

Unconventional monetary policy at the international,  
national and local level

*To Linnaea*

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**Unconventional monetary policy at the international,  
national and local level**

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## **Abstract**

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This thesis is based on four essays. The first investigates time-variation in the relationship between short interest rates and consumption in the USA and Sweden. Results based on Bayesian VAR models indicate that the short rate ceased to respond to consumption shocks when constrained by the zero lower bound. Analysis using shadow rates indicate that the Federal Reserve was able to conduct effective monetary policy through unconventional instruments, but that the Riksbank was not.

The second essay investigates the relation between municipal and government bond yields during the time when the Riksbank conducted quantitative easing in terms of government bond purchases. According to the results the spread between municipal and government bonds increased on days when the Riksbank announced bond purchases. However, further analysis using VAR models suggests that this was reversed in the medium run and the spread decreased – at least temporarily.

The third essay studies the risks associated with municipal bonds. Due to previous bailouts it is not clear whether municipal debt has an implicit government guarantee. If there is a government guarantee municipal bonds should not be associated with credit risk, at least not in excess of government bonds. Analysis of the spread between government and municipal bonds, using a VAR model and looking at the variance decomposition and impulse-response functions, establishes that municipal bond yields are associated with credit risk.

The final essay studies the forecasting accuracy of the policy rate path published by the Riksbank. For the period 2010 to 2014, the forecasting accuracy of the policy rate path was significantly worse than that of a forecast implicit in market prices. The poor forecasting accuracy during this period is attributed to that the Riksbank during this period had incentive to present a higher than expected policy rate path. This because it had reason to want long run interest rates to be high in order to discourage high debt levels due to high housing prices.

*Keywords:* Bayesian VAR, Cointegration, Forecast evaluation, Municipal debt, Spread, Stochastic volatility, Sveriges Riksbank, Time-varying parameters, Unconventional monetary policy

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## Introduction

“Debt continues to be the bedrock upon which this economy is built”. The quote comes from the movie *The Big Short* and it is uttered by one of those pompous executives that the audience immediately knows to be an ignorant idiot. But it is true. Just about everyone borrows, and anyone who does not borrow almost certainly saves. Debt and interest rates therefore connects almost all aspects of society. When interest rates change it affects where people live, what they eat, if they have children, where they work. It affects if a road is built, if a new drug gets funding and whether new trees are planted. Frankly it is a bit daunting to think about. But if the financial crisis told us anything it is that we must not shy away from complexity. No one can understand the financial system, but we can address the issues we see and believe that our understanding improves with trying. For some this entails studying fat tailed distributions in order to account for the fact that the world is less normal than what would be convenient. For others the question is if housing prices are sustainable and what (if anything) should be done to prepare for the next unexpected swing. For this thesis it entails studying the intersection between monetary policy, financial risks and local governments.

One of the peculiarities of recent financial economics is that monetary policy has been constrained by the notion that interest rates probably should not become too negative. The low interest rates are driven by low inflation rates, which has prevailed in spite of decent economic growth. It would be interesting to ponder why this happens, but it is imperative to understand what it implies. Are we walking into a new trap? Central banks have not faced this uncharted environment with passivity. Instead they have employed new methods to fulfil their objectives. The most prominent is probably to purchase bonds from the market, so called quantitative easing. Another unconventional policy is that central banks inform the public about its intentions for the future, hoping that this will alter expectations and thereby affect interest rates. This is called forward guidance.

Trying to understand this changing economic environment is a big topic in recent research. One strand of research focus directly on time-variation in macroeconomic relations (Cogley & Sargent, 2001; Primiceri, 2005; Stock, 2001). This question has become even more prominent since central banks have become constrained by the zero lower bound (Karlsson & Österholm, 2018). As central banks then must resort to unconventional instruments it raises the question of whether they can still be as effective in

responding to the real economy and influence it. This is the topic for the first essay in the thesis titled *Consumption and the interest rate – A changing dynamic?*. According to the findings unconventional monetary policy instruments have enabled monetary policy to remain responsive to consumption growth shocks in the US, but not in Sweden.

The question of the effectiveness of unconventional monetary policy has also been addressed by studying how interest rates and asset prices respond to the unconventional instruments. Since bond purchases is perhaps the most prominent type of unconventional monetary policy it is not surprising that they have received much attention in the literature (Gagnon et al., 2011; Joyce et al., 2011; Krishnamurthy & Vissing-Jorgensen, 2011; Szczerbowicz, 2015). The second essay in the thesis, *The Relation between municipal and government bond yields in an era of unconventional monetary policy*, studies the effect of quantitative easing on municipal bond yields in Sweden. The results indicate that municipal bonds are affected by quantitative easing, something that corroborates previous results for Sweden on other financial assets (De Rezende, 2017). One reason why municipal bonds are interesting in this context is that they are close substitutes to government bonds, at least regarding the characteristics of the issuer. In fact it could be argued that Swedish municipal bonds have an implicit government guarantee in which case they arguably are no more likely to default than government bonds. The third essay in the thesis, *A guarantee – Does the obligee agree? A decomposition of sub-sovereign bond spreads*, investigates the yield spread of municipal bonds in Sweden and establishes that the spread is associated with credit risk, meaning that the market does not regard municipal bonds as safe as government bonds.

Even though there are direct channels through which both quantitative easing and the policy rate can influence the economy, one central aspect of monetary policy is always to manage expectations. What the market believes the central bank will do in the future can be as important as the actions actually taken. A constrained policy rate cannot always be lowered, but expectations can still be managed. One straightforward way to manage expectations of what the policy rate will be in the future is by stating what the policy rate will be in the future, i.e. publishing a policy rate path. Actually, publishing policy rate paths has a longer history than unconventional monetary policy and the Riksbank has published such paths since 2007.<sup>1</sup>

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<sup>1</sup> Central banks in the Czech Republic, Israel, Norway and New Zealand have also published similar paths since before the zero lower bound.

But the path has not always been uncontroversial. A previous member of the board, Lars E. O. Svensson, has claimed that the Riksbank “leaned against the wind” during the period 2010 to 2014, which caused them to publish “unreasonable” policy rate paths (Svensson, 2015).<sup>2</sup> The final essay of the thesis, *A forecast evaluation of the Riksbank’s policy-rate projections*, studies the accuracy by which the Riksbank’s policy rate path forecasted the actual policy rate. Results indicate that this accuracy was significantly worse than a forecast implicit in market prices specifically for the period 2010 to 2014. I argue that the reason for this result is that the Riksbank, during this period, had an incentive to allow the policy rate path to deviate from expectations. However, with forward guidance central bank again has an incentive to deviate from expectations. This since the objective of forward guidance arguably is to decrease long term interest rates. Understanding the implications of such incentives is therefore relevant in the debate about unconventional monetary policy.

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<sup>2</sup> Here “leaning against the wind” refer to that the Riksbank was trying to increase interest rates in order to discourage private debt levels, fuelled by rising housing prices.

## Theoretical framework

There are three theoretical concepts that are essential for this thesis. The first is the dynamic IS-equation. Though not explicitly discussed in the essays it is the theoretical foundation for much of the analysis. The dynamic IS-equation describes how interest rates affects the real economy. “I” stands for investment and “S” for savings. In the typical (New Keynesian) model interest rates affect individuals’ decisions to consume or save. If the interest rate is high saving is more appealing and increases. Consequently consumption decreases. As total savings equals total investments and total consumption equals total production this implies a further relation between interest rates and the real economy (typically modelled with production as a function of the interest rate). In the New Keynesian framework this is combined with a Philips curve – which links inflation with the real economy – to describe the non-policy part of monetary policy.<sup>3</sup>

The second concept that is essential for this thesis is the risk-premium. A risk-premium is the reduction in price a buyer demands in order to buy a risky asset. Because a lower price implies a higher expected return this is equivalent to saying that the buyer demands a premium in expected return. One of the key insights in asset pricing is that not all risk comes with a premium. If it is possible to buy assets whose risks offset each other, the risk is neutralized and there is no reason for the seller to offer a risk premium.<sup>4</sup> With respect to interest rates and bonds two important systematic characteristics are liquidity and credit risk. If an asset has high liquidity it is always possible to sell it, even when the market at large is constrained. Credit risk is the risk that a debt will not be repaid. This is a systematic risk since it commonly happens that many debtors fail during particular crisis periods. Bonds that are illiquid or that are issued by debtors who might default on their debt therefore have a higher expected return than safe and liquid assets. The return that the buyer receives if the asset is held until it is repaid (maturity) is called yield to maturity, or just yield. The difference in yield between safe and risky assets is called the “yield-spread”. This is the standard estimate of the risk premium received for holding the risky bonds.

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<sup>3</sup> This argument holds for closed economies. In an open economy export/import and foreign investments must be considered.

<sup>4</sup> This is the logic behind diversification. If one hold sufficiently many assets it is only co-movement among assets that will affect the total value of one’s wealth.

The third concept that is essential for this thesis is the yield-curve. The yield-curve is drawn with the yield on the vertical axis and time to maturity (time until the debt will be repaid) on the horizontal axis. The interest rate payed on a one year loan is typically different from the interest rate on a two year loan and so on. Marking down these rates/times and drawing a line through them gives a yield-curve. Theoretically there are two things that decide what this curve looks like. One is the expectations of what the short rate will be at different times in the future. The second is a risk-premium received to compensate for the fact that it is generally riskier to lend money for a longer time. This risk-premium is called the term-premium. Note that there is a big difference between the yield curve, which depends on expectations about the future, and the realized short rate, which is what actually happened (in the future).

## Methodological considerations

All essays in this thesis use time series analysis and three out of four use vector autoregressive (VAR) models. A basic (univariate) time series model uses past observations of a variable to study it, possibly together with past and present observations of other variables. One example of time-series data is your monthly income over a period of time. A time series model then describes how your income each month relates to some set of historic variables. This is in contrast to cross sectional data (which is the monthly income of several people at a specific date) or panel data (which is the monthly income of several people over a period of time). In a VAR model two or more time series are modelled together. For example your monthly income and consumption are likely somehow interdependent. A VAR-model describes how each variable depends on past values of both itself and other variables. It is thus a “seemingly unrelated regression”. The “unrelated” comes from the fact that each variable has its own equation. The “seemingly” comes from the fact that these single equations should not be considered independent from each other. The secret is in the error-terms. If income at one point in time happens to be large according to its equation (above its expected value), consumption will likely also happen to be large. A VAR allows us to model these dependencies and dynamics. One direct implication of the dependencies is that the variation around the mean of each variable is partly dependent on the variation in the other variables. The decomposition of variance into parts dependent on different variables is called “variance decomposition”. Even though VAR models capture the dynamics of the system it is typically not straightforward to understand these dynamics by just looking at the parameters of the model. The usual way to present the dynamics is instead to see what happens if only one variable deviates from the mean in only one period (an impulse). The responses to these impulses are typically presented as graphs and are called “impulse response functions”.

In the first essay, *Consumption and the interest rate – A changing dynamic?*, I estimate VAR-models where both the parameters and the volatility are allowed to vary through time. When estimating these models I use a Bayesian approach rather than the frequentist approach used in the other essays. Philosophically a difference between these is that the frequentist approach is based on the insight that sufficiently many random draws from a population will reveal information about the true distribution of the population. A Bayesian approach instead proposes that any study starts with a

set of beliefs about reality which we then update as more information is revealed. How we update beliefs also depend on how credible we believe the new information is. In practice the Bayesian approach is standard when dealing with time-varying parameter VAR models. One reason is that a frequentist approach typically compares the likelihood of the theoretical model given a set of parameters. When the parameters are time-varying there are more parameters than time periods, so the parameters must be restricted in order to find a solution. Even with standard restrictions the likelihood function tends to have many potential solutions, which makes finding the maximum likelihood a heavy task. Updating is comparatively more straightforward, especially given how the models are set up. There is a method developed to solve these models using a frequentist approach, (Giorgi et al., 2017) but as far as I know this has not yet been applied in any published work.

The use of time series methods in this thesis is largely decided by the data, but when studying municipal and central government bonds there are several bonds from each issuer. There is therefore a panel of data. My coauthors and I turn these panels into time-series. The reason is that we are interested in comparison between the issuers. Bond prices differ much depending on time to maturity and the coupon of the bond. In order to compare bond prices, the bonds of each issuer must therefore be matched with a similar bond by the other issuer. But here there are so few bonds that it is not feasible to find pairs that are similar enough. We therefore summarize the information in the bonds by drawing yield curves and use the difference between the yield-curves to represent the difference between issuers. An alternative would be to do as Gilchrist and Zakrasjšek (2012) and only draw the yield-curve for the government bonds. Adjusted for the coupon this could then be compared to the individual municipal bonds. However, we do not expect there to be any relevant difference in liquidity or credit risk between the municipal bonds. There is therefore little value in estimating specific spreads for each bond. Since we have so few bonds this approach might also induce a problem with the individual bonds “rolling down the yield curve”. Furthermore, the ends of the yield curve are often problematic and through our choice of method we give more weight to bonds in the middle of the curve. What we do can be described as comparing two “synthetic five year zero coupon bonds”.

Another choice we make is how to estimate the yield curve. In this thesis two methods are used – smoothing splines (de Boor 1978) and the Nelson-Siegel method (Nelson and Siegel 1987). When using splines the curve can

be defined to be very flexible in which case it comes close to each bond in the data. In practice this gives strong weight to the bonds closest to the five year time to maturity where we estimate the spread. The Nelson-Siegel method uses a functional form which will deviate more from the individual bonds. It, in some sense, averages the information given the functional form. A sort of midway would be the Nelson-Siegel-Svensson model (Svensson, 1994), which is a more flexible version of the Nelson-Siegel model. Given the limited number of bonds it is however not obvious that this higher flexibility is preferable. The parameters in the Nelson-Siegel model have economic interpretations and one alternative way to go is to make assumptions about the evolution of these in order to fit the model (Diebold and Li, 2006; Diebold, et al., 2006). Though intriguing, interpreting the parameters is quite far from the rather instrumental use made of yield curves in this thesis.

In order to determine if the yield spread of municipal bonds are affected by credit risk, the third essay, *A guarantee – Does the obligee agree? A decomposition of sub-sovereign bond spreads*, uses variance decomposition and impulse response functions. Variance decomposition is an established method to determine how much information the regressors provide to the model. In combination with significant impulse responses this can establish whether credit risk influences the yield spread. However, these estimates does not directly inform us about how much of the expected yield spread that is a cost of credit risk and how much is due to liquidity. The analysis is therefore complemented with a time series regression using a portfolio of credit default swap spreads to capture the credit risk premium.

The only essay in this thesis not using VAR-analysis is *A forecast evaluation of the Riksbank's policy-rate projections*, which instead uses a standard set of forecast evaluation tools. The only thing that is slightly non-standard is that I use a dummy variable to investigate if the forecasting performance of a particular period stands out in the data. This approach is not controversial and has been used for similar purpose before (Natvik et al., 2019). But there are other ways to address the issue. Acknowledging that I am studying a structural break in the time series there are methods to let a model find the breaks in the data (endogenously). Using a dummy variable it is the author who defines the period. Throughout this essay, the most

straightforward method is used and so also with the choice of dummy variable to specify a particular period.<sup>5</sup>

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<sup>5</sup> It might be noted that preliminary results using a CUSUM-chart is consistent with the findings in the essay, though these results are omitted from the analysis and only available from the author on request.

## Data considerations

All essays in this thesis estimate some relation with government interest rates. Both the second and the third essay compare government issued bonds with bonds issued by the municipal sector. In these essays the municipal sector is represented by Kommuninvest of Sweden AB. Kommuninvest of Sweden AB (henceforth Kommuninvest) is a local government funding agency owned by Kommuninvest Economic Association, which in January 2020 consisted of 278 (out of 290) municipalities and 12 (out of 21) regions. Kommuninvest borrows capital on the financial market and lends exclusively to its members. In 2018 debt issued by Kommuninvest made up 54 percent of the total debt of the municipal sector. Its debt is guaranteed jointly by all members and it has the highest possible credit rating at both Moody's Investor Service (Aaa as of 2002) and Standard & Poor's (AAA as of 2006) (Kommuninvest of Sweden, 2020). Considering its strong position in the market, its exclusive lending to the members and the joint repayment guarantee by a vast majority of the municipal sector, Kommuninvest is a reasonable representative of the municipal sector for the purposes of these studies. Another advantage using Kommuninvest is that it has market-maker agreements on selected bonds. This ensures that there exists a reasonable series of price data. The alternative to using Kommuninvest bonds would be to use bonds issued by individual municipalities. These issuers are, however, typically large municipalities and not representative of the municipal sector. Also, the price-data is less reliable given that the quoted prices are not necessarily tradable, the volumes are typically smaller and trades are even less frequent.

In the third essay government bonds represent the risk free asset. This is fairly standard, considering that government assets are highly liquid and that governments in principle can print money to repay debt if needed. However, there are some concerns. One is that government bonds are too liquid and in fact have a negative liquidity premium, which implies that a liquidity spread would be overestimated (Longstaff, 2002). Another possible concern is that there has been examples of governments defaulting on debt. Other alternatives are interbank rates or swap rates, but these also have their problems. Rates on government issued securities can still be considered the conservative choice to represent the risk free asset.

Using the government bonds the third essay decomposes the yield-spread into credit risk and liquidity risk. But doing so requires finding variables that captures these risks. Since risk-analysis is a central part of finance there is a multitude of such proxies, but they are often based on trade data or

cross sectional price data. Even though Kommuninvest bond data is relatively good there are very few actual trades outside of the interbank market. In order to capture the risks for the municipal sector we therefore employ a set of variables based on either alternative data from Kommuninvest, data on closely related securities, or market wide data. It is very likely that some of the variation that goes unexplained in our model would have been captured if we had asset specific data. However, as discussed earlier, only risk that affect many assets should come with a risk premium. Since we want to study risk premiums, risks in closely related assets should capture the changes in risks that we are interested in. Still, it is common in the literature related to bonds to use asset specific variables, also in risk factor decompositions. But in those cases decomposition is most often done in the cross-section and therefore the relative liquidity of assets becomes more important. In this essay we can only study the time series. The parameters estimated here are therefore directly related to how the asset responds to the risk factors, not the responsiveness compared to other assets.

## The essays

### **Consumption and the interest rate – A changing dynamic?**

This essay addresses the question of whether the relation between the short interest rate and consumption growth has been stable over the Great Moderation and the financial crisis. The question is addressed by assessing models using constant or drifting parameters as well as models with or without stochastic volatility in a Bayesian VAR framework. This approach has previously been employed to similar purposes in related studies on macroeconomics and monetary policy (Cogley and Sargent, 2005; Korobilis, 2013; Nakajima, 2011; Primiceri, 2005). The essay specifically uses the method developed by Chan and Eisenstat (2018) in order to choose the model that best describes the data. Results are then analyzed based on the preferred model. The analysis is conducted for both Sweden and the USA, where Sweden is a small and open economy while the USA is a large economy. According to the results the response of interest rates to shocks in consumption growth decreases during times when monetary policy is constrained by the zero lower bound. This is not surprising considering that central banks are less able to use the policy rate to respond to consumption shocks when the policy rate is constrained. However, central banks have not been passive in face of the lower zero bound. Instead they have employed unconventional monetary policy to influence market rates. One way to capture the effect of unconventional monetary policy is by using what is called “shadow rates”, which are constructed specifically for this purpose. Analysis using shadow rates implies that US monetary policy remain highly responsive to consumption also when faced with the zero lower bound, while Swedish monetary policy is not. Looking at the policies employed it is not obvious that the Riksbank is any less responsive as regards the size of the policies employed, which suggests that it is the effectiveness of the policies that differs. According to Díez de los Ríos and Shamloo (2017) small open economies cannot sufficiently affect the term premium component of the yield because international markets provide too many close substitutes to domestic government debt. This explanation could apply to the difference in the responsiveness to consumption growth between Sweden and the USA found in this essay.

## **The relation between municipal and government bond yields in an era of unconventional monetary policy**

In this essay we investigate how the five-year Swedish municipal bond yield has been related to the corresponding yield on government bonds during the period when the Riksbank has employed quantitative easing. The analysis is conducted in two parts. First we conduct an event study to assess the short-run effects of the Riksbank's bond-purchase announcements. The analysis is based on daily data on government and municipal bond yields. According to the results a 100 basis point change in the government bond yield typically results in a 67 basis point change in the municipal bond yield over the day. Estimates from the announcement days also indicate that quantitative easing typically was successful at lowering yields on both government bonds (40 to 50 basis points) and municipal bonds (30 to 35 basis points). In the second step we estimate bivariate vector autoregressive models in order to study the dynamic relationship between the yields. Even though the link to unconventional monetary policy is not as direct as in the event study case the analysis is conducted over a period when the repo rate was potentially constrained by the zero lower bound. Arguably unconventional monetary policy was affecting results throughout the period, much as monetary policy would in normal times. Our VAR analysis indicates – in line with the event study – that an unexpected decrease in the government bond yield initially increases the municipal yield spread. However, after approximately four weeks, the effect has been reversed and the municipal bond yield-spread is lower than it was initially.

## **A guarantee – Does the obligee agree? A decomposition of sub-sovereign bond spreads**

The purpose of this essay is to investigate if credit markets believe that municipal bonds have a credit risk premium (larger than that on government bonds). The essay thus belongs to an established literature decomposing bond spreads in general and municipal bond spreads in particular (Longstaff et al., 2005; Schwarz, 2018; Schwert, 2017). Although municipalities, just as states, have a tax base as a security for its loan, municipalities are not allowed to print money. It might therefore happen that municipalities are not able to meet its obligations to creditors. However, if there is a government guarantee of municipal debt (explicit or implicit) this implies that municipal debt is as secure as government debt. An ambiguity in assessing the risks in the Swedish municipal bond market was introduced in 1992 when

the newly revised Swedish Local Government Act was undermined by a central government bailout of a municipality. It is therefore not clear whether municipal debt has credit risk. In this essay we study the yield-spread of the municipal sector and try to decompose it into liquidity and credit risk. Considering the low frequency of trades in the bonds there is reason to suspect that yields might react to risk factors with some delay. Using variance decomposition we conclude that 35 percent of the forecast-error variance is attributed to shocks to liquidity and 27 percent to shocks to credit. Using a credit default swap portfolio in a time-series regression we attributes 37 basis points to the credit risk spread – out of the 80 basis point yield-spread. Since the estimated spread is non-zero, perceived credit risk of municipal bonds is not equal to that of the government bonds. Thus, investors and creditors in general do not believe in the existence of a central government guarantee. This in turn implies that municipalities potentially benefit from actions that increase their credit worthiness.

### **A forecast evaluation of the Riksbank's policy-rate projections**

This essay evaluates the forecasting performance of the policy rate path published by the Riksbank using data from 2007 to 2019. In its construction it is as an extension of Beechey and Österholm (2014) and with some additions it uses the standard set of tools employed in that essay. The forecasting performance of the Riksbank is compared to a forecast implicit in market data. According to the results the Riksbank's forecast was at par with the market-based forecast, except for the period 2010 to 2014. During this period the board of the Riksbank on several occasions expressed concerns with rising housing prices (Goodfriend and King, 2016). In the essay I argue that the incentive to increase interest rates in the market caused the Riksbank to publish a policy rate path that lay above what the market forecasted. The fact that the Riksbank turned out to be less accurate was because the forecast did not only reflect beliefs about the future, but also incentives to affect market interest rates. According to Svensson (2015) the Riksbank actively moved to increase interest rates in order to stem the increase in housing prices during this period.

## Concluding remarks and policy implications

Some of the most interesting results in the thesis regards the effectiveness of unconventional monetary policy. And they are somewhat conflicting. Results from the first essay suggests that the US central bank (the Federal Reserve) is able to respond to shocks to consumption growth using unconventional monetary policy, but the Riksbank is not. On the other hand the second essay suggest that during the period when the Riksbank has been using unconventional monetary policy the spread between municipal and government bond yields has been decreasing. Since municipal debt is risky (according to the third essay) this suggests that risk premiums have been decreasing. If this holds more generally it implies that the Riksbank has not been able to respond to real economy shocks using unconventional monetary policy, but it has decreased risk premiums. This thesis focuses on municipal bonds which arguably are closely linked to government bonds. Previous research indicate similar pass through to other assets, but as far as I know there is not that much research on long run relationships like the one estimated in this essay. It would be interesting to see if other assets exhibit a similar decrease in spreads over the period. Furthermore, it would also be relevant to see if the findings regarding consumption holds also for other real variables, perhaps especially for investments. Investments is a variable that is closely linked to interest rates and studying how it interacts with interest rates could help clarify the explanation of the results.

This thesis only takes small steps towards large questions. For example, the most interesting question when studying monetary policy is perhaps whether it is successful at achieving its goals. But say that we believe that the Riksbank was leaning against the wind, that this gave them incentive to set a high policy rate path and also that this reduced their credibility and thereby their ability to affect the economy. A prudent first step in such analysis is perhaps to establish that the forecast was poor and if possible try to relate that to leaning against the wind. The second step might be to establish whether this lack of accuracy affected credibility. If this is established it might be time to estimate the consequences for effectiveness. This thesis only addresses the first of these steps but this alone might have policy implications. If the policy rate path is a policy instrument it implies that it will be used to implement policy. If the policy objective is to decrease (or increase) interest rates that is what it should do. However, interest rates are based on market expectations of future central bank behavior (future short rates). So the only way to affect interest rates is to deviate from market expectations.

If market expectations are wrong this is not an issue. If market expectations are well informed there is an issue, since the only way to affect interest rates is by deviating from well informed expectations. The problem is that deviating from well informed expectations will, on average, result in poor predictions. This might be considered a problem in itself. In a second step, making poor predictions might also affect credibility and if credibility is lost it is not possible to affect expectations any more. Forward guidance is thus only applicable if the market is wrong or if the market is gullible. If we assume that the market typically is neither, the idea of forward guidance as a policy instrument will not be a good idea. Investigating the merits of this argument is, however, a topic for future research. This thesis is only one step on the road ahead.

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