly to average excess return on both a-days and n-days. The slope coefficients are negative on both a-days and n-days due to the negative realized market risk premium in our sample period.

Table 10: Fama-MacBeth regression results using ten book-to-market-, ten size-, ten momentum- and ten industry portfolios

Fama-MacBeth regressions			
	Intercept	Beta	R ²
A-day	17.0*** (4.59)	-26.7*** (-3.39)	0.090
N-day	17.5*** (10.14)	-8.9*** (-2.66)	0.092
A-Day - N-day	-0.5 (-0.13)	-17.8** (-2.08)	

The table reports the results from Fama-MacBeth regressions, using ten beta-sorted portfolios, ten book-to-market portfolios, ten momentum portfolios, ten size portfolios and ten industry portfolios. We report the intercept, the average coefficient on

beta, the average R^2 separately for announcement days and non-announcement days. The third row reports the results of a t-test on the difference between average excess return on announcement days and non-announcement days. The t-statistics are reported in parentheses and are calculated using robust standard errors.

Table 10 reports the Fama-MacBeth regression result using the 40 test assets, separately for a-days and n-days. On n-days the intercept is 17.5 bps with a t-statistic of 10.14, and the slope coefficient is -8.9 bps and with a t-statistic of -2.66. On a-days the intercept is 17.0 bps with a t-statistic of 4.59, and the slope coefficient is -26.7 bps with a significant t-statistic of -3.39. We also show that there is a significant difference of -17.8 bps between average excess returns on a-days and n-days, with a t-statistic of -2.08. The R^2 is 9.0% on a-days and 9.2% on n-days.

The results show that on both a-days and n-days the market beta relates significantly to average excess returns. This implies that when examining the collective effect of all 40 different sorts of portfolios, we are not able to relate the significant relationship between beta and average excess return exclusively to days with macroeconomic announcements. Even though we report a significant relationship on both kinds of days, there is a significant difference between a-days and n-days. This shows that market beta capture more of the spread in returns on a-days than on n-days. On a-days average excess return decreases 17.8 bps more than on n-days. This shows that market beta is able to explain the spread in returns even though the portfolios are sorted by firm characteristics that represent anomalies of the CAPM.

In addition to examining the 40 test assets together, we perform a Fama-MacBeth regression using the portfolios sorted on industry, book-to-market value, size and momentum separately. We test if market beta is able to explain the cross-section in average excess returns, for the different types of portfolios individually.

Table 11: Fama-MacBeth regression results using different types of portfolios

Fama-MacBeth regression VW				
	Industry	Book-to-market	Size	Momentum
A-day	-4.5 (-0.63)	5.0 (0.79)	-51.7*** (-3.73)	-21.2 (-1.15)
N-day	-5.1 (0.73)	1.0 (0.17)	-17.2*** (-3.08)	-5.36 (-0.70)

This table reports the results from Fama-MacBeth regressions, using ten book-to-market portfolios, ten momentum portfolios, ten size portfolios and ten industry portfolios. We report the average coefficient on beta in basis points (bps) for each type of portfolio, separately for announcement days and non-announcement days. The t-statistics are reported in parentheses and are calculated using robust standard errors.

Table 11 reports the Fama-MacBeth regression result using ten industry portfolios, ten book-to-market portfolios, ten size portfolios and ten momentum portfolios, separately for a-days and n-days. The table reports the result for value-weighted portfolios. The results for the equal-weighted portfolios are found in the appendix. We report significant slope coefficients on both a-days and n-days for portfolios sorted on size. On a-days the slope coefficient is -51.7 bps with a t-statistic of -3.73, and on n-days the slope coefficient is -17.2 bps with a t-statistic of -3.08. For the value-weighted portfolios sorted on book-to-market ratio, momentum and industry we report insignificant slope coefficients on both a-days and n-days.

The results on book-to-market portfolios, momentum portfolios and industry portfolios show that there is no significant relationship between market beta and average excess return. This holds on both a-days and n-days. This implies that market beta is unable to explain average excess returns using portfolios sorted by these types of characteristics, which represent anomalies of the CAPM. The results for portfolios sorted by size show that market beta is significantly related to average excess return on both a-days and n-days. Even though size factor considered an anomaly of the CAPM, we provide empirical evidence of market beta being able to capture the spread in average excess return across portfolios sorted on size characteristics. This is consistent with the Fama-MacBeth regression results using all the different kinds of portfolios together.

6. Robustness

6.1 Announcement day versus non-announcement day betas

We use full-sample betas in all the Fama-Macbeth regressions and single pooled regressions. We calculate full-sample betas by regressing daily excess return of the different portfolios on the market for the whole sample period, without distinguishing between betas being different on a-days and n-days. This can be a potential source of error and lead to biased results. To examine this, we compute betas for each type of day for the ten beta-sorted portfolios, and test if there is a significant difference in betas on a-days and n-days.

Table 12 presents the difference between estimated a-day betas and n-day betas for each beta-sorted portfolio, and their corresponding p-value. We find that there is little difference between a-day betas and n-day betas, except for two of the portfolios, P5 and P9. The differences are -0.354 and 0.117, but not significant (p-value > 0.100). The small differences in a-day and n-day betas indicate that using full sample betas will not bias our results.

Table 12: Difference between a-day beta and n-day beta

	Low	2	3	4	5
β_{non}	0.083	0.208	0.333	0.465	0.609
$\beta_{\text{ann}} - \beta_{\text{non}}$	-0.006 (1.000)	0.015 (0.823)	0.064 (0.332)	0.042 (0.458)	-0.354 (0.115)
	6	7	8	9	High
β_{non}	0.642	0.811	0.933	1.111	1.504
$\beta_{\text{ann}} - \beta_{\text{non}}$	0.001 (1.000)	0.011 (0.886)	-0.016 (0.842)	0.117 (0.186)	-0.047 (0.729)

The table reports the difference in estimated market betas on a-days and n-days for the ten beta-sorted portfolios. P-values for the difference are computed using robust standard errors and are reported in parentheses. P-value > 0.100 is significant at 10% level.

We repeat the Fama-MacBeth two-stage regression using ten beta-sorted portfolios, separately on a-days and n-days. We use separate betas for a-days and n-days to show that our results are not biased by the full-sample betas. This results in a significant relationship between market beta and average excess return on a-days and an insignificant relationship on n-days, similar to our main results. We see that by using a-day betas the slope coefficient is -

20.07 bps with a t-statistic of -4.61 on days with announcements. For days without announcements the slope coefficient is -0.7 bps and insignificant with a t-statistic of -0.19. When using n-day betas the slope coefficient is still significant on a-days with a slope coefficient of -23.3 bps and a t-statistic of -1.82, and on n-days the slope coefficient is -0.6 bps with an insignificant t-statistic of -0.15.

Table 13: Fama-MacBeth regression results using a-day beta and n-day beta separately

Fama-MacBeth regressions						
	A-day beta			N-day beta		
	Intercept	Beta	R ²	Intercept	Beta	R ²
A-day	4.0* (1.83)	-20.7*** (-4.61)	0.255	6.1 (0.94)	-23.3* (-1.82)	0.259
N-day	2.1*** (3.10)	-0.7 (-0.19)	0.244	6.1*** (2.82)	-0.6 (-0.15)	0.255

This table reports the result from the Fama-MacBeth regressions, using daily excess return on ten beta-sorted portfolios, separately for a-days and n-days. These estimates are computed using a-day beta and n-day beta separately. The slope coefficient describes the relationship between average excess return and market beta. T-statistics is reported in brackets and calculated using robust standard errors.

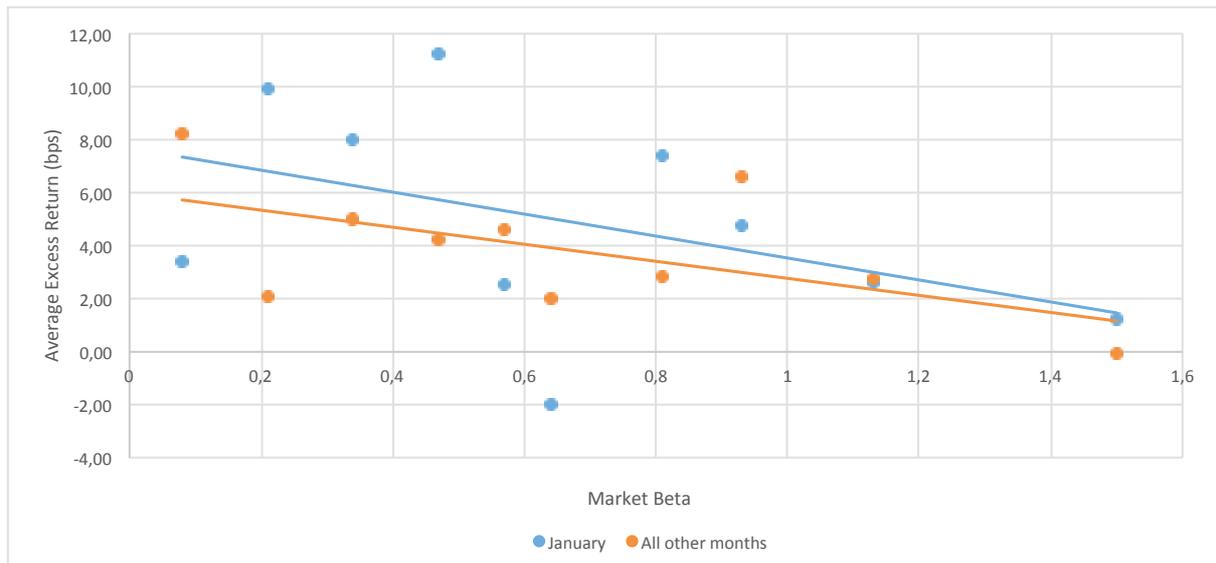
Using a-day and n-day betas separately, we find the same relationship between market beta and average excess return on a-days and n-days, as when using full-sample betas. On this basis we argue that using full-sample betas does not bias our findings.

6.2 The January effect and the turn of the month effect

We examine if our main results are affected by periods when stock returns are expected to be higher. Rozeff and Kinney (1976) find that in the month of January there is on average higher stock returns than in all other months. Another period with generally expected higher stock returns was documented by Ariel (1987) and Lakonishok and Smidt (1988). They provide empirical evidence of average stock returns being higher during the turn of the month. The turn of the month period is the last trading day of a month, and the four consecutive trading days. The January effect and the turn of the month effect are anomalies of the efficient market hypothesis, and if such periods exist in our sample this could lead to biased results. We have a negative realized market risk premium in our sample period, resulting in decreasing average excess return with increasing beta. The effect of these anomalies would indicate that the negative implied market risk premium in our main results would actually be even lower than

reported. We test if there is a difference between average excess returns in January relative to all other months, and in the turn of the month relative to all other days.

Figure 8: Average daily excess return in January and all other months



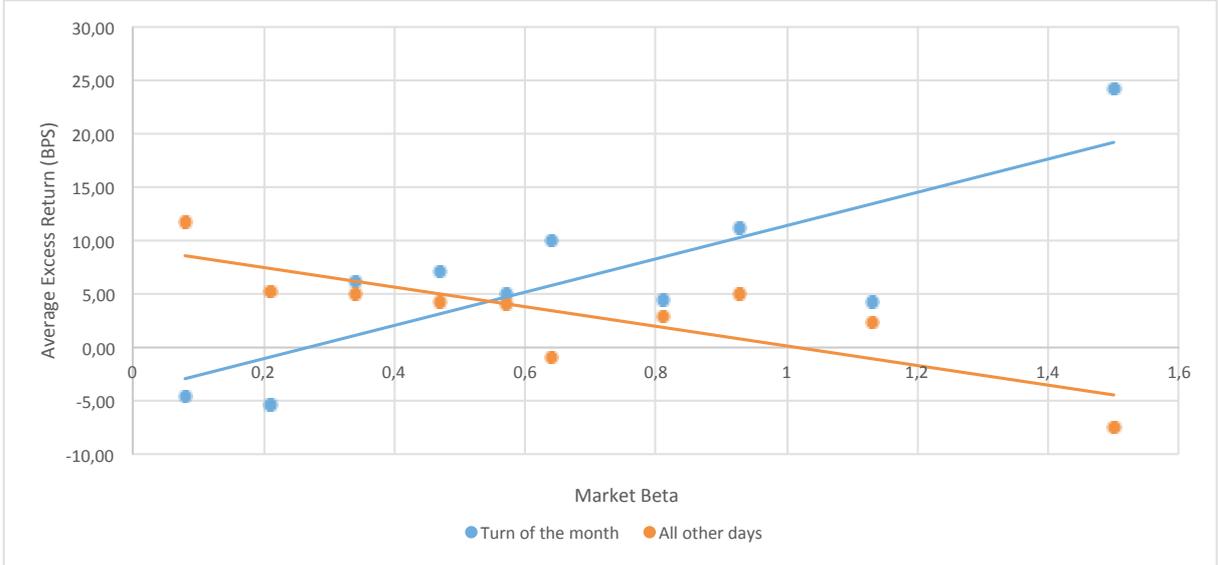
The figure plots average excess return against beta for ten beta-sorted portfolios, separately for January and all other months. On the x-axis, we report the market beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 8 shows the relationship between market beta and average excess return using ten beta-sorted portfolios, separately for January and all other months. On the X-axis we report the market beta and on the Y-axis we report average excess return. The implied market risk premium is negative in both periods. We show that for the ten beta-sorted portfolios market betas are related to average excess return in January, though not significantly related. In January the slope coefficient is - 3.1 bps with an insignificant t-statistic of -0.28. There is no significant difference between average excess return in January and average excess return in all other months. We therefore reject the “January effect” as a potential bias in our main results.

Figure 9 shows the relationship between market beta and average excess return using ten beta-sorted portfolios, separately for days in the turn of the month and all other days. On the X-axis we report the market betas and on the Y-axis we report average excess return. We show that market beta is positively related to average excess return in the turn of the month, though not with significance. The slope coefficient is 11.2 bps with an insignificant t-statistic of 1.50. We perform a t-test of the difference between average excess return on days in the turn of the

month an all other days and find that there is no significant difference in average excess return in these periods.

Figure 9: Average daily excess return in the turn of the month and all other days



The figure plots average excess return against beta for ten beta-sorted portfolios, separately for the turn of the month and all other days. On the x-axis, we report the market beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

The positive implied market risk premium in the turn of the month shows that excess return increase with beta. This indicates that there might be a turn of the month effect in our data. But since this is not significant and there is no significant difference in average excess returns between the periods, we argue that our main results are not biased by the “turn of the month effect”.

8. Conclusion

We provide empirical support of market beta being able to capture the spread in average excess return in the Norwegian stock market on days when important macroeconomic news is scheduled to be announced. By contrast, we find that this does not hold on days with no announcements. The announcements we use are days with changes in key interest rate, unemployment rate, gross domestic product, the consumer price index and the wage index. We perform a Fama-MacBeth two-stage regression using ten beta-sorted portfolios as test assets, separately on announcement days and non-announcement days. We report a significant relationship between market beta and average excess return on announcement days, and an insignificant relationship on all other trading days. This holds for both equal- and value-weighted beta-sorted portfolios, and when using 90 individual stocks as test assets.

There is on average a negative realized market risk premium in our sample period (2001-2015), resulting in decreasing return with increasing beta. The inverse proportional relationship between market beta and average excess return results in a negative implied market risk premium. Even though we report a negative implied market risk premium, our main results on announcement days show that market beta actually is an important determinant of average excess return, as explained by the CAPM.

We show that it is the combined effect of all announcement days together that provide a significant relationship between the market beta and average excess return. The market beta is not able to capture the spread in average excess return when we analyze the risk-return relationship on the different types of announcement days separately. One possible explanation for the insignificant results is the low number of observations for each type of announcement. We also show that the risk-return relationship in the Norwegian stock market is only significant on days with domestic macroeconomic news, relative to days with international news from the US. Furthermore, we find that market beta is not able to capture the spread in returns for portfolios sorted on anomalies of the CAPM. This holds for momentum- and book-to-market-sorted portfolios and industry portfolios. We find a significant risk-return relationship on both types of days, using portfolios sorted on size and when we analyze all the different types of portfolios together. This relationship is more prominent on announcement days than on non-announcement days.

In further research the sample period should be extended, considering the negative realized market risk premium from 2001-2015. It is fair to assume that the two recessions the global economy encountered during the “dot com” bubble and the financial crisis has affected our results, as one would usually expect a positive market risk premium. By increasing the time horizon, the impact of the economic recessions will level out, and the realized market risk premium will most likely be positive.

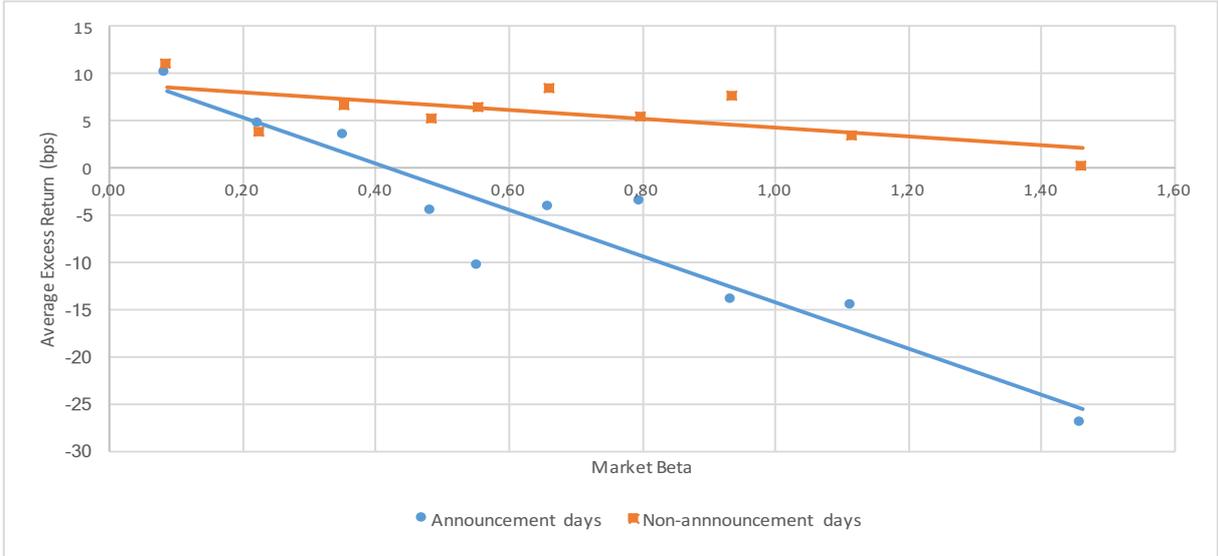
9. Appendix

In this appendix, we provide additional figures, and tables from the Fama-MacBeth regression results.

A.1 Figures of daily excess return for ten beta-sorted portfolios

Figure 10 shows the relationship between market beta and average excess return for ten equal-weighted beta-sorted portfolios, separately for a-days and n-days. On the X-axis we report the market beta, and on the Y-axis we report the average excess return measured in basis points. We show a linear relationship between market beta and average excess return, but given the negative realized market risk premium in our sample period, the slope of the security market line is negative.

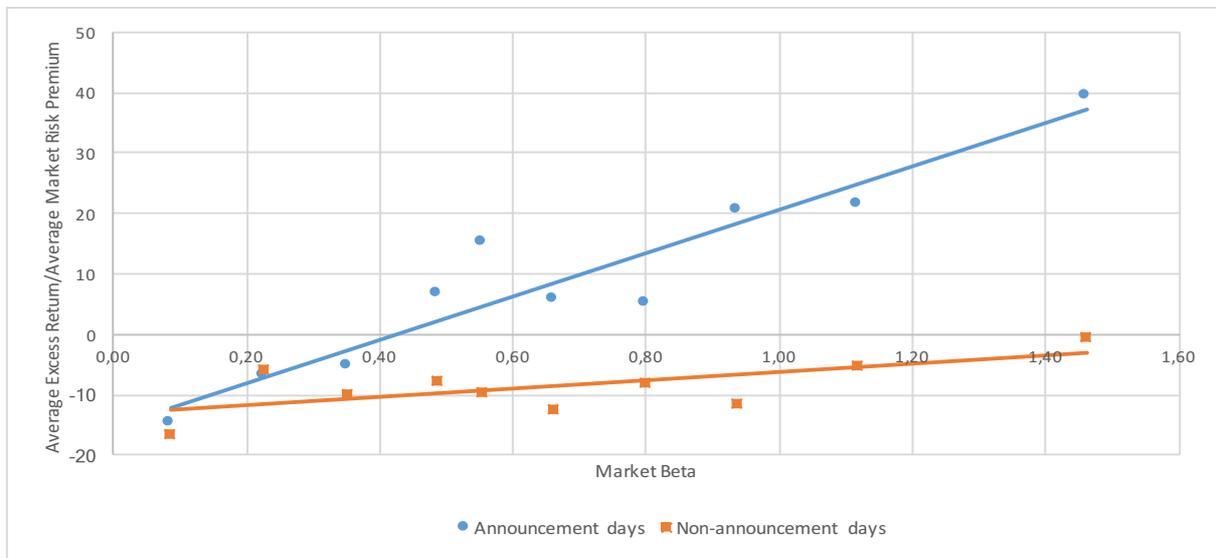
Figure 10: Average daily excess return for ten beta-sorted portfolios



The figure plots average excess return against beta for ten equal-weighted beta-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio’s full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 11 shows the relationship between market beta and the ratio of average excess return over average realized market risk premium, using ten equal-weighted beta-sorted portfolios, separately for a-days and n-days. On the X-axis we report the market beta, and on the Y-axis we report the ratio of average excess return of the ten beta-sorted portfolios over the average market risk premium.

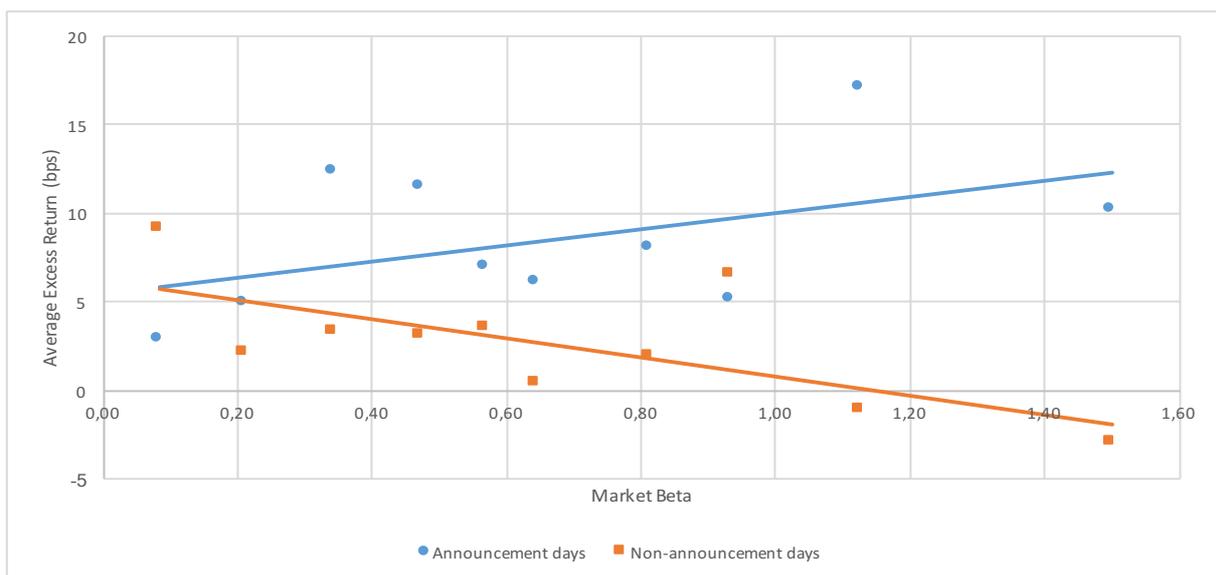
Figure 11: Ratio between average excess return and market risk premium (EW)



The figure plots the ratio between average excess return and average realized market risk premium against beta for ten equal-weighted beta-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the ratio of average excess return over average market risk premium. The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period. .

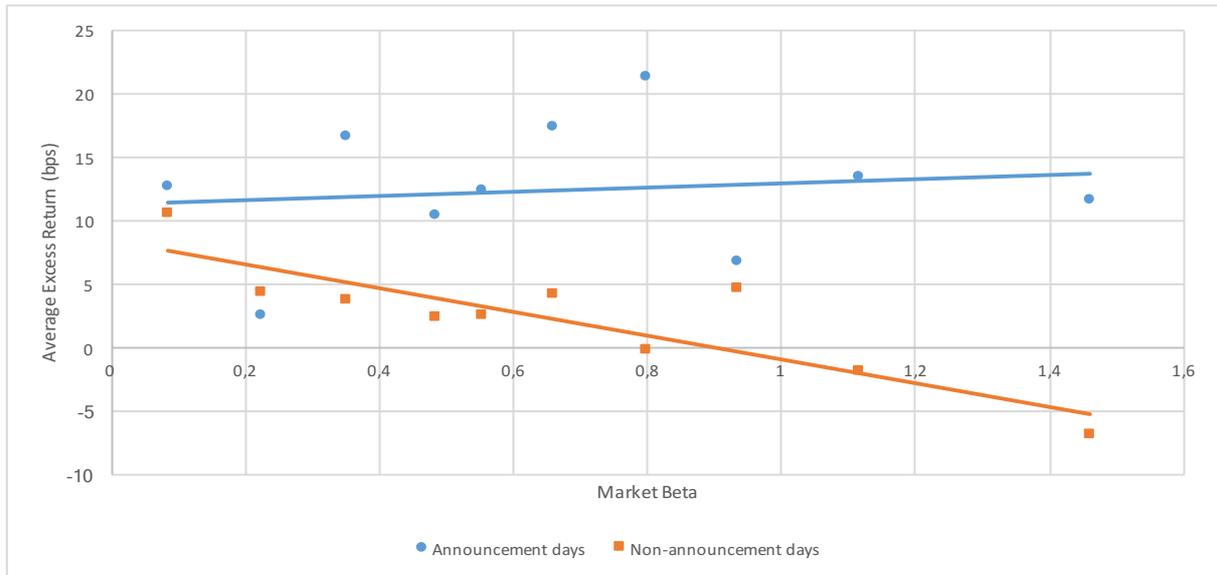
Figure 12 and 13 show the relationship between market beta and average excess return for ten value-weighted and ten equal-weighted beta-sorted portfolios, separately for U.S. a-days and n-days. On the X-axis we report the market beta, and on the Y-axis we report the average excess return measured in basis points.

Figure 12: Average daily excess return for ten beta-sorted portfolios (U.S. announcement days, VW)



The figure plots average excess return against beta for ten value-weighted beta-sorted portfolios, separately for U.S. announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 13: Average daily excess return for ten beta-sorted portfolios (U.S. announcement days, EW)

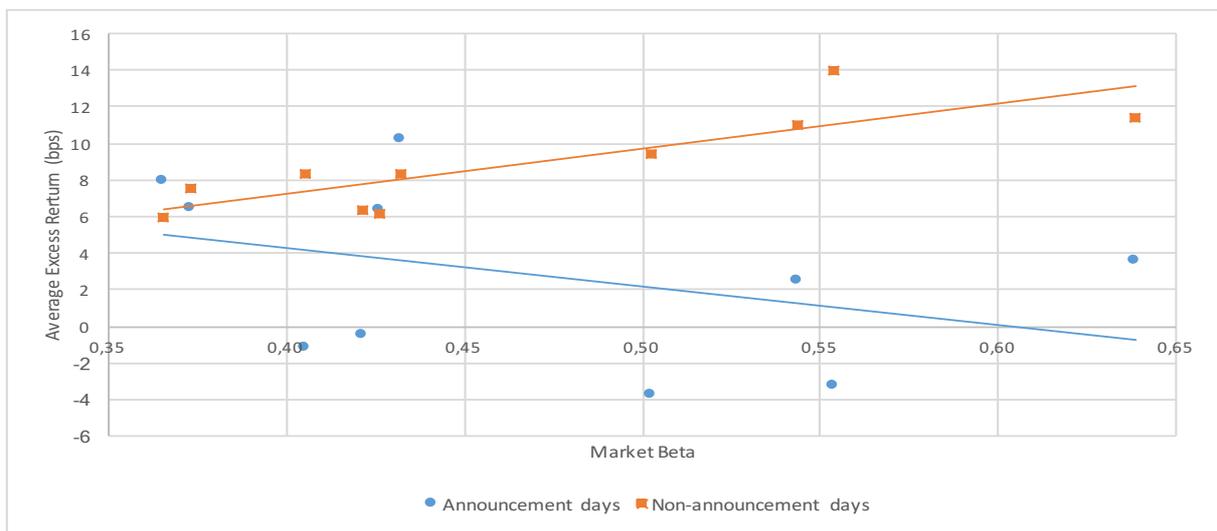


The figure plots average excess return against beta for ten value-weighted beta-sorted portfolios, separately for U.S. announcement days and non-announcement days. On the x-axis, we report the portfolio’s full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

A.2 Figures of daily excess return for different types of portfolios

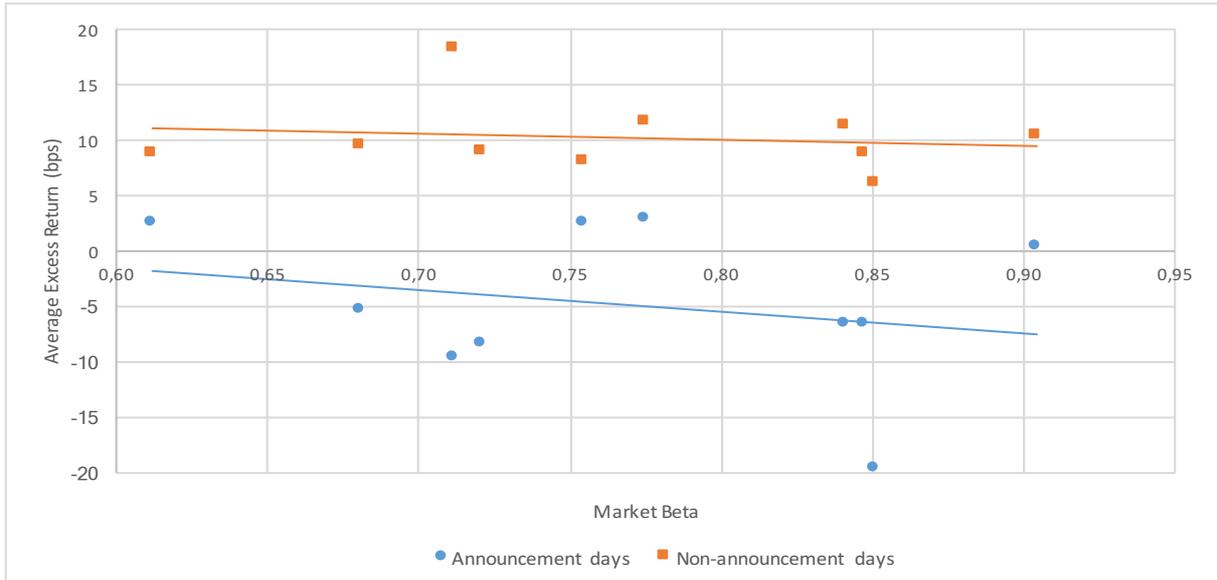
The figures in this section show the relationship between market beta and average excess return for ten momentum portfolios, ten size portfolios, ten book-to-market portfolios and ten industry portfolios, separately for a-days and n-days. On the X-axis we report the market beta, and on the Y-axis we report the average excess return measured in basis points.

Figure 14: Average daily excess return for ten equal-weighted momentum-sorted portfolios



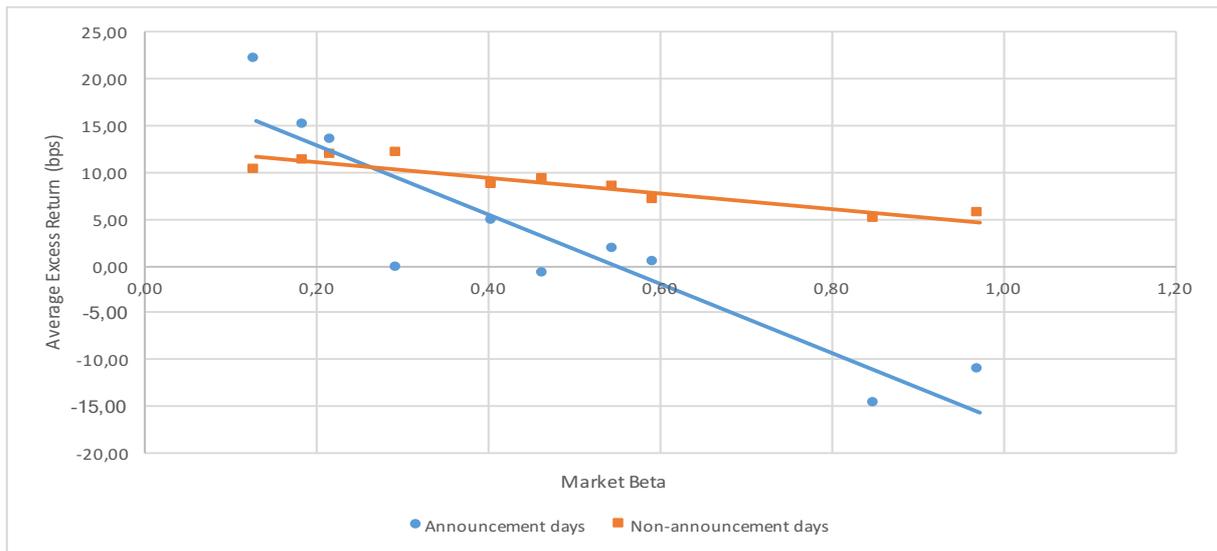
The figure plots average excess return against beta for ten equal-weighted momentum-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio’s full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 15: Average daily excess return for ten value-weighted momentum-sorted portfolios



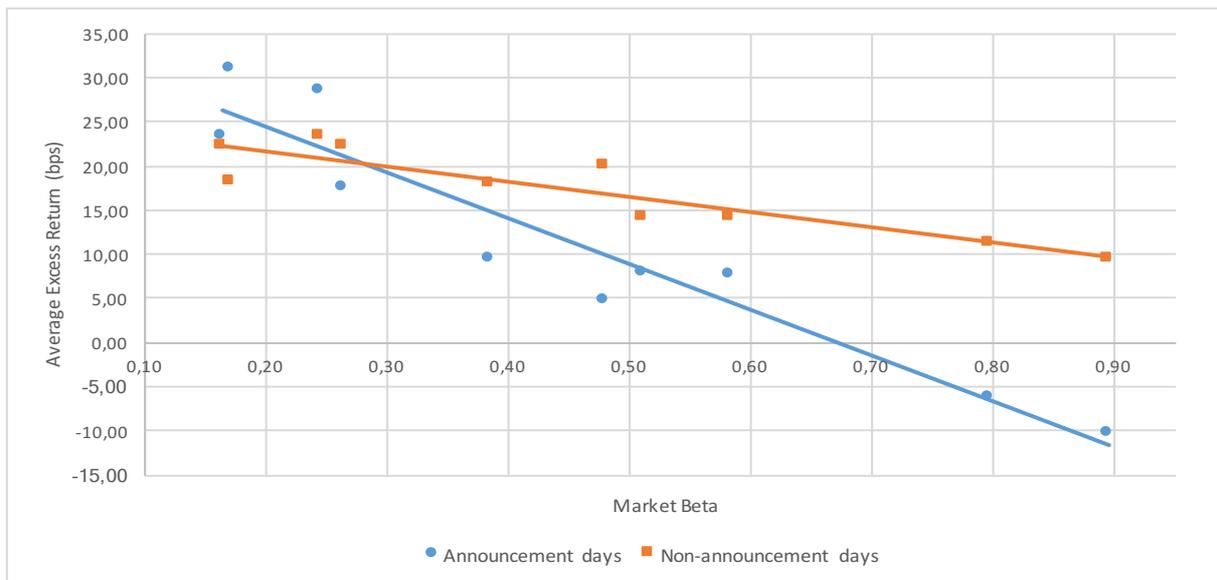
The figure plots average excess return against beta for ten value-weighted momentum-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 16: Average daily excess return for ten equal-weighted size portfolios



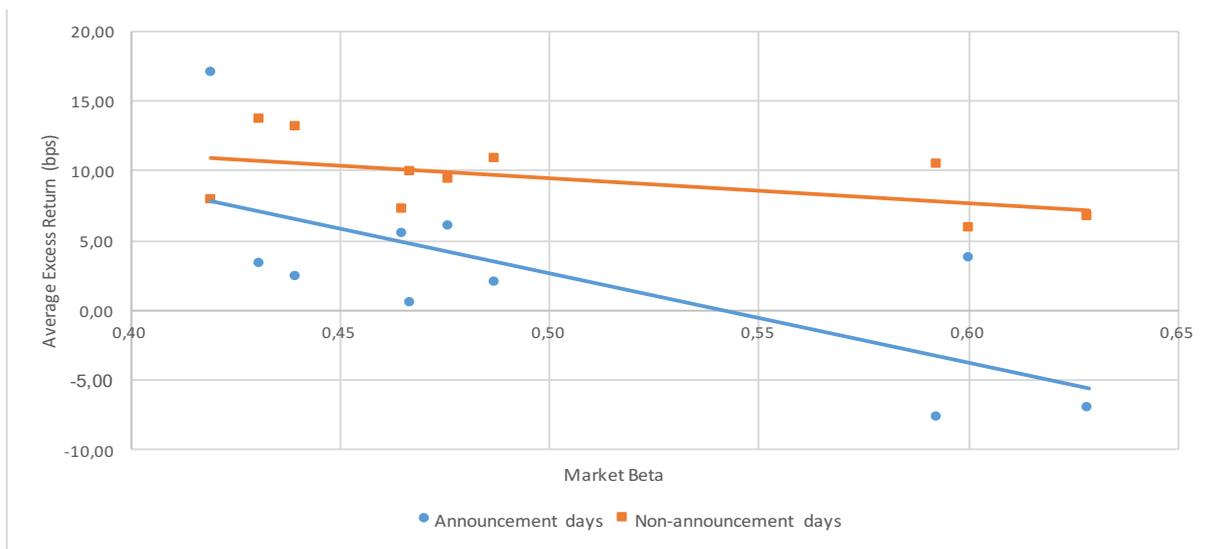
The figure plots average excess return against beta for ten equal-weighted size portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 17: Average daily excess return for ten value-weighted size portfolios



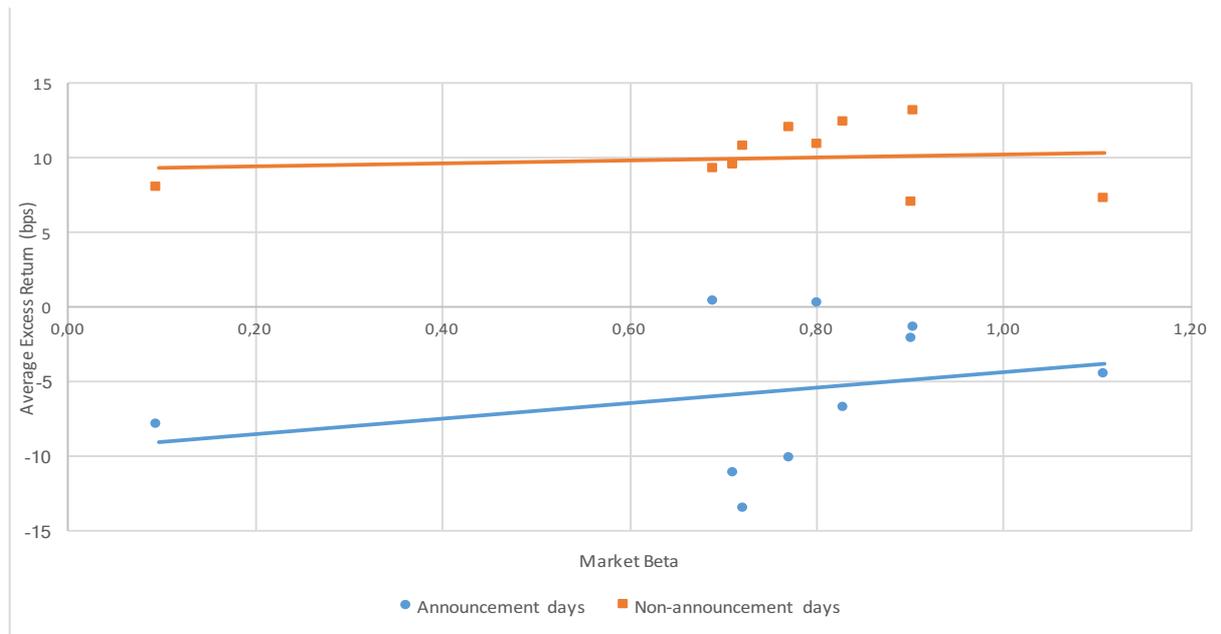
The figure plots average excess return against beta for ten value-weighted size portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 18: Average daily excess return for ten equal-weighted book-to-market-sorted portfolios



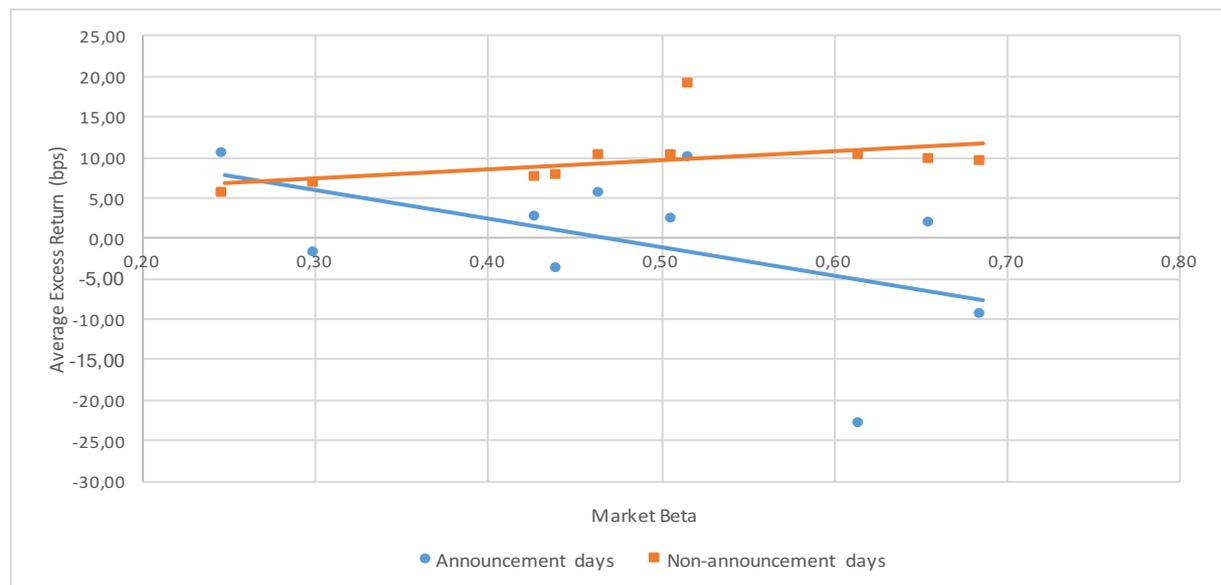
The figure plots average excess return against beta for ten equal-weighted book-to-market-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 20: Average daily excess return for ten value-weighted book-to-market-sorted portfolios



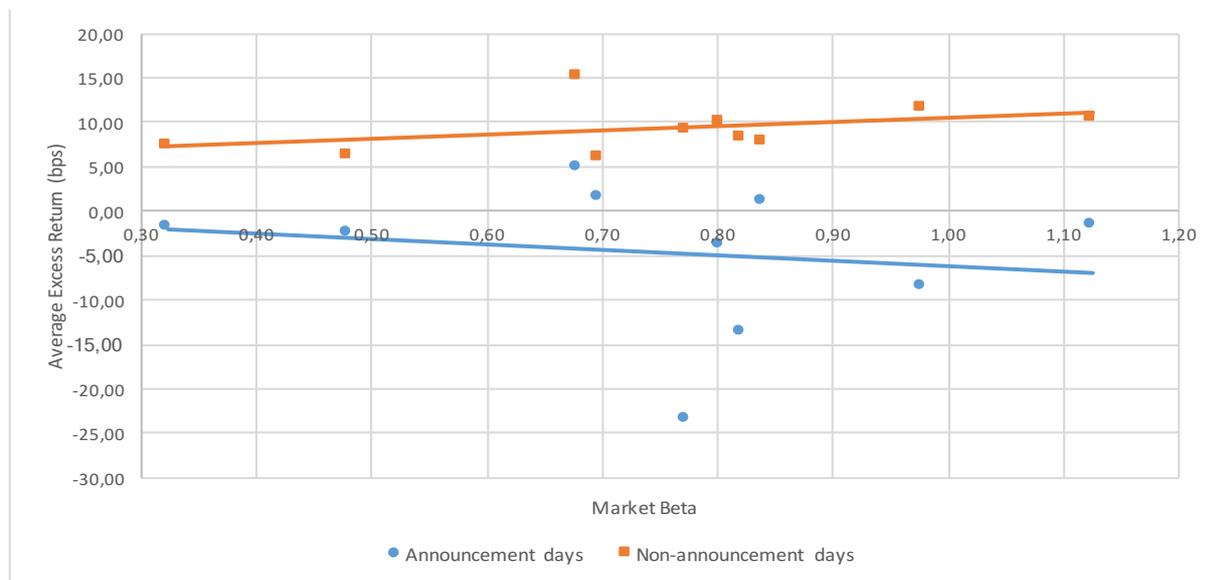
The figure plots average excess return against beta for ten value-weighted book-to-market-sorted portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 19: Average daily excess return for ten equal-weighted industry portfolios



The figure plots average excess return against beta for ten equal-weighted industry portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio's full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

Figure 21: Average daily excess return for ten value-weighted industry portfolios



The figure plots average excess return against beta for ten value-weighted industry portfolios, separately for announcement days and non-announcement days. On the x-axis, we report the portfolio’s full-sample beta. On the Y-axis, we report the average excess return in basis points (bps). The figure includes trend-lines assuming a linear model. The sample covers the 2001-2015 period.

A.3 Fama-MacBeth regression results for different types of portfolios (EW)

Table 11 reports the Fama-MacBeth regression result for ten industry portfolios, ten book-to-market portfolios, ten size portfolios and ten momentum portfolios, separately for a-days and n-days. The table reports the result for equal-weighted portfolios.

Table 14: Fama-MacBeth regression results for ten industry, book-to-market, size and momentum portfolios (EW)

Fama-MacBeth regression EW				
	Industry	Book-to-market	Size	Momentum
A-day	-32.8 (-1.41)	-62.6* (-1.74)	-36.8*** (-2.85)	-21.2 (-1.13)
N-day	10.5 (1.26)	-18.2 (-1.26)	-8.2 (-1.61)	24.4*** (3.12)

This table reports the results from Fama-MacBeth regressions, using ten book-to-market portfolios, ten momentum portfolios, ten size portfolios and ten industry portfolios. All portfolios are equal-weighted. We report the average coefficient on beta in basis points (bps) for each type of portfolio, separately for announcement days and non-announcement days. The t-statistics are reported in parentheses and are calculated using robust standard errors.

The size and book-to-market portfolios show a negative and significant slope coefficient on a-days and an insignificant slope coefficient on n-days. The size portfolios have a slope

coefficient of -36.8 bps with a t-statistic of -2.85 on a-days. On n-days the slope coefficient is -8.2 bps and insignificant with a t-statistic of 1.61. The book-to-market portfolios have a slope coefficient of -62.6 bps with a t-statistic of -1.74 on a-days. The same portfolios have an insignificant slope coefficient of 18.2 and a t-statistic of 1.26 on n-days. These results are consistent with the results from the Fama-MacBeth regressions using beta-sorted portfolios and individual stocks. The momentum portfolios show an insignificant slope coefficient of -21.2 bps (t-statistic = -1.13) on a-days, and a significant slope coefficient of 24.4 bps (t-statistic = 3.12) on n-days. The slope coefficient for portfolios sorted by industry is insignificant on both a-days and n-days.

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