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The impact of monetary policy announcements on stock prices

A panel data study on large Swedish firms

Author:

Rasmus Håkansson

Supervisor:

Martin Strieborny

Abstract

This thesis aims to investigate the impact of domestic- and foreign monetary policy on stock returns of Swedish firms, currently listed at the Nasdaq Large Cap. Daily stock returns are regressed against FOMC- and Riksbank policy changes respectively on the day of their announcements, using a fixed effects model. Control variables and time dummies are included in the model to account for changing characteristics over time. In order to examine the industry-specific asymmetries of monetary policy, 12 repeated fixed effects regressions are carried out for 6 different industries with foreign- and domestic rate changes as the dependent variable. The methodology and general approach is well grounded in previous research on the topic and is the first one of its kind analyzing Swedish monetary policy.

The results seem to support the hypothesis of a negative relationship between domestic monetary policy tightening and stock prices where the coefficient for rate changes was highly significant. The coefficients in the fixed effects regression using foreign rate changes was statistically insignificant although that is not considered firm evidence for a non-existent relationship. The results from the repeated regressions are quite inconclusive, probably due to methodological reasons. This thesis builds on the existing event study research examining the effect of monetary policy on stock returns.

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1 Introduction

This paper aims to investigate the impact of monetary policy changes on stock prices. A number of studies focuses on US monetary policy and stock prices but the research is lacking in some countries, such as in Sweden, and I therefore found it interesting to investigate how foreign and domestic monetary policy affects Swedish stock prices. The interest stems from the fact that changes in the short term interest rate affect asset markets through a number of transmission channels. The reaction of the stock market as a whole has been shown to be determined by a magnitude of factors such as: current business cycle conditions (Basitha – Kurov, 2008), the autonomy of monetary policy (Ammer et. al, 2010), as well as the development of financial markets (Wongswann, 2005). The strong response from the stock market has previously been attributed to the effect monetary policy has on the real rate of interest. However, Bernanke and Kuttner (2005) provided evidence that only a small fraction of the response can be attributed by this factor alone. A larger portion of the effect can rather be explained by market expectations of future earnings and dividends.

This paper analyzes stock prices from firms currently listed at Nasdaq Stockholm's large cap, with rate changes from the Riksbank and the FED as the main explanatory variables. As a starting point, a fixed effects regression including the whole sample size is carried out in order to assess the average stock response. This is accomplished through two different regressions, the first one with Swedish stock prices as the dependent variable and Swedish rate changes as the main independent variable and the second one with Swedish stock prices as the dependent variable and the US rate changes as the main independent variable. Proxy variables for firm size and external finance dependence are included in the model coupled with a time trend to account for changes in the response of monetary policy over time.

My main hypothesis is that a raise of the domestic interest rate should result in a decline of stock prices through down revised expectations of future earnings and dividends. A raise of the US interest rate should also result in a decline of stock price through the same mechanisms. The state of the US stock market is important for the overall economic outlook and decisions from the FED might serve as an indication of where the global economy is

headed. Periods of successive cuts of the interest rate might be interpreted as economic expansion up ahead and vice versa. Previous research by Wongswann (2005) and Ammer et.al (2010) has shown that foreign equity indices and stocks are roughly as sensitive to US monetary policy surprises as US indices and stocks.

As a second step firms are divided into separate groups based off of their two-digit ICB-codes and repeated regression are performed for each group using a fixed effects regression. ICB stands for Industry Classification Benchmark and is commonly used by stock exchanges, such as Nasdaq Stockholm, to segregate markets within the economy. These repeated regressions are first performed with the Swedish stock prices as the dependent variable and the Swedish rate changes as the independent variable and later with the US rate changes as the explanatory variable and Swedish stock prices as the dependent variable. Given previous research on the industry-specific response I would expect a greater sensitivity to monetary policy from firms operating in cyclical, more capital intensive industries. Control variables for firm size, finance dependence and time fixed effects are excluded from these repeated regressions to account for the loss of degrees of freedom that follow the lower sample size.
A total of 51 firms are included in the sample and daily stock returns are analyzed from 2006-2015 on the day of the policy announcement.

This thesis builds on the existing event study literature examining the impact of monetary policy on stock daily stock returns and is, as far as I know the first one of its kind in Sweden, at least when it comes to model specification and methodology.

2 Theoretical background

2.1 The efficient market hypothesis

The efficient market hypothesis is very important when measuring the impact of monetary policy on stock prices since assumptions about market adjustment has implications for study design and the interpretation of the results. The efficient market hypothesis states that a market is considered effective when the stock price fully reflects all available information. News that is reaching the market will immediately cause a shift in the stock price so that the new information can be incorporated in the price. The interpretation of the term "all available information" has resulted in three different forms or stages of the EMH: Weak efficiency, semi-strong efficiency and strong efficiency, presented below. (Bodie et.al, 2011)

Weak – and strong efficiency are both problematic to assume when it comes to the response of stock prices on monetary policy changes. Weak efficiency would imply a slow adjustment period where excess returns can be accumulated long after news of the policy change reached the market. Strong efficiency would imply that all monetary policy changes are anticipated and thus already incorporated in the stock price. Therefore, related literature on the topic usually adopt a semi-strong perspective where the market reacts to policy surprises in a relatively short period of time. Some studies rely upon high-frequency data where the response is determined only after a few hours of the announcements, such as in a study by Ammer et.al (2010), whilst several others look at daily frequency data: Bernanke and Kuttner (2003), Ehrmann and Fratscher (2004). This study relies on semi-strong efficiency as well and the market is assumed to adjust within one day, hence daily stock returns are examined.

2.2 Implications of unconventional monetary policy

In the wake of the financial crisis a number of European countries started pursuing an extremely expansionary monetary policy as a short term solution to the global recession. Although these methods were considered a temporary fix the monetary expansion has continued until this day. Most of continental Europe including Sweden, Denmark, Norway and the euro zone have now followed the US example and introduced quantitative easing programs, which basically means that the central bank purchases large quantities of government bonds in order to increase the money supply. (Hannoun 2015)

The European Monetary Union has in recent years been very aggressive with their stimulus packages and economies outside of the euro zone, such as Sweden, have been negatively affected through exchange rate appreciations. Although the Riksbank has made successive cuts in the prime rate along with quantitative easing programs the krona has continued to depreciate and the Riksbank decided on an expansion of its bond-purchase plan in late 2015 for a fourth time. (Billner, Magnusson, 2015) According to Riksbanken (2013), quantitative easing has resulted in lower interest rates for corporations, households and banks. This is important when examining the relationship between monetary policy and stock prices since quantitative easing programs affects the interest rates. The announcement for the Swedish QE programs are usually presented in conjunction with prime rate changes and the market simultaneously adjusts to two policy changes simultaneously on those days.

3 Literature review

This next chapter focuses on existing literature related to some of the underlying assumptions, the variables of interest as well as a more detailed description of the interaction between monetary policy and stock prices and the evidence of it. A crucial distinction in the literature is presented in section 3.1, namely the difference between anticipated and unanticipated policy changes. In section 3.2 the author examines the benefits and drawbacks from using an event study approach in this specific context. In section 3.3, the different potential transmission channels of foreign and domestic monetary policy are presented and previous literature of them is discussed. Section 3.4 studies the research revolving the industry-specific response of stock prices.

3.1 Anticipated and unanticipated changes in policy rates

According to EMH all publicly available information is already incorporated in the share price of a stock. Assuming semi-strong efficiency, the market should adjust the stock price instantaneously when new information emerges and disregard news that is highly anticipated. An important distinction in the literature is therefore that of anticipated and unanticipated policy changes. Bernanke and Kuttner (2005) developed a measure for monetary policy surprises derived from changes in the rate of FED target rate futures. With this new measure they found that an unanticipated cut of 25 basis-points of the FED's target rate is associated with a 1 % increase in broad stock prices.

Using a different method, accounting for endogeneity and omitted variable bias, analyzing intra-day data, Farka (2009) finds that an unanticipated 1 % increase of the FED's target rate results in a decline of 5,6 % in the stock market.

A problem with this approach is that there are difficulties determining to what degree a policy change was anticipated or not. Some research therefore makes the assumption that all policy changes are unanticipated. This is the assumption made in a study conducted by Stevenson (2002) on the German stock market, analyzing bank stocks. Due to technical difficulties this thesis will not distinguish unanticipated and anticipated rate changes.

3.2 International transmission of monetary policy

Since this thesis also studies the effect of foreign rate changes on domestic stock prices it is important to examine and understand the international transmission of monetary policy. In the literature, foreign monetary policy is generally referred to as US FOMC announcements and most of the studies conducted in this field are based on this assumption. US monetary policy decisions affects foreign stock prices through various transmission channels and apart from the importance of exchange rate regimes Wongswan (2005) concluded that financial development is a vital determinant in the response of foreign equity indexes. Although Sweden has its own currency the financial system is well developed which would indicate a greater sensitivity to US monetary policy. Sweden placed 10th in the overall Financial Development Index 2012 and 1st at the index for financial access the same year (World economic forum, 2012).

Ammer et.al (2010) also found, using intra-day analysis, that foreign stocks reacted roughly as much to unanticipated FOMC announcements as did US stocks. One explanation of this surprising result was that the foreign stocks on average operated in more cyclical industries, making them more sensitive to policy shocks. 19 Swedish firms were included in the study, although it is impossible to determine if these contributed significantly to the results, since the data set contained a total of 1388 firms.

3.3 The credit channel

Another variable that might affect the response from stock prices on monetary policy is the size of the firm. Prime rate changes by the central bank should in theory affect firms credit conditions through a number of mechanisms. As the interest rate goes up it becomes increasingly difficult for firms to gather funds and monetary policy shocks should therefore have a larger impact on firms heavily dependent on external finance. It is assumed that small firms have a harder time gathering funds and smaller firms should therefore be more sensitive to rate changes. This is also supported in previous research by Bernanke and Blinder (1992) has shown that financially constrained firms are more likely to be cut off as credit conditions worsen in the economy. The sample of this thesis consists of the 51 largest public firms which should be less sensitive to monetary policy compared to smaller firms. However, this theory lies beyond the scope of this thesis and is not tried out in practice. Although the sample is relatively heterogeneous the size of the firms varies and a measure for firm size is included as a control variable. The equity ratio is another proxy used in this thesis to control for financial constraints and it is measured as shareholder's equity divided by total assets.

Numerous measures for financial constraints have been used in the literature, firm size being one of the more prominent, although size still is considered a flawed proxy in this regard. (Source) In this paper, total assets are used as a measure for firm size to control for external finance dependence. Lamont, Polk and Saa-Requejo (2001) made an attempt to find a better proxy and developed a measure based on capital and book ratios, derived from information in annual reports. When size is replaced by these measures the authors find that financially constrained firms are just as sensitive to monetary policy as less constrained ones.

3.4 Industry-specific response to monetary policy

The impact of monetary policy on stock prices is likely to differ across industries for various reasons. Firms operating in more cyclical industries are generally more sensitive to monetary policy, as shown by Ammer et. al (2010) where more cyclical industries with a higher proportion of foreign sales exhibited a greater sensitivity to US monetary policy surprises. Although highly relevant to my thesis, no data could be found on foreign sales for my sample

and is therefore not included in the analysis. A similar study from Fratscher (2004) demonstrated that capital-intensive firms in the industrial sector reacted roughly two to three times as strongly to monetary policy surprises compared to less cyclical industries. This is all considered evidence in the literature for what is known as the demand channel of monetary policy.

3.5 Event studies

This thesis is conducted as an event study where stock prices are regressed to rate changes on policy announcement days to avoid some of the problems with endogeneity and omitted variable bias. The omitted variable bias in this case is quite obvious and stems from the fact that there are a lot of different factors determining stock returns in the short run. Rigobon and Sack (2004) found that these problems resulted in biased estimations which downplayed the effect of monetary policy on stock prices in the United States.

An event study approach will allow me to capture the effects of a specific event without the prevalence of other exogenous shocks. The reasoning behind the approach is that the relative importance of other shocks, such as portfolio shocks, will be limited since a larger proportion of the variance will be explained by the monetary policy announcement. This is also the reason why I choose a narrow event window of only one day. Performing a regression using a wider window of opportunity would require more endogenous variables and the identification of the monetary policy shocks would be more complicated, all else equal.

4 Data

This paper will examine how Swedish firms reacts to foreign and domestic monetary policy changes. My sample consists of 51 firms, currently listed at the Nasdaq Large Cap, followed from 2006-2015. Policy announcements are defined as changes in the prime rate as issued in press releases from the Riksbank (domestic) and FOMC (foreign).

2006 was chosen as a starting point due to practical reasons since most comprehensive data of annual reports run ten years back. Obviously, there are no annual reports for 2016 and that is the reason for 2015 as my end point. The time period is consistent with the current body of research on the topic: Bernanke and Kuttner and Kuttner (2003), Ammer et.al (2010), Ehrmann and Fratscher (2004). Unlike most of the related literature the study period measures the impact of monetary policy on stock returns before, during and after the financial crisis. Neither FOMC's nor the Riksbank's routines have changed since 2006.

This paper falls under the category of event-studies and the effect of the policy change is measured on the day of the announcement. The choice of daily frequency strikes a balance between getting reliable estimates and including other relevant exogenous shocks, as argued above in section 3.5. The sample period consists of 36 Riksbank announcements from 1/20/2006 until 07/2/2015 and 15 FOMC announcements from 2/1/2006 until 12/17/2015

Statements from the Riksbank are usually released one and a half hours before the Swedish stock exchange opens which, given semi-strong efficiency, indicates that some adjustment might have already been made by the time the exchange opens. Stock returns are therefore calculated as the log difference of the daily closing quotes:

$$r_{i,t} = \frac{\ln(P_{i,t})}{\ln(P_{i,t-1})}$$

Where t= the day of the policy announcement

FOMC statements are usually released one and a half hours after the Swedish stock exchange has closed. By the same logic no adjustment will be made in the Swedish market until opening hours the day after the announcement. I will therefore use the same method as above for the foreign regression, only with a one-day lag to account for the time differences:

$$r_{i,t} = \frac{\ln(P_{i,t+1})}{\ln(P_{i,t})}$$

An exception to the rule of time specific statement releases are the announcements made on the 8th of October 2008 at the brink of the financial crisis. FOMC released a statement at 7am and the Riksbank responded shortly thereafter and issued a press release. This implies that the Swedish stock exchange only had five and a half hours to adjust to the first US statement compared to other dates. However, I will not make any corrections for this inconsistency since this was a rather extreme situation which most likely is not representative for the sample as a whole. Considering the stock exchange had to adjust to two policy changes on the same day 5 hours is deemed adequate for measuring the market's response.

All data on stock returns and industry affiliation are gathered directly from NasdaqOMX web page. Industry affiliation is based on a two-digit ICB-codes which is an Industry Classification Benchmark commonly used in global stock exchanges. Data regarding policy announcement are retrieved from the respective central bank's web page.

Firm specific data is gathered interchangeably from the global database Orbis and the Swedish database Retriever Business whenever data is missing in Orbis. Both Orbis and Retriever Business collect their data from firms' annual reports. Some information is also derived directly from the Annual Reports and all data expressed in money is converted to US dollars using consistent exchange rates for all firms in the sample.

5 Methodology

In this chapter I will outline the methodology used in this thesis as well as reasoning and explanations of the choices have made throughout. The general approach is well grounded in previous research related to the topic although some alterations have been made to make it appropriate for a thesis at this level.

5.1 Panel regression and firm-specific effects

The analysis of this paper will be carried out through a number of panel regressions, using a fixed effects model. The choice of panel models provides both practical and theoretical benefits and have previously been used for similar research questions in the literature. The practical benefits stem from the fact that a panel model allows pooling of the whole sample and performing a single regression, instead of performing repeated regressions one firm at a time. The theoretical benefits are several fold and perhaps more important for the results that follow:

Performing regular linear OLS regressions in this specific case would result in omitted variable bias since there are a lot of dependent variables that can explain stock returns in a given period of time. Using a narrow window of opportunity might dissolve some of the bias considering more of the variance will be explained by the policy shocks.

A fixed effects model on the other hand has the advantage of eliminating all omitted variable bias caused by unobservable time-invariant dependent variables without having to specify them. This is important because I am interested in the heterogeneous response of the individual firms listed at the Large Cap and not the response of them as an average or an index. Ehrmann and Fratzscher (2004) showed that the individual response of firms listed at the S&P500 differed greatly with a distribution of returns skewed to the left. A fixed effects model takes care of these across-firms differences by excluding the effect of unobservable variables, such as management skills or reputation, thus creating a more homogenous result.

However, a fixed effects model does not eliminate time-varying omitted variable bias and some control variables will therefore be included in the model. Since all time-invariant unobserved heterogeneity is accounted for the estimates of the control variables are less biased compared to OLS, although I am not particularly interested in these estimates. I will use total assets and equity ratio to try to control for firm size and external finance dependence. Time dummies are included at a quarterly frequency to account for time-dependent exogenous shocks. The model is estimated with robust standard errors to control for heteroscedasticity and clustered data.

$$r_{i,t} = \alpha_i + \beta_{RC} RC_t + \beta_{TA} TA_{i,t} + \beta_{ER} ER_{i,t} + \delta_t T_t + \varepsilon_{i,t}$$

Where $r_{i,t}$ = logarithmic return of stock i at time t

α_i =Firm fixed effects

β_{RC} = Rate change sensitivity

RC_t = Prime rate change in percentage points at time t

β_{TA} = Total assets sensitivity

$TA_{i,t}$ = Total assets of firm i at time t, measured as thousands dollar

β_{ER} = Equity ratio sensitivity

$ER_{i,t}$ = Equity ratio of firm i at time t

δ_t = Time fixed effects

T_t = dummy variable equal to one if the observation belongs to quarter t and zero otherwise.

$\varepsilon_{i,t}$ = Error term

5.2 Industry-specific effects

One problem with fixed effects is that some variables must be left out from the model. A fixed effects model implies that all time-invariant variables are accounted for and including dummies for both firms and industry will result in collinearity and the industry dummy will be dropped. I will therefore perform repeated regressions on one sector at a time in order to

catch the industry-specific effects of monetary policy. Given that the firms in these repeated regressions have similar characteristics and that the degrees of freedom decreases with the lower sample size I will specify the model as follows:

$$r_{i,t} = \alpha_i + \beta_{RC} RC_t + \varepsilon_{i,t}$$

Where $r_{i,t}$ = logarithmic return of stock i at time t
α_i = Firm fixed effects
β_{RC} = Rate change sensitivity
$\varepsilon_{i,t}$ = Error term

5.3 Regression results

As a start, two consolidated fixed effects regression are carried out. The first one with the Swedish prime rate changes as the independent variable and the second one with the FED target rate changes. A summary of the results is displayed below in Table 2 and 3.

Table 1 Results for domestic monetary policy

Variable	***Coefficient***	***Robust Standard Error***	***P-value***
αi	.0126858	.0038936	0.000
βRC	-.0480786	.0059587	0.688
βTA	.0029066	5.18e-09	0.761
βER	-1.58e-09	.0071901	0.133
$\delta t2$	-.0038648	.002529	0.175
$\delta t3$	.003519	.0025552	0.317
$\delta t4$	.0021441	.0021223	0.022
$\delta t5$	.0082724	.0035123	0.914
$\delta t6$	-.0003624	.003346	0.000
$\delta t7$	-.0282125	.0029501	0.000
$\delta t8$	-.0188325	.0041778	0.973
$\delta t9$	.0001346	.0038943	0.112
$\delta t10$	-.0062157	.0038374	0.000
$\delta t11$	-.0373387	.0050262	0.000
$\delta t12$	-.0873032	.0079581	0.000
$\delta t13$	-.064731	.0087593	0.000
$\delta t14$	-.027843	.0065794	0.000
$\delta t15$	-.0409518	.0031845	0.000
$\delta t16$	-.0260387	.0029422	0.420
$\delta t17$	.0025619	.0031489	0.544
$\delta t18$	.0012345	.0020221	0.000
$\delta t19$	-.012407	.0029246	0.001
$\delta t20$	.0124676	.0034036	0.166
$\delta t21$	-.0032945	.0023454	0.646
$\delta t22$	.0020372	.0044083	0.000
$\delta t23$	-.0241901	.0044774	0.052
$\delta t24$	-.0074109	.0037192	0.000
$\delta t25$	-.018152	.0034825	0.000
$\delta t26$	-.027412	.0035139	0.000
$\delta t27$	-.0191409	.0048347	0.029
$\delta t28$	-.0084813	.0037841	0.017
$\delta t29$	-.0067555	.0027367	0.000
$\delta t30$	-.0229587	.003479	0.002

Table 2 Regression results for foreign monetary policy

Variable	***Coefficient***	***Robust Standard Error***	***P-value***
αi	-.0040162	.0060668	0.511
βRC	.0248984	.0140435	0.082
βTA	8.03e-09	8.77e-09	0.364
βER	.0079165	.0138911	0.571
$\delta t2$	.0021071	.0032808	0.524
$\delta t3$	.0429406	.011367	0.000
$\delta t4$	.0017384	.0071008	0.808
$\delta t5$	.0035514	.0135979	0.795
$\delta t6$	.0333465	.0083381	0.000
$\delta t7$	.0050922	.0123335	0.681
$\delta t8$	.0029714	.0025255	0.245

To capture the industry-specific effects a total of 12 repeated regressions are carried out for the different sectors, 6 for the Swedish rate changes and 6 for the FED target rate changes. A summary of the results is presented below in Table 4 and 5.

Table 4 Regression results for industry-specific response of foreign monetary policy

Sector	**Coefficient**	**Robust standard errors**	**Firms**
Financials	.0177316***	0,0031112	13
Industrials	.0120657**	.0034753	13
Consumer goods- and services	.0171829*	.0053462	9
Technology and telecom	.0250008*	.0073015	7
Health Care	.017986	.0057753	4
Basic materials	.0237103	.0060554	5

** Significant at the 5 % level*
***Significant at the 1 % level*
**** Significant at the 0.1 % level*

Table 5 Regression results for industry-specific response of domestic monetary policy

Sector	Coefficient	Robust standard errors	Firms
Financials	-.0046107	.0055039	13
Industrials	-.0085738	.0039626	13
Consumer goods- and services	.0029552	.002067	9
Technology and telecom	.0003639	.0034283	7
Health Care	-.0060015	.0039623	4
Basic materials	.0075684	.0045945	5

* *Significant at the 5 % level*
***Significant at the 1 % level*
*** *Significant at the 0.1 % level*

6 Analysis and discussion

The results of the 4 regression are analyzed and discussed in this next chapter, starting with the analysis of the consolidated regression with domestic rate changes in section 6.1.1 and the consolidated regression with foreign rate changes in section 6.1.2. Industry-specific effects are discussed in sections 6.2.1 and 6.2.2.

6.1.1 The impact of domestic monetary policy on stock prices

The regressions result from the following fixed effects model:

$$R_t = 0{,}0126858 - \ 0{,}0480786\beta_{RC} + \ controls + 0{,}02303503\varepsilon_t$$

Telling from these results, there seem to be a negative trend between stock returns and interest rate changes. The coefficient is highly significant at the 5 % level. Both Total assets and Equity ratio turned up as insignificant variables in the model which implies that changes in firm size and external finance dependence does not help explain stock returns in this specific case. The intercept in this case is specified by STATA as the average difference of the fixed effects.

Many of the time dummies in the regression are significant which indicates that the impact of domestic monetary policy varies over time and is determined by other exogenous factors outside of the model. Furthermore, these time dummies may display the asymmetric response from stock prices over time. From 2006 to the beginning of 2008 most of these time dummies were insignificant which implies that the response remained the same during that time compared to the base quarter in the beginning of 2006. This is represented in the regression results by quarterly dummy 2 through 10 and the common denominator for this time period is that all rate changes are positive. From the midst of the financial crisis on the 8th of October 2008 until 26th of October 2010, represented by dummies 11 through 16, all of the time dummies are significant and negative. Unsurprisingly, this seems to suggest that the impact of

monetary policy on stock prices during the financial crisis increased and is different compared to the base quarter in 2006. Next follow a time period from December 2010 until September 2012 where the time dummies are insignificant and cannot be differentiated from the base quarter, which makes sense since the pattern of rate changes is similar to that of 2006 through 2008. From December 2012 through July 2015 we reach a pattern similar to that of 2008-2010 with significant negative time dummies and exclusively negative rate changes.

Although a somewhat oversimplified analysis these results seem to support the notion that the impact of monetary policy varies over the business cycle and asymmetries between raises and cuts of the interest rate. Periods of monetary expansion are generally associated with an increased impact on stock prices compared to periods of monetary tightening The point of including these time dummies in the first place however is to control for time-dependent exogenous shocks so that the coefficient for rate changes does not suffer greatly from omitted variable bias. Further research is needed to really determine the asymmetries of monetary policy and the importance of business cycles.

These findings are consistent with economic theory as well as the results from similar studies, usually conducted on the US market with FED monetary policy surprises as the main explanatory variable. Bernanke and Kuttner (2005) finds that a surprise cut of 1 % point of the FED funds target rate generally is associated with a 4,68 % increase in stock prices. This is almost identical to the results of this study. Another study from Rigobon and Sack (2004) finds that a 25 unanticipated raise of the interest rate is associated with a 1,7 % of the S&P500 index. In a similar vein to mine: Ehrmann and Fratscher (2004) finds that surprise tightening of 1 % point lowers stock returns by 5,5 %. All and all, this support my main hypothesis of a negative relationship between monetary policy changes and stock prices.

6.1.2 The impact of foreign monetary policy on stock prices

The regression results in the following fixed effects model:

$$R_t = -0{,}040162 + \ 0{,}0248984\beta_{RC} \ + controls + \ 0{,}03131578\varepsilon_{,t}$$

Based on these results there seem to be a positive relationship between the interest rate and stock prices. The coefficient in this case however is highly insignificant at the 5 % level. On average, a monetary expansion by 100 basis point results in decreased stock returns by approximately 2,5 %. The coefficient in this case however is highly insignificant at the 5 % level.

At first glance this might seem like a rather surprising result since it implies that US (foreign) monetary policy has little impact on Swedish (domestic) stock prices. This is the opposite of what has been shown by previous similar research and what I stated in my hypothesis. Event studies conducted on foreign equity markets using FED monetary surprises as the main independent variable found foreign stocks and indices to be roughly as sensitive to US monetary policy as US domestic stocks. (Ammer et.al 2010, Wongswann, 2005).

There are a few possible explanations for these results:

First of all, as shown by Bernanke and Kuttner (2003), the response of the stock market as a whole is not determined by actual rate changes but rather whether or not the change was anticipated. This makes sense from a perspective of semi-strong efficiency, which this study relies upon. The price of a stock should reflect all publicly available information, including expectations of future policy changes. Anticipated rate changes should therefore have no impact on stock returns. This paper is based solely on actual rate changes and some of them might have been highly anticipated.

Secondly, 8 out of the 15 FED funds target rate changes in my sample occurred during the financial crisis in 2008, a time where the relative importance of US monetary increased dramatically. During this time period the market had to adjust to a lot of different exogenous shocks simultaneously and the positive impact of interest rate cuts on stock prices were most likely mitigated by the variance from other more dominant negative shocks. Basitha and

Kurov (2008) states in their study that the current business cycle and the context of how the interest rate change are carried out also is important when determining the impact of monetary policy on stock prices. During the financial crisis; rate cuts and other expansionary measures might have been interpreted by investors as a signal of the financial crisis' severity and not as a sign for higher expected future earnings. Furthermore, an event study by Ricci (2015) examining large European bank stocks during the financial crisis, found no significant relationship between interest rate cuts and stock prices. The author calculated abnormal returns, measured as the difference between stock returns during the rate change and stock returns prior to the rate change. The cumulative abnormal return could not be separated from zero during the financial crisis.

6.2.1 The impact of foreign monetary policy on different industries

Telling from the charts above, the repeated regressions performed on the different industries provide quite inconclusive results. Significant coefficients are found for following sectors: Financials, Industrials, Technology and Telecommunications, and Consumer goods- and services. Technology and telecommunications seem to exhibit the greatest sensitivity to rate closely followed by Consumer goods- and services and Financials. Surprisingly enough, the coefficients are all positive which would imply a positive relationship between foreign monetary policy and stock prices, contrary to what would have been expected given my hypothesis and previous research.

However, the arguments presented above with regards to foreign monetary policy applies here as well. Some of the cuts, predominantly the ones during the financial crisis, might have been highly anticipated and the positive effects of these cuts were most likely mitigated by other shocks revolving around the financial crisis. Although the interest rate was cut, the market was adjusting to all other shocks simultaneously and it might have expected an even greater monetary easing.

One way to interpret the positive coefficient is that stock returns decreases as the interest rate decreases, which is most likely what happened during the financial crisis. The interest rate cuts might have had positive impact on stock prices but it was not enough to result in positive

stock returns. This is a reasonable explanation as to why the coefficient for foreign rate changes came out positive for all industries and why it was significant for most industries.

In a similar vein to this study, Ehrmann and Fratscher (2004) examined the responsiveness of US stocks to FOMC policy surprises across different industries. The consumer goods industry was split up into two different parts to account for their cyclical differences and the more cyclical part was shown to be more than twice as responsive to monetary policy surprises as the less cyclical part. In this study the consumer goods industry is not separated and it also includes consumer services due to the small sample sizes. That is one explanation as to why the coefficient for consumer goods- and services proved to be greater than expected by my hypothesis and previous research.

6.2.2 The impact of domestic monetary policy on different industries

At first glance, the results from the repeated regression derived from domestic rate changes seem even more inconclusive since all of the coefficients are statistically insignificant. This is especially surprising considering the results from the consolidated regression where a significant negative relationship was found, as would be expected by my hypothesis.

These results however cannot be compared straight off since the model specification is different compared to the consolidated regressions. The control variables firm size and equity ratio are excluded from these regressions, but more importantly, the time dummies are omitted to account for the loss of degrees of freedom that comes with the lower sample size. The domestic rate changes are more evenly spaced out over time and many of the time dummies are significant in the consolidated regression which implies that time-dependent exogenous shocks are an important factor when determining the impact of domestic monetary policy in this particular sample. Reintroducing the time dummies in the repeated regressions resulted in an entirely different outcome but the model as a whole became insignificant due to lack of sufficient replications in the sample. Similar event studies examining industry-specific effects usually have a much larger sample of firms which results in more consistent and robust results. (Ammer et al, 2010, Fratscher, 2004).

6. Conclusion

This paper examines the impact of domestic- and foreign monetary policy on stock prices in Sweden. The relationship is examined by regressing domestic and foreign rate changes by the central bank against stock prices of Swedish firms on the day of the announcement. The model is estimated through two fixed effects regressions, one with the FED funds target rate changes as the main independent variable and the other one with the Riksbank's prime rate changes as the main independent variable. The dependent variable in both cases is daily stock returns on the day of the announcement, measured as the log-difference of the daily closing quotes. Control variables for external finance dependence and time dummies to account for time-dependent shocks are also included in the model. Repeated regressions are performed on 6 different industries in order to determine the industry-specific response of domestic- and foreign monetary policy. Once again, a fixed effects regression is chosen but time fixed effects and the control variables are excluded from the model due to methodological problems with the lower sample size.

The results from the consolidated domestic regression provide evidence for a negative relationship between monetary policy and stock prices, where the coefficient for rate changes is highly significant. Many of the time dummies included in the model are significant as well which indicates that other time-varying exogenous shocks are important determinants when measuring the impact of monetary policy on stock prices over the present time period. All and all, the results are consistent with similar studies on the topic and support my main hypothesis of a negative relationship between the interest rate and stock prices.

The results from the consolidated foreign regression are a bit more inconclusive and a significant result could not be derived from the model. However, I do not consider this evidence for a non-existent relationship between foreign monetary policy and stock prices for two main reasons. First of all, more

than half of the observations in my sample occur during the financial crisis, a time where the variance on the stock markets increased tremendously. Secondly, since I do not employ an exogenous measure for monetary policy shocks it is impossible to determine whether the rate change was anticipated or not, which given the efficient market hypothesis would be extremely important for the outcome. The results from the repeated regressions are quite inconclusive as well which most likely is explained by the methodological alterations made as a consequence to the lower sample size.

In summary, the purpose of this thesis is not reached completely. While the study provides further evidence for a negative relationship between domestic monetary policy and stock prices it fails to display the industry-specific response and the impact of foreign monetary policy. The inconclusive results from the consolidated foreign regression are most likely a consequence of an unfavorable sample given the methodology employed in this paper. A method extracting monetary policy surprises would have allowed me to study the effect of monetary policy on stock prices with a greater sample, more evenly spaced out over time. However, it might not be possible to conduct such a study using Swedish monetary policy surprises, due to technical difficulties with regards to gathering data. The results from the repeated regressions might also be a result of unfavorable method choices given the sample. In this case, it might have been better to perform to perform a single regression, using some specification of the random effects model, although that would have had its drawback too. Further research is needed to really determine the asymmetries of monetary policy and the importance of business cycles. A measure of monetary policy surprises and a different methodology to determine the industry-specific response are suggestions for similar research projects in the future.

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8 Appendix