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The Effect of Changes in the Funding Rate on Market Interest Rates: The Swedish Case

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Abstract:

Understanding the effect of central bank policy actions on asset prices is important both to central banks in estimating the welfare effects of their actions and to individual investors in making correct decisions. Studies of these effects have been made predominantly on the U.S. market. This paper will investigate the direct effect of an unexpected change in the main Swedish funding rate on Swedish market interest rates. Data on the funding rate, interbank rate and market interest rates are used in regressions quantifying this effect. The unexpected part of a change in the funding rate is isolated using the one month Swedish interbank rate. The results indicate that an unexpected rate cut or hike causes a decrease or an increase in the market rates respectively. The expected part of a funding rate change is found to be largely insignificant. The conclusion is that there is evidence of an announcement effect and that the Swedish interest rate markets are not proven inefficient.

The ideas of economists and political philosophers, both when they are right and wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist.

- J.M. Keynes, "The general theory"

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DEFINITIONS:

Riksbank	- The Swedish Central Bank
STIBOR 1M	**-** The one month STockholm Interbank Offered Rate. This is the average interest rate set daily in lending between members of the Swedish banking system for maturity in one month.
Reporänta	- The main funding rate of the Swedish Central Bank

By adjusting its lending and borrowing interest rate, a central bank can control the money flow in and out of the economy. This tool is used by central banks to achieve their goals for the economies in which they act. The main goal of the Swedish Riksbank is to achieve price stability. This is done using an interest rate called Reporänta, which affects prices in the economy through a transmission mechanism. In addition to having an effect on prices, the Reporänta affects many other parts of the economy, including asset valuations and market yields.

1. Introduction

In controlling the supply and cost of money, central banks are sometimes considered more powerful than governments in terms of economic policy. Although they usually target variables such as inflation, growth and unemployment, the central banks only have direct control over the short-term interest rates and the supply of money. In the case of Sweden, this direct effect is limited to one week, which is the length of the weekly repurchase agreements that the Riksbank makes with the banking system. The Riksbank weekly rate is called Reporäntan and a new auction is performed every Wednesday. By being predictable and transparent, a central bank can stabilize expectations of future short term rates and thereby retain a practical control of a larger part of the yield curve. Rates with short maturities are indeed largely controlled by investors' expectations of future central bank rates[1] but it is well known in the markets that longer term interest rates are less affected. There is no fixed point of maturity where the Reporänta stops affecting the market rates, but a rather a gradual decline. The reason for this is that the central bank rate which has a maturity of one week becomes less and less of a substitute for the longer rates as it is practically impossible to predict what the Reporänta will be in two years' time. Therefore, other factors become relatively more important in setting the rate. Examples are term premium, international interest rates and expectations of inflation along with other factors which may ultimately have an effect on interest rates.

[1] This is part of the *expectations theory* which states that long-term interest rates mirror expectations for the future. This is often combined with the *liquidity preference theory* which states that people require a premium for investing money during a longer period of time.

In most of the world's more open and modernized economies, the central banks have adopted certain outspoken goals and are making an effort to be transparent and predictable in their actions. This reduces volatility and uncertainty in the markets. In a forward looking and efficient market, an expected change in the central bank rate does not affect market prices when it is announced as this would lead to possible arbitrage. Nevertheless, even though central banks try to be open, there is always a degree of uncertainty. An announcement that was not entirely expected will thus affect the prices in the market.

This paper will attempt to demonstrate a reaction to the policy action of the Swedish Riksbank by the interest rate markets. More specifically, the analysis is conducted on the reactions of Swedish treasury bill and government bond yields to a change in the Reporänta. The efficiency of the market is tested by investigating whether or not market reactions are confined to unanticipated changes in the Reporänta.

A change in the market interest rates affects the wealth in the economy through numerous channels. Examples of these are through its usually inverse relationship with share prices, its inverse relationship to real estate prices or through the redistribution effect where market interest rates are positively correlated to the value of outstanding loans in the economy. It is therefore material for the Riksbank to understand the relationship between Reporänta and market rates in order to predict the wealth effect of its policy decisions, i.e. the effect of its decisions on private and public wealth and thereby on the outlook for spending and inflation. If the short-term interest rates affect asset prices both in the short and long term, they will affect private wealth and costs of borrowing. These effects are said to be part of the transmission mechanism and will have an impact on factors such as consumption and investment in the economy. In addition, private and institutional investors who control assets affected by the Reporänta will want to know how they are affected by it in order to optimize their decisions in the market. The results of this essay will model how market assets, namely government bills and bonds, are affected by changes in the Reporänta.

Studies similar to the one in this paper have been made before. These are mainly concentrated in the U.S. on the Federal Reserve but have also appeared in a few other countries. This paper makes a similar study to that of Kuttner (2001), but targets the Swedish market. The unanticipated change in the Reporänta is obtained using the STIBOR 1M rate. The change in the STIBOR 1M on the day a change in the Reporänta is announced adjusted for a weekday effect is used as a proxy for the surprise to the market. The changes in market yields for different maturities are then measured for these same days. A regression is then created which attempts to explain the variation in market yields with the anticipated and unanticipated parts of the rate change.

Section two of this paper brings up the earlier research made on the subject and provides a foundation for this study. Section three states the hypothesis of the paper and discusses the method employed. Section four presents the data and sources used. Section five presents the results along with interpretations and analysis. Section six concludes the paper.

2. Earlier Research

This section is an historical review of the research made on the subject and on the evolution of thought leading up to the current situation. This is meant to supply the reader with a background as well as create a foundation for this paper.

The reaction of asset prices to central bank policy has been a subject of interest for many years. Waud (1970) perhaps wrote the first paper on the subject when he examined the response of stock prices in the U.S. to changes in the Fed funds rate. The results were a clear inverse relationship between a rate change and share prices. On the subject of market interest rates, the eighties provided important research by Smirlock and Yawitz (1985) and Cook and Hahn (1988). Both compared Fed funds rates to the bond market prices and found another inverse relationship. The conclusions reached in the late eighties seemed to merit no further research as the results obtained were the ones expected from both market practitioners and academics.

Nevertheless, Radecki and Reinhart (1994) made a similar study to that of Cook and Hahn (1988), focusing on the period 1989-1992, and could find no evidence of market interest rates reacting to Fed funds rate changes. This contradicted earlier research and there seemed to be no consensus explanation for the results. The announcement effect seemed to have disappeared. In the late nineties and beginning of the new millennium [Thornton 1992, Neumann and Weidmann (1997), Kuttner (2001)] one explanation gained momentum: Because the Federal Reserve had become more transparent during the late eighties, the market had anticipated rate changes to a greater extent. Because an efficient market does not react to an expected event, the effect seemed to disappear. There should therefore still be a reaction to the part of a rate change which was unexpected[2].

[2] Actually, this was first proposed by Smirlock and Yawitz in 1985, who also had a method for separating the unanticipated part. This did not receive much attention at the time because most of the changes in the Fed funds rate were unanticipated.

Kuttner and Krueger (1996) determined that the Fed funds futures mirror the market expectations are an unbiased estimator of future Fed funds rates. Kuttner (2001) used this result to separate the unexpected part of a rate change from the expected one. The difference in Fed funds futures implied rates before and after a rate change were assumed to reflect the surprise to the market of the change. This was then adjusted to match the number of days affected by the change. *Equation 2.1* shows the model used by Kuttner (2001):

$$\Delta\tilde{r}_{\tau}^{u} = \frac{m_s}{m_s - \tau}(f_{s,\tau}^{0} - f_{s,\tau-1}^{0}) \qquad \textit{Equation 2.1}$$

In *Equation 2.1*, the left hand side represents the unexpected part of a rate change and the right hand side is the difference in Fed funds futures implied rates[3] adjusted for the number of days affected. The first part of the right hand side is an adjustment to the number of days of the future contract affected by the expected new rate. The second part is the difference in the implied rate before and after the announcement by the Federal Reserve. A similar model will be used below along with a further justification of its rationale. Kuttner's (2001) results were accompanied by several other papers reaching similar results but using other methods. Notably, Rigobon and Sack (2002) employed a hetereoskedasticity-based model to estimate the true response to the changes in monetary policy. Although the method was fundamentally different from that of Kuttner (2001), similar conclusions were reached.

This paper uses a method comparable to the one used by Kuttner (2001). The analysis concerns the response of Swedish treasury bills and government bonds to an unexpected change in the Reporänta. Hence, this paper is very close to a replication study of Kuttner (2001). A summary of previous research relating to the subject of this paper is available in appendix a.

[3] It is relatively straightforward to extract the expected future fed funds rate from the price of a fed funds future.

3. Method

The hypothesis to be tested in this paper is that there is a significant direct effect on market yields from the unanticipated element of a change in the Reporänta. Furthermore, the anticipated element is predicted to be insignificant as it is already discounted in a forward-looking market. The final part of the hypothesis states that the economic and statistical significance of the change in the Reporänta in determining market yields should decline with longer maturities. This section will bring up the economic and practical background for the hypothesis. It will also provide a description of the model employed. Firstly, the Swedish Riksbank's system for controlling interest rates and money supply is reviewed. This is followed by a discussion on the shape of the yield curve. Thirdly, the theory behind using the STIBOR is reviewed. Finally, the statistical model employed is discussed in more detail.

3.1 Overview of the Riksbank system for monetary policy

The background to the current system of monetary policy was a collapse of the Swedish Krona and also in the trust of the Riksbank. After high pressure for devaluation and tough resistance from the Riksbank, the Swedish Krona was allowed to float from the Ecu-peg in 1992. With a floating currency, the Riksbank specified price stability as its main goal and set the target of two percent inflation plus or minus one percentage point. In June 1994, a new system for monetary policy was introduced.

The current system consists of one main rate called Reporänta, at which the banking system is allowed to borrow or lend money through weekly repurchase agreements. The Reporänta is the main tool of the Riksbank in maintaining its goal of price stability. Adjustments in the Reporänta affect the economy through a lag and are therefore based on forecasts of the economy. This lag is believed to be about two years and is calculated through a model of the transmission mechanism[4]. Inflation forecasts are published four times per year and contain the current view of the Riksbank.

The other two main interest rates are called lending rate and deposit rate and form practical limits to short term market rates. When the system has a deficit or surplus

[4] For a more detailed description of the Swedish transmission mechanism, see the homepage of the Swedish Riskbank: URL:[http://www.riksbank.com/templates/Page.aspz?id=10547] 2005-12-07

of money during the week, the Riksbank provides lending and borrowing facilities overnight. These are set at 75 basis points higher and 75 basis points lower than the Reporänta respectively. Because the Riksbank is considered virtually risk-free, the short term interbank rates never exceed the limits set by the overnight facilities. In practice, the Riksbank does not want the overnight rates to fluctuate even within the corridor set by the facilities. They therefore provide so called fine-tuning operations which keep the rates even tighter around the Reporänta[5].

3.2 The Reporänta and the yield curve

The Riksbank effectively controls interest rates with maturities of less than one week using the Reporänta and overnight facilities. What about longer term interest rates? The liquidity preference theory states that a market participant who expects the Reporänta to be constant will still require a higher rate of interest for lending money for a longer period of time. This is based on the assumptions that individuals prefer consumption today over consumption tomorrow. Another argument is that the risk increases for longer periods of time, one can never be certain of the future interest rates. Therefore, the market interest rates will always trade at a premium to the Reporänta, a premium which increases with longer maturities. At some point, the current Reporänta becomes unimportant as the main part of the contract is so far away that the Reporänta cannot be predicted with any certainty. At that stage other factors such as supply and demand and market expectations of the performance of the economy become more important. Nevertheless, a change in the Reporänta will always have a marginal effect on the yields of all different maturities as it affects the beginning of the period to maturity, although this effect is negligible for longer maturities. Consequently, the short end of the yield curve is expected to be largely influenced by the Reporänta whereas its effect on longer maturities will decline. Figures 3.1 and 3.2 show simple models of the interest rate components and the decomposition of the different parts of the yield curve. These models reflect market consensus and are not claimed to be complete. Rather they are included to give the reader a basic image of the functioning of the yield curve.

[5] For a more detailed description of the Swedish Riksbank system for monetary policy, see the homepage of the Swedish Riksbank: URL:[http://www.riksbank.com/pagefolders/20712/Riksbanken.pdf]

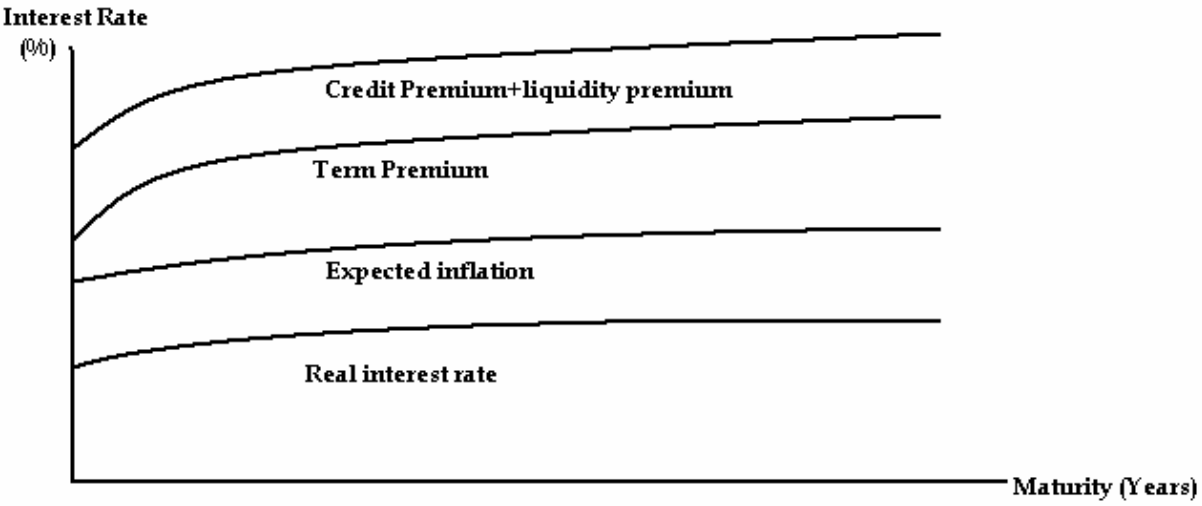

Figure 3.1: The components of the interest rate

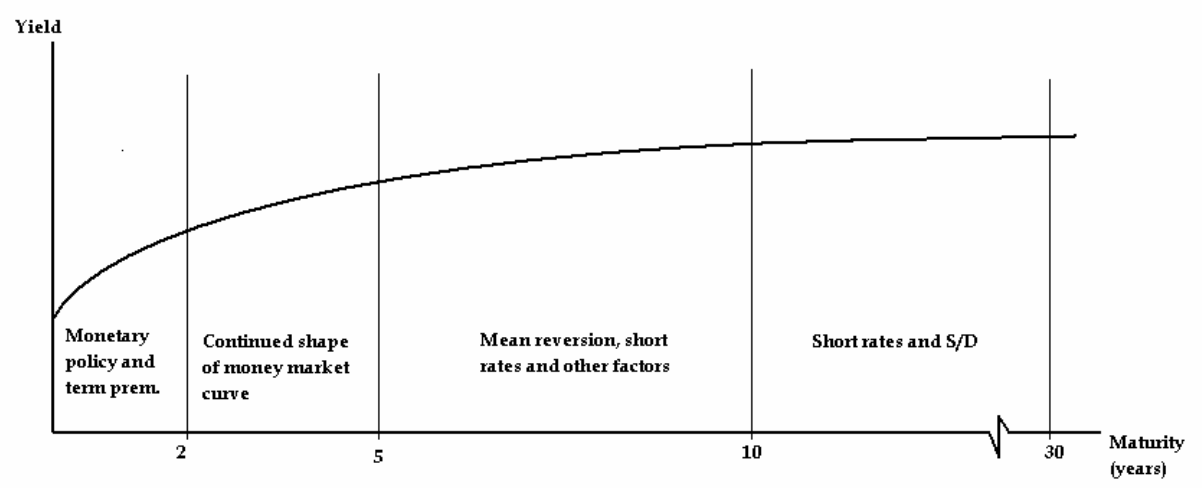

Figure 3.2: Decomposition of the yield curve

3.3 The STIBOR 1M and the change in the Reporänta

STIBOR rates are set daily by the banking system and represent the average rate at which they lend and borrow money to each other for a certain maturity. Given that the banks have access to funding at the Reporänta weekly and close to it during the weeks, the short-term STIBOR rates will remain close to the Reporänta. The Swedish Riksbank announces its rate decisions in a press release in the morning of the day following their meetings. Therefore, the effect on the market is assumed to take place during the trading hours of that day. On the day before a Reporänta announcement, the STIBOR 1M will be at a level that is adjusted for the market's expectations on the expected announcement. For example, the Reporänta is at one percent, and the market is expects an increase of 25 basis points with effect from the next day[6] with 80 percent certainty. This will result in a STIBOR rate of 1,20 percent plus premium on the day before the announcement. By observing the change in the STIBOR 1M on the day of the announcement and assuming that the premium remains constant, the magnitude of the surprise can be measured.

In addition to the Reporänta, there are exogenous factors affecting the STIBOR 1M, e.g. macro events affecting demand for money. These factors are discussed further in section 5.3.2. The STIBOR is trading with a premium over the Reporänta, but because we are looking at the difference in STIBOR and not the absolute value, the premium will not affect the results.

[6] There is usually a weekday effect as the Reporänta is always effective from the Wednesday closest to the decision. For simplicity, this example assumes that there is no such effect. We are also assuming that the markets does not expect any further changes to the Reporänta during the following month.

The STIBOR 1M rate can be separated into its elements in the following way:

$$S_{1M,T-1} = \frac{\left((r_{T-1} * n) + E(\sum_{(T-1+n)}^{(T-1+m)} r_t) \right)}{m} + \tau \qquad \textit{(Equation 3.3.1)}$$

The term $S_{1M,T-1}$ in *Equation 3.3.1* is the STIBOR 1M on the day before an announcement, r_x is the Reporänta on day x, *m* is the number of days in the month, *n* is the number of days to the next Wednesday, E(X) is the market expected value of X and τ is the premium on the STIBOR. The most convenient way to look at the expression for STIBOR 1M in *Equation 3.3.1* is as the predicted average expected Reporänta during the next month plus a premium. The term $(r_{T-1} * n)$ illustrates that the Reporänta will remain constant and known until the beginning of the next repurchase-period (Wednesday). The second term in the numerator of the right hands side in *Equation 3.3.1,* $E(\sum_{(T-1+n)}^{(T-1+m)} r_t)$, represents the sum of expected daily Reporänta during the days of the month for which the Reporänta is not certain. When the announcement comes, the STIBOR 1M will react as shown in *Equation 3.3.2*:

$$S_{1M,T} = \frac{(r_{T-1} * n) + E\left(\sum_{(T+n)}^{(T+m)} r_t \right)}{m} + \tau \qquad \textit{(Equation 3.3.2)}$$

In *Equation 3.3.2*, all variables are labelled as in *Equation 3.3.1* and the former is similar to the latter. There is however one important difference, the second term in the numerator on the right hand side of *Equation 3.3.2* is in practice significantly different from its counterparty in *Equation 3.3.1.*

In practice, as illustrated in *Equation 3.3.3,* this second term will equal the newly announced Reporänta multiplied by the number of days left of the STIBOR 1M after the new Reporänta is put into effect. In other words, we assume that the market expects the new Reporänta to remain in place for the remainder of the 30 days.

$$E\left(\sum_{(T+n)}^{(T+m)} r_t\right) \approx r_{T+n}(m-n) \qquad \textit{(Equation 3.3.3)}$$

The reason why the *expected* value of the term $\left(\sum_{(T+n)}^{(T+m)} r_t\right)$ is used in *Equation 3.3.2* is that there is always the possibility of unexpected and unscheduled changes in the Reporänta. This is discussed further below. To quantify the unexpected change in the Reporänta, this paper starts with the difference between *Equation 3.3.2* and *Equation 3.3.1*. It is easy to see that this will get rid of the effect of the term premium. After getting the difference $(S_{1M,T} - S_{1M,T-1})$, we need to complete one more step before arriving at the approximation of the unanticipated change. Because the repurchase agreements always run from Wednesday to Wednesday, there will sometimes be a few days after the announcements before the new Reporänta is put into effect. The difference must therefore be scaled up in order to get the full surprise to the market. *Equation 3.3.4* illustrates how we arrive at the final value for the unanticipated change, it is also identical to *Equation 2.1* which is the one used by Kuttner (2001) for fed funds futures:

$$U = \frac{(S_{1M,T} - S_{1M,T-1}) * m}{(m-n)} \qquad \textit{(Equation 3.3.4)}$$

The adjustment made in *Equation 3.3.4* can be explained more clearly with an example. Imagine that the number of days before the new Reporänta is put into effect is equal to half of the number of days in the STIBOR rate observed. If the market expects no change and the Riksbank announces a hike of one percentage point, this would increase the Reporänta by one percentage point during half of the period of the STIBOR. This would logically cause an immediate increase in the STIBOR of 50 bps as it is the amount of the increase in the average rate during the period of the STIBOR. Therefore, the fact that it

takes a number of days for the change to come into effect causes an underestimation of the surprise to the market. *Equation 3.3.4* compensates for this effect by scaling up the effect.

Equation 3.3.4 also illustrates one of the main reasons why STIBOR 1M was chosen instead of for STIBOR 1W. The weekday effect which is adjusted for can become very large if STIBOR 1W is used. It may for example mean that you have to multiply the change in the STIBOR by seven. This would mean that a very small difference in the STIBOR translates into a large difference in the analysis. Such discrepancies may arise due to any of the exogenous factors affecting the STIBOR, for example the demand for money in the economy. By using the STIBOR 1M the risk of small discrepancies causing large errors in the analysis is greatly reduced. A potential weakness with the analysis presented in this paper exists due to the fact that the market expectations may be wrong in their timing of a rate change. This issue is discussed further in section 5.3.

3.4 The statistical model used

The regression upon which most of the results are based is a multiple regression using the OLS method. The unanticipated and anticipated changes in the Reporänta are taken as explanatory variables to the changes in market yield. The regression is then varied by explaining market yield changes of different maturities and comparing the results. *Equation 3.1* illustrates the model used. In the presentation of results, regressions are also made where the unedited change in the Reporänta is used to explain the change in market yields. This is done to provide a comparison of the results achieved.

$$I = \alpha + \beta_1 unanticipated + \beta_2 anticipated \qquad \textit{(Equation 3.4.1)}$$

The data used in the regression is the intraday change in the Reporänta and market yields on the days where an announcement was made. Because we expect the market yields and STIBOR to be efficient, we expect the coefficient of the anticipated change to be insignificant both statistically and economically. The coefficient of the unanticipated change is expected to be highly significant for shorter maturities and less significant for longer ones. This would be in accordance with the factors affecting the yield curve discussed in section 3.2.

In this type of analysis it is always worth mentioning the risk of spurious correlation: one or more exogenous variables affecting both the explained and explanatory variables causing an illusion of correlation and causality. In this analysis, it would be possible that both the variation in the STIBOR 1M and that in the market yield is caused by an exogenous factor. This paper assumes that this kind of movement is small enough to disregard as most of the movement in the STIBOR 1M is due to the announcement. For further discussion of the issue, see section 5.3.

4. Data

This section start by covering the data used and the sources employed in obtaining it. Furthermore, the exact formatting of the data, limitations and potential measurement problems will be covered.

4.1 Data series and sources

All measurements were made on dates when the Riksbank made an announcement about the Reporänta. Therefore, the natural starting point was to find all such available data points. As mentioned in section 3.1, the current system with the Reporänta has existed since June 1994. Before that, the monetary control system worked differently. Principally, the announcement effect will have existed before the current system as well. However, data from before the start of the current system is not exact enough and has limited the scope of the study to the new system. After the implementation of the new system, the Riksbank has had a strict procedure of announcements during the morning hours on the day after a decision[7]. Therefore, the analysis has been restricted to data points after June 1994. The changes in the interest rates have been measured in basis points on the day of the announcement and resulted in 82 observations. The closest following Wednesday has also been noted to be used in *Equation 3.3.3* as it is the date on which the new rate was put into effect. The source for dates that changes in the Reporänta were put into effect and size of the changes is the homepage of the Swedish Riksbank[8]. The source for announcement dates is the press archive of the Riksbank[9].

[7] See the press archive of the Swedish Riksbank.
URL:[http://www.riksbank.com/templates/YearList.aspx?id=10685] 2005-12-07
[8] Key interest rates statistics from the Swedish Riksbank.
URL: [http://www.riksbank.com/templates/stat.aspx?id=17184] 2005-12-07
[9] See the press archive of the Swedish Riksbank.
URL:[http://www.riksbank.com/templates/YearList.aspx?id=10685]

The second data series used is the STIBOR. This was calculated as the basis point change in the STIBOR 1M during the day of an announcement. Hence, the data points are on the same dates as those for the Reporänta and the source is the statistical database on the Riksbank homepage[10]. The third collection of data series is that of market yields. The same method of the basis point change on the announcement day was used in this case and the source was once again the statistical database of the Riksbank homepage[11]. The securities were government bills of one month and twelve months and government bonds of two years, five years and ten years. *Table 4.1.1* summarizes the data and sources used.

Table 4.1.1 Summary of data and sources used in analysis.

Data	Source
Dates and size of change in Reporänta	Statistical database at homepage of the Riksbank
Announcement dates for changes in Reporänta	Press archive at homepage of the Riksbank
Intraday change in STIBOR 1M on announcement dates	Statistical database at homepage of the Riksbank
Intraday changes on announcement days in yields of one month and one year treasury bills as well as two year, five year and ten year government bonds.	Statistical database at homepage of the Riksbank.

[10] Swedish market interest rate statistics.
URL:[http://www.riksbank.com/templates/stat.aspx?id=17186] 2005-12-07
[11] Swedish treasury bills yield statistics.
URL:[http://www.riksbank.com/templates/stat.aspx?id=17187] 2005-12-07
Swedish government bond yield statistics.
URL:[http://www.riksbank.com/templates/stat.aspx?id=17188] 2005-12-07

4.2 Measurement issues and restrictions

All data sets are measured in percentage units and have been obtained to at least three decimal places. Hence, the measurement is accurate to a tenth of a basis point. The Reporänta is measured as the rate announced in conjunction with Riksbank meetings. The STIBOR is one fixed rate which is set at a specific time each day. All other rates are taken as market closing rates. As stated above, the Reporänta was only available with the required accuracy from the beginning of June 1994, which therefore is the start date of the analysis.

Because all measurement is done on the daily change on the day of the announcement, only the immediate effect is measured. Another interesting research approach would be to examine whether or not there is evidence of any bias in asset yields during a longer period following a rate change. Evidence of this could indicate over- and underreactions to changes in the Reporänta. Yet another point to note is that we assume the STIBOR rates to be an accurate proxy for market expectations. Because the STIBOR only reflects the interbank market, there is a possibility that the wider market has a different opinion about the future Reporänta. This potential difference is assumed to be virtually nonexistent due to the fact that the banks have access to the same information as the market and that there is interaction between the banks and the wider market.

5. Results

This section will start by presenting a summary of the results from the analysis. This will be accompanied by an interpretation of the economic and statistical significance of the results. Section 5.2 will use the results obtained to confirm or reject the hypothesis. There will also be a discussion of possible objections or improvements of the study. Section 5.3 covers potential weaknesses of the study.

5.1 The results of the analysis: presentation and interpretation

The regressions made are identical to the one in *Equation 3.4.1* where the maturity of the market yield is varied. The table also displays the result when using the unadjusted change in the Reporänta to explain the change in the market yield. The method is ordinary least squares and the software used is Eviews 3.1. Results for different maturities are presented in *Table 5.1.1*. The full collection of regression results are available in appendix c.

	Coefficients of explanatory variables					
Maturity	**Intercept**	**Anticipated**	**Unanticipated**	**Total**	**R^2**	**F-stat**
Month	-0.001676	0.161531	0.549572	0.321592	0.494957	38.71112
	(.8286)	(.0106)	(.0000)	(.0000)		
Year	0.006176	0.154849	0.446066	0.274972	0.189760	9.250998
	(.6428)	(.1481)	(.0014)	(.0001)		
Two yrs	-0.001123	0.071192	0.423084	0.216342	0.195791	9.616597
	(.9191)	(.4216)	(.0003)	(.0003)		
Five yrs	-0.000988	0.028525	0.261708	0.124710	0.096179	4.203357
	(.9214)	(.7215)	(.0114)	(.0181)		
Ten yrs	-0.003043	0.027510	0.161583	0.082813	0.051924	2.163311
	(.7330)	(.6996)	(.0764)	(.0733)		

Table 5.1.1: Summary of results from regressions. Note that the numbers within parenthesis are the p-values for the coefficients.

In *Table 5.1.1*, the results from the regressions for all different maturities are summarized. All the statistics refer to regressions of the form in *Equation 3.4.1*, except for the numbers in the column labelled Total. This column was inserted for comparison and represents the coefficient of the total change in the Reporänta when regressed upon changes in market yields.

The second column confirms to us the fact that the intercept of the equation is likely equal to zero. There is no bias in the direction of the interest rates. The third column contains the coefficients for the anticipated rate change and is expected to be insignificant. Surprisingly, the coefficient for the shortest maturity is positive and significant almost to a p-value of one percent. This result and others following will be discussed further in section 5.2. The other coefficients in the column are insignificant as expected.

The third column in *Table 5.1.1* represents the coefficients of the unanticipated change in the Reporänta. As expected, these are all significant both economically and statistically although the coefficient for the ten year maturity is a border line case. The next column representing the coefficient when regressing the total change in the Reporänta on market yields. This column has a high statistical significance, just like the unanticipated element, but a lower economic significance. This is also expected as the total change in the Reporänta includes insignificant noise in the form of anticipated changes.

The sixth column is the R-squared, which tells us how much of the variation in the explained variable that can be attributed to variations in the explanatory variables. We notice that this value drops drastically for higher maturities. Finally, the F-statistic tells us whether or not the entire regression is significant in explaining the variation in the yield.

5.2 Testing the hypothesis

The hypothesis states that the unanticipated element of a change in the Reporänta will have a significant impact on the market yields and that the significance will decline with increasing maturities. This statement reflects the discussion of the components of the yield curve in section 3.2. From *Table 5.1.1* we can see that the coefficient of the unanticipated change ranges from 0.55 for one month yields to 0.16 for ten year yields. The values are statistically different from zero at high certainties with the exception of the ten year maturity where the null cannot be rejected at the five percent level. The interpretation of this is that the importance of the Reporänta for market yields is highest for the one month bill and becomes small and insignificant at long enough maturities. This is also observed from the R-squared which declines from 50 percent to five percent as the maturities increase. Consequently, the results confirm the hypothesis.

The second part of the hypothesis states that the expected changes in the Reporänta are insignificant to the market yields. This is confirmed for all maturities but the one month yield. Here, the anticipated change in highly significant and leads to a significant change in the market yields. This result is not in accordance with the hypothesis and implies that the expected change in the Reporänta has an impact on short interest rates alone.

One possible explanation for this could be that Swedish markets overreact to expected changes by self-reinforcing trends due to group psychology and trend following. If this effect is small it makes sense that it cannot be observed on the other market yields because the impact of the Reporänta is smaller overall for longer maturities. With a smaller impact of a policy change, the magnitude of the shock required to create a clear trend will not be present. This could be an interesting field of future research. If one could find evidence of mean reversion on the day following the announcement, it would indicate that the market overreacts.

Another, perhaps more plausible, reason for the significance is the presence of spurious correlation that is brought up in section 5.3.2. An exogenous variable influencing the STIBOR 1M and the one month market yield on the announcement days would strengthen the apparent significance and effect of both the anticipated and unanticipated change in the Reporänta. An example would be a sudden change in the demand for money in the economy. This would affect the STIBOR 1M and the market yields simultaneously. Note that such an event is likely to have a higher impact on the short term yields than on the longer maturities. Consequently, the effect could be explained by the presence of spurious correlation. Apart from the regression on the one month yields, our results point to the anticipated change as being insignificant. Further research may be aimed at explaining this anomaly.

One objection to the analysis, similar to the one discussed in section 5.3.2, is that the changes in the Reporänta itself could be correlated with an exogenous variable which in turn causes the variation in the market yields. If this were true, it would threaten the validity of the analysis. However, the argument can be dismissed by looking at the processes through which the two variables are set. The market yields are set from minute to minute, reacting to every new piece of information. The Reporänta on the other hand is usually set through a slow and rigid process. Any information important enough to cause a change in the Reporänta will already be priced into the market yields on the announcement date. The Riksbank has the possibility of unscheduled meetings and changes in the Reporänta. This option exists to provide mobility in drastic situations and is seldom used. Even when this option is used by the Riksbank, an efficient market is expected to react faster than the governing board at the Riksbank.

A final issue to bring up concerns the result of the regression; how should the coefficients of the explanatory variables be interpreted? The hypothesis predicts a significant effect, but not a quantitative level. A natural way to look at the coefficients is as the fraction of Reporänta change that translates into changes in the yield. The assumptions of high coefficients for lower maturities and lower for longer ones are confirmed in the results. It is difficult to draw any conclusions for the coefficient on the unanticipated change in the one month maturity regression. This is once again partially due to the weekday effect. The more days after the announcement before the new Reporänta takes effect, the lesser the reaction of the market yields. This is because a lesser part of the time to maturity is subject to the new rate. For longer maturities, the weekday effect will be comparably small and more significance can be put to the size of the coefficient. However, this paper will not attempt to explain the economic information inherent in the magnitudes of the coefficients. This may be an interesting subject for further studies.

5.3 Weaknesses

This section will bring up the inherent weaknesses of the model employed and attempt to argue why they are not likely to affect the results significantly.

5.3.1 The timing of the change in the Reporänta

As mentioned in section 3.3, a potential weakness is that the market is wrong about the *timing* of the rate change rather than the size. This could lead to a misinterpretation of market rates. The following example illustrates the issue: STIBOR 1M is 2,125% on day t. The current Reporänta is 2%, in this example we ignore any premiums and assume that the STIBOR 1M is only dependent on the Reporänta. The market expects a hike of 50bps after the scheduled meeting in three weeks. If the Riksbank announces the hike on t+1 instead, the market might no longer expect any future hikes and the STIBOR 1M moves to 2,5%. Assuming that the Reporänta is effective on the day of the announcement, this would imply a surprise to the market of 37,5bps when the surprise is actually 50bps on day t+1.

After recognizing the problem stated above, there are several reasons why it will not render the results of this paper useless. Firstly, the Riksbank has a very structured system for controlling the Reporänta. There are eight scheduled meetings each year where the Reporänta policy is decided upon. These are anticipated and never lie within a month from each other. Thus, the issue will only be a reality when the Riksbank calls for unscheduled meetings during which the Reporänta may be altered. This possibility exists as protection against unexpected or drastic situations and will arise very rarely if at all. Secondly and perhaps more importantly, if a change in the Reporänta is expected to happen within a month, this will be priced into the securities market as well as the STIBOR market. Therefore the effect should practically cancel out as we are measuring the effect of an unexpected change in the Reporänta on market yields. If as in the above example the hike was actually expected in three weeks, the markets will have priced in the hike in three weeks as well. The regression will measure the effect of a 37,5bps surprise, which will be appropriate as the market experiences two surprises simultaneously: A 50 bps positive surprise today and a 50 bps negative surprise in three weeks, giving a grand total of 37,5 bps. Consequently, this kind of situation is not expected to affect the results of this paper.

5.3.2 Spurious correlation and the STIBOR 1M

The analysis of this paper is based on the assumption that the variation in the STIBOR on announcement days is almost entirely due to the decision on the Reporänta. If the STIBOR is influenced by exogenous factors, apparent causality between the Reporänta and the market yield will be put into question.

The banking system has the Riksbank as an alternative to borrowing and lending internally. There is both the Reporänta which is available weekly and fine-tuning operations which are usually available from day to day. In addition to this, we assume that, ceteris paribus, lending and borrowing from the Riksbank is preferred to lending and borrowing from other banks due to a lower risk. This implies that the STIBOR for short maturities will not move outside the spread of available interest rates set by the Riksbank. STIBOR rates with longer maturities may move outside this channel because they are not available from the Riksbank. The factors likely to cause such movement are various macroeconomic flows affecting the supply and demand of money in the economy as well as expectations of future rates. These fluctuations are expected to be transitory because the market is aware of the fact that the Riksbank adjusts money supply to keep interest rates close to the Reporänta. Other than these, the STIBOR is expected to adjust for expected Reporänta changes and to react to unexpected ones.

Although kept small and short-lived, the possibility of fluctuations in the STIBOR 1M rate due to exogenous factors could cause a flaw in the method of this paper. If for example there is a sudden surge in consumption in the economy and the STIBOR 1M increases suddenly, this is likely to be accompanied by an increase in the market yields for the same reasons. This type of occurrence on an announcement date could in this paper, mistakenly, be interpreted as a response of market yields to the change in the Reporänta. Note that the effect would show up as a response to both the unexpected and expected parts of the Reporänta. *Diagrams 5.3.1.1* and 5*.3.1.2* illustrate the movement of the Reporänta and the STIBOR 1M during different periods.

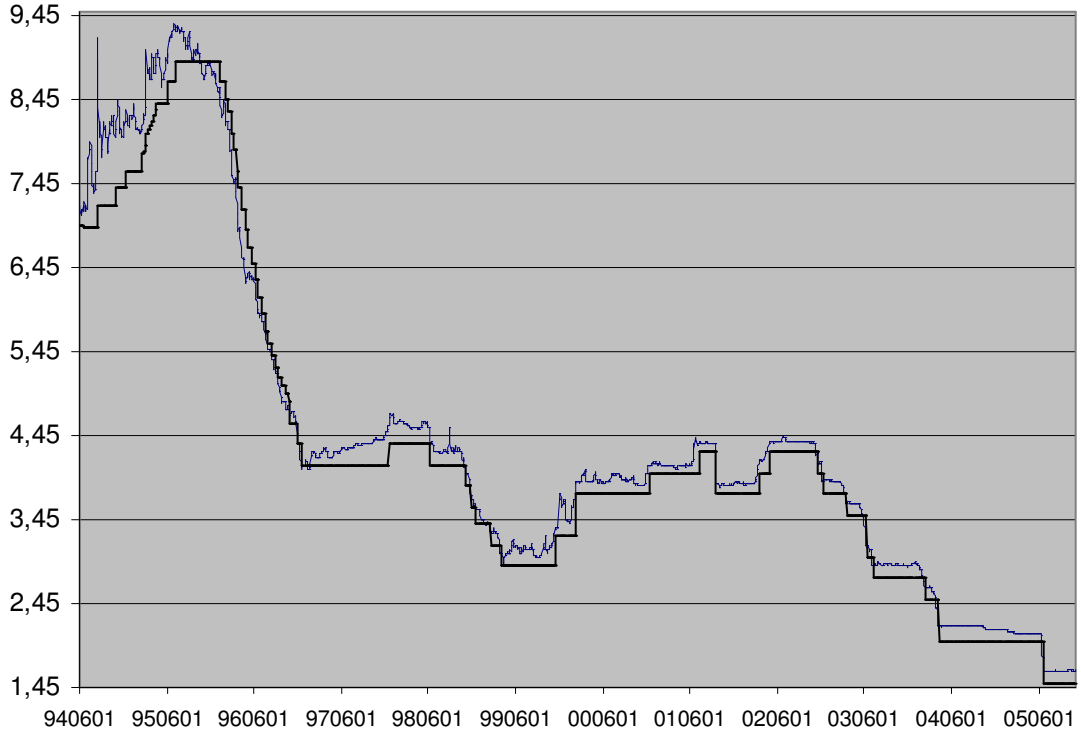

Diagram 5.3.1.1: The STIBOR 1M and the Reporänta since 1994-06

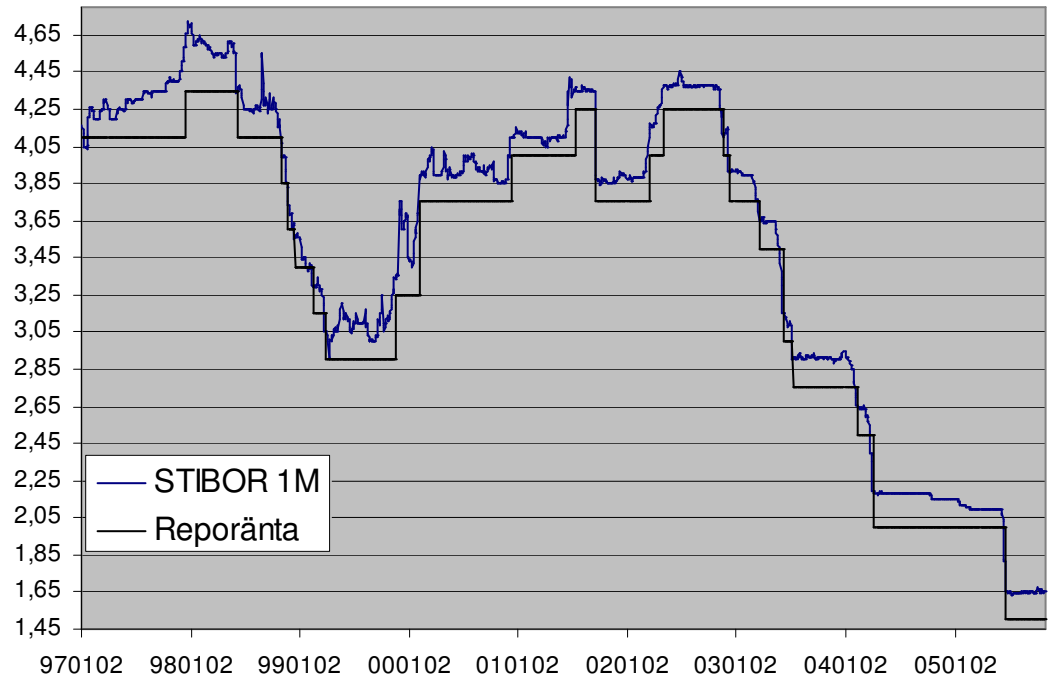

Diagram 5.3.1.2: The STIBOR 1M and the Reporänta since 1997-01

Diagram 5.3.1.1 shows that there is indeed variation in the STIBOR on non-announcement dates. This can be explained by either changed expectations of the future Reporänta or exogenous factors affecting the market for money. In comparing the data series after 1997-01 (*Diagram 5.3.1.2*) and the data preceding it in *Diagram 5.3.1.1*, one can see that the fluctuations in the STIBOR 1M are declining over time and are virtually nonexistent during the final years. This can be attributed to a number of things. Firstly, the confidence in the Riksbank has gradually increased after the Swedish bank crisis in the beginning of the 1990's. This was further strengthened in 1999 when the Riksbank was made independent from the government and the goal of price stability was established by law. Secondly, the increased usage of fine-tuning operations has created an even narrower interest rate spread, and finally changes in the Reporänta have become less frequent. In order to see how the variation in the STIBOR is concentrated to announcement dates, *Diagram 5.3.1.3* was created. It shows the daily changes in the STIBOR 1M and in the Reporänta.

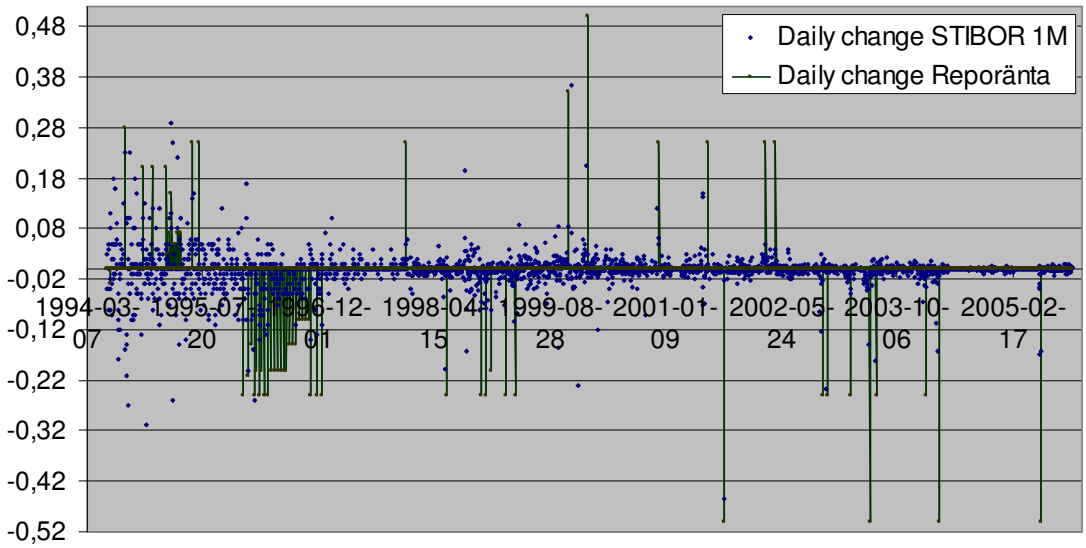

Diagram 5.3.1.3: The daily change in Reporänta and STIBOR 1M

Diagram 5.3.1.3 illustrates the decreased volatility of the STIBOR 1M even clearer than the two previous diagrams. This confirms the notion that the STIBOR 1M is controlled by expectations of the Reporänta. In the period 1994 to 1997, the Riksbank implemented frequent changes in the Reporänta, making it difficult to predict the future and thereby created a volatile STIBOR market. During later years, with longer periods of stability in the Reporänta, it is apparent from *Diagram 5.3.1.3* that the Reporänta does not move significantly other than on announcement dates. For further analysis, one could include dates of other press releases by the Riksbank and other sources of information that might affect expectations. By comparing the dates to the movements in the STIBOR even more of the variation is likely to be explained.

Conclusively, most of the variation in the STIBOR 1M is indeed due changes in the expectation of future Reporänta. However, one must be aware that some of the variation in the STIBOR 1M is caused by exogenous factors. These variations will be comparably small on announcement dates, but may indeed exist. The effect may be a slight overestimation of the effect of a change in the Reporänta on market yields. The joint reacion of the STIBOR and market yields to exogenous factors is likely to be strongest for the same maturities. Hence the problem would mainly affect the regression on the one month market yields. Such spurious correlation would lead to an apparent increase in both the unanticipated and the anticipated part of the change in the Reporänta. Therefore, one way to identify the problem may be to look for apparent significance of the anticipated changes in the Reporänta. This is discussed in section 5.2.

6. Conclusion

The influence of the Riksbank in terms of effect on market yields has been confirmed in this paper. A strong positive relationship has been established between unanticipated changes in the Reporänta and the market yields. The analysis concludes that the causality is quite clear; an unanticipated change in the Reporänta causes a change in the market yield. The exogenous factors affecting the market yield become stronger with longer maturities, lessening the impact of the Reporänta. These factors constitute the error term in the regressions made. The results reached were similar to those reached in earlier studies on other economies. This further reinforces the conviction that the method used was appropriate.

The STIBOR 1M rate is used as a proxy for the market's expectations on the actions of the Riksbank. The rate change as a reaction to changes in the Reporänta is taken as the surprise element of the change after adjusting for a weekday effect. This method is similar to that used by Kuttner (2001) with Fed funds futures. Spurious correlation between the STIBOR 1M and the market yields is recognized as a possible flaw in the method but is assumed to be practically insignificant, except for market yields with one month maturity. Nevertheless, the existence and magnitude of exogenous effects on the STIBOR 1M would make an interesting subject for further research. Another point worth looking into in the future might be the reason for the significance of the anticipated change in the Reporänta for market yields of one month. This may indeed be related to the existence of spurious correlation as mentioned in section 5.2. Finally, a model describing and measuring the magnitude of the effect of changes in the Reporänta on market yields would be interesting. Having confirmed that unanticipated effects have an effect, the size of this effect should be studied and explained.

7. Appendix

a. Summary of previous research

Table 2.1: Earlier research

Year	Author	Conclusions
1970	Waud	Evidence for the announcement effect of discount rate changes that reflects a public consensus of its effect.
1985	Smirlock and Yawitz	Separates endogenous and exogenous parts (anticipated and unanticipated respectively) of announcement effects and finds that only the exogenous ones lead to a significant announcement effect. Asset prices are found to quickly adapt to the new information in accordance with efficient markets.
1988	Cook and Hahn	Changes in the fed funds rate from 1974 through 1979 are found to have a significant effect on market interest rates. The effect is the same on maturities less than a year and weakens for longer maturities.
1992	Thornton	What causes the announcement effect from a discount rate change? The discount rate is found to have no direct effect on the market interest rates. There is however a positive correlation that is attributed to the new information content of the change.
1994	Radecki and Reinhart	During the period 1989-1992, the previous link between central bank rates and market interest rates seemed to have weakened and no evidence of an announcement effect was found.
1997	Neumann and Weidmann	The positive correlation between discount rate changes and market interest rates is found to be purely an announcement effect. Furthermore, only unanticipated changes are significant and the effect declines for longer maturities.
2001	Kuttner	Only unanticipated changes in the fed funds rate are found to have an economically and statistically significant effect on market interest rates. The effect also declines for longer maturity market rates.
2004	Rigobon and Sack	The impact of monetary policy on equities and interest rates is studied using a heteroskedasticity based model. A clear negative reaction from equity prices to changes in the Fed funds rate is established and a similar but positive reaction is found to exist for interest rates.

b. Changes in the Reporänta on the announcement days

Date	Actual	Expected	Unexpected
94-05-26	-0,05	-0,05	0
94-08-11	0,28	0,255	0,025
94-11-02	0,2	0,19	0,01
94-12-13	,20	0,086207	0,113793
95-02-09	,20	0,0625	0,1375
95-06-06	,25	0,208621	0,041379
96-01-09	-0,25	-0,05345	-0,19655
96-02-22	-0,25	-0,058	-0,192
96-07-30	-0,15	-0,10862	-0,04138
96-10-24	-0,25	0	-0,25
97-12-11	0,25	0,238	0,012
98-03-27	0	0	0
98-06-04	-0,25	-0,0025	-0,2475
98-11-03	-0,25	-0,18276	-0,06724
98-11-24	-0,25	-0,17034	-0,07966
98-12-15	-0,2	-0,11724	-0,08276
99-01-15	0	0,006	-0,006
99-01-29	0	-0,0144	0,0144
99-02-12	-0,25	-0,1636	-0,0864
99-02-26	0	-0,0144	0,0144
99-03-12	0	0,024	-0,024
99-03-25	-0,25	-0,12	-0,13
99-04-09	0	0,1068	-0,1068
99-04-23	0	-0,024	0,024
99-05-07	0	-0,0324	0,0324
99-05-21	0	-0,0024	0,0024
99-06-03	0	0,035	-0,035
99-06-18	0	0,0144	-0,0144
99-07-02	0	-0,0396	0,0396
99-08-13	0	-0,0156	0,0156
99-08-27	0	0	0
99-09-17	0	-0,006	0,006
99-10-06	0	0,155	-0,155
99-11-12	0,35	0,248	0,102
00-02-04	0,5	0,254	0,246
00-03-23	0	0,14875	-0,14875
00-05-05	0	0,078	-0,078
00-06-08	0	0,00875	-0,00875
00-07-07	0	0,012	-0,012
00-08-17	0	0,0175	-0,0175
00-10-10	0	0,095172	-0,09517
00-12-07	0,25	0,1725	0,0775
01-02-02	0	0,0024	-0,0024
01-03-27	0	-0,00724	0,007241
01-04-27	0	0	0
01-05-31	0	-0,01	0,01
01-07-06	0,25	0,244	0,006
01-08-24	0	0	0
01-09-18	-0,5	-0,02931	-0,47069
01-10-16	0	0,003103	-0,0031
01-12-05	0	-0,02	0,02
02-02-08	0	-0,0024	0,0024
02-03-19	0,25	0,239655	0,010345
02-04-26	0,25	0,202	0,048
02-06-06	0	-0,00625	0,00625
02-07-05	0	0,024	-0,024
02-08-16	0	-0,0024	0,0024
02-10-17	0	0,005	-0,005
02-11-15	-0,25	-0,1024	-0,1476
02-12-05	-0,25	0,0475	-0,2975
03-02-07	0	0	0
03-03-18	-0,25	-0,19643	-0,05357
03-04-25	0	0	0
03-06-05	-0,5	-0,3125	-0,1875
03-07-04	-0,25	-0,0316	-0,2184
03-08-15	0	0,0024	-0,0024
03-10-16	0	0	0
03-12-05	0	0	0
04-02-09	-0,25	-0,24357	-0,00643
04-03-31	-0,5	-0,4625	-0,0375
04-04-29	0	-0,0075	0,0075
04-05-28	0	0	0
04-06-24	0	0	0
04-08-20	0	0	0
04-10-14	0	0,00625	-0,00625
04-12-09	0	0,0025	-0,0025
05-01-28	0	0,0024	-0,0024
05-03-15	0	0	0
05-04-29	0	0	0
05-06-21	-0,5	-0,33241	-0,16759
05-08-24	0	0	0
05-10-20	0	0,00875	-0,00875

c. Regressions

Dependent Variable: MONTH
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPECTEDMONTHADJ	0.161531	0.061671	2.619236	0.0106
UNEXPMONTHADJ	0.549572	0.078121	7.034879	0.0000
C	-0.001676	0.007716	-0.217256	0.8286
R-squared	0.494957	Mean dependent var		-0.019146
Adjusted R-squared	0.482171	S.D. dependent var		0.091283
S.E. of regression	0.065688	Akaike info criterion		-2.571914
Sum squared resid	0.340874	Schwarz criterion		-2.483863
Log likelihood	108.4485	F-statistic		38.71112
Durbin-Watson stat	2.172424	Prob(F-statistic)		0.000000

Dependent Variable: YEAR
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPECTEDMONTHADJ	0.154849	0.106018	1.460591	0.1481
UNEXPMONTHADJ	0.446066	0.134297	3.321501	0.0014
C	0.006176	0.013265	0.465613	0.6428
R-squared	0.189760	Mean dependent var		-0.007927
Adjusted R-squared	0.169248	S.D. dependent var		0.123893
S.E. of regression	0.112923	Akaike info criterion		-1.488329
Sum squared resid	1.007369	Schwarz criterion		-1.400279
Log likelihood	64.02150	F-statistic		9.250998
Durbin-Watson stat	2.308149	Prob(F-statistic)		0.000246

Dependent Variable: TWOYRS
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPECTEDMONTHADJ	0.071192	0.088129	0.807807	0.4216
UNEXPMONTHADJ	0.423084	0.111637	3.789834	0.0003
C	-0.001123	0.011027	-0.101881	0.9191
R-squared	0.195791	Mean dependent var		-0.014744
Adjusted R-squared	0.175431	S.D. dependent var		0.103373
S.E. of regression	0.093869	Akaike info criterion		-1.857933
Sum squared resid	0.696100	Schwarz criterion		-1.769882
Log likelihood	79.17525	F-statistic		9.616597
Durbin-Watson stat	2.213894	Prob(F-statistic)		0.000183

Dependent Variable: FIVEYRS				
Included observations: 82				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPECTEDMONTHADJ	0.028525	0.079749	0.357687	0.7215
UNEXPMONTHADJ	0.261708	0.101022	2.590612	0.0114
C	-0.000988	0.009978	-0.099034	0.9214
R-squared	0.096179	Mean dependent var		-0.009463
Adjusted R-squared	0.073298	S.D. dependent var		0.088239
S.E. of regression	0.084943	Akaike info criterion		-2.057764
Sum squared resid	0.570015	Schwarz criterion		-1.969714
Log likelihood	87.36834	F-statistic		4.203357
Durbin-Watson stat	1.940085	Prob(F-statistic)		0.018418

Dependent Variable: TENYRS				
Included observations: 82				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPECTEDMONTHADJ	0.027510	0.071047	0.387208	0.6996
UNEXPMONTHADJ	0.161583	0.089998	1.795413	0.0764
C	-0.003043	0.008889	-0.342326	0.7330
R-squared	0.051924	Mean dependent var		-0.008244
Adjusted R-squared	0.027922	S.D. dependent var		0.076753
S.E. of regression	0.075674	Akaike info criterion		-2.288868
Sum squared resid	0.452397	Schwarz criterion		-2.200817
Log likelihood	96.84357	F-statistic		2.163311
Durbin-Watson stat	1.825469	Prob(F-statistic)		0.121706

Using the total Reporänta to explain the variation in market yield:

Dependent Variable: MONTH				
Included observations: 82				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACTUALCHANGE	0.321592	0.042106	7.637649	0.0000
C	-0.009655	0.007813	-1.235797	0.2202
R-squared	0.421688	Mean dependent var		-0.019146
Adjusted R-squared	0.414459	S.D. dependent var		0.091283
S.E. of regression	0.069850	Akaike info criterion		-2.460835
Sum squared resid	0.390326	Schwarz criterion		-2.402134
Log likelihood	102.8942	F-statistic		58.33368
Durbin-Watson stat	2.049207	Prob(F-statistic)		0.000000

Dependent Variable: YEAR
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACTUALCHANGE	0.274972	0.068572	4.009952	0.0001
C	0.000188	0.012724	0.014790	0.9882
R-squared	0.167358	Mean dependent var		-0.007927
Adjusted R-squared	0.156950	S.D. dependent var		0.123893
S.E. of regression	0.113755	Akaike info criterion		-1.485446
Sum squared resid	1.035222	Schwarz criterion		-1.426746
Log likelihood	62.90329	F-statistic		16.07971
Durbin-Watson stat	2.287662	Prob(F-statistic)		0.000136

Dependent Variable: TWOYRS
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACTUALCHANGE	0.216342	0.057849	3.739760	0.0003
C	-0.008359	0.010734	-0.778728	0.4384
R-squared	0.148808	Mean dependent var		-0.014744
Adjusted R-squared	0.138168	S.D. dependent var		0.103373
S.E. of regression	0.095967	Akaike info criterion		-1.825544
Sum squared resid	0.736768	Schwarz criterion		-1.766843
Log likelihood	76.84730	F-statistic		13.98580
Durbin-Watson stat	2.186673	Prob(F-statistic)		0.000345

Dependent Variable: FIVEYRS
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACTUALCHANGE	0.124710	0.051674	2.413383	0.0181
C	-0.005783	0.009589	-0.603111	0.5481
R-squared	0.067864	Mean dependent var		-0.009463
Adjusted R-squared	0.056213	S.D. dependent var		0.088239
S.E. of regression	0.085723	Akaike info criterion		-2.051307
Sum squared resid	0.587872	Schwarz criterion		-1.992607
Log likelihood	86.10360	F-statistic		5.824418
Durbin-Watson stat	1.918363	Prob(F-statistic)		0.018091

Dependent Variable: TENYRS
Included observations: 82

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ACTUALCHANGE	0.082813	0.045625	1.815061	0.0733
C	-0.005800	0.008466	-0.685069	0.4953
R-squared	0.039552	Mean dependent var		-0.008244
Adjusted R-squared	0.027546	S.D. dependent var		0.076753
S.E. of regression	0.075689	Akaike info criterion		-2.300293
Sum squared resid	0.458300	Schwarz criterion		-2.241592
Log likelihood	96.31201	F-statistic		3.294446
Durbin-Watson stat	1.819976	Prob(F-statistic)		0.073262

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