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Monetary Policy and Financial Statements: Digesting the Firm Balance Sheet

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Abstract. The aim of this study was to examine the connection between the key interest rate and firm leverage, and how that connection is affected if the changes in the rate is anticipated or not. In this study we cannot show that the Swedish repo rate is associated with firm leverage. We can however support earlier evidence on the effect of friction when anticipating monetary policy changes. The only significant capital structure determinant we can find support for is profitability. We can thereby not prove a consistent relation between leverage and macroeconomic factors.

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Table of Content

1 Introduction

How do firms make decisions about their capital structure, and how can monetary policy affect those decisions? The basis for modern thinking of capital structure is heavily influenced by the propositions in the Modigliani–Miller theorem, but as we allow for market imperfections, the frictionless implications get distanced. As the leverage increases, so does the risk of default. From a theoretical standpoint, defaulting is just a swap in ownership, but in practice, the default is associated with bankruptcy costs. This proposes the idea of an optimal capital structure, consisting of a dynamic trade-off in reaping the benefits of leverage and the expected cost of a default. The inherent risk of leverage comes from both the macro environment and the more internal and industry-specific factors, and they all contribute to the risk of ending in a bankruptcy. From an investor perspective, the protection from the riskiness is dealt by the size of collaterals or raising the interest rate, in response to changes in the market environment. Regarding the field of optimal capital structure, increasing cost of debt would then be accompanied by a period of deleverage.

In a world with friction, costs associated with bankruptcy are unavoidable. At the same time, debt-financing is a fundamental function for firms to raise capital. One of the more powerful factors that affects the cost of debt and help drive the short-run economic fluctuation is the key interest rate of central banks, but the question is how these fluctuations shape firms´ choice of capital structure. Theoretically, firms should adjust their level of debt according to changes in the cost of debt, but is that the case in practice? We will examine the relation between this monetary policy tool and the leverage of firms to see if theory is interrelated with reality.

The aim of this study is to discover whether current theories on the relationship between policy rates and leverage is consistent on a micro level, and how the anticipation of policy changes influence the relation it has on leverage. The study makes use of a quantitative research method because of the data requirements that our study demands.

The research questions that we will try to answer is, can we see how Swedish firm leverage respond to a changing repo rate, and how will that response vary if the change was anticipated or not.

The study is structured as follows. Section two presents the current states of knowledge by describing the main channels of monetary policy and prominent theories of capital structure determinants relevant for the hypotheses. In section three the research design is described together with the considerations made in the data. The fourth section addresses the results from the statistical analysis. The fifth and final section contain a summary of the study and concluding remarks.

2 Literature Overview and Theoretical Framework

The nature of the key interest rate very much follows and influence the economic activity. Therefore, a plausible statement is that most of the firm elements will correlate with the key interest rate since its movement is continuously monitored and forecasted. This pose a difficulty in determining the exogenous effect of the rate, as firms' reactions to it are mostly anticipated, and associated actions are thus more proactive, rather than reactive. In that sense, the key interest rate coefficient could already be entirely captured by the balance sheet items. That is an issue as we try to capture the subtle. The analysis conducted in this study will estimate the general importance of factors on leverage, rather than assuming causal responses.

To get an overview of the research and theories that help explaining the finance decisions of firms, we have summarized relevant theories and findings and accompanying implications. These considerations will help to set up the hypotheses. An additional consideration is the focus of a sub-time period (2010-2011) that we will emphasize to be a setting of unanticipated changes in the key interest rate. The justification for classifying this period as unanticipated is influenced by previous work of Fernström and Qi (2019), the arguments highlighted will be summarized.

Conventional Monetary Policy

We initially separate the long run and short run effects of the policy. In the long run, the effects of the monetary policy transmission mechanism on the economy is neutral, apart from the determination of the inflation rate. The study only addresses the short run, where there is an effect both on the inflation, but also on the real economy. The conventional monetary policy

tools are open market operations, reserve requirements and the discount rate, that together help shape the official interest rate faced by the different economic actors.

The official interest rate transmits mainly through signalling and the market interest rate. The signalling conveys the expectations of the future market conditions, indicating a period of saving or consumption. Different from the area of anticipations, the market interest rate is subjected to less potential noise. It operates through the short period transfers in the interbank market to adjust for excess and deficit in funds, motivated by the reserve requirement, short-term lending, and deposit rates. When the central bank increases the policy rate, the law of one price ensures that arbitrage opportunities are eliminated, i.e., the banking institutions follow and increase their lending rates. The securities with the shortest maturities are affected directly, while the longer are affected ascendingly.

The market participants decide on the maturity of their loans, depending on their anticipation of changes in the rate. If the policy rate is expected to increase, loans and investments with shorter maturities are preferred, as the expected return gets higher. This corresponds with a higher interest rate for securities with longer maturities at the capital market, e.g. government bonds or longer bank loans. Since changes in the policy rate tends to be persistent, the actors adjust their forecasts. Using the same logic as in the relationship between the central bank and the banking sector, the banking sector transmits changes to firms and households (Hopkins et. al., 2009).

As mentioned, market rates contain noise, thus preventing a perfect correlation with the policy rate. An increasing rate would suggest a rise in the long-term market rate, but can equally be interpreted in an unexpected setting, as a powerful signal in battling inflation. In that situation behaviour of participants would cause an inverted yield curve instead (Ellingsen and Söderström, 2001). Market rates can also change prior to notices or press releases from the central bank if the participants act in foreseen.

The Four Transmission Channels

The influence that the policy rate has on the real economy could be classified in four different channels. The effects are identified as changes in asset prices, money credit, bank rates and exchange rates.

The interest rate channel relates to the Fisher equation, how the expectation of stickiness in inflation drive changes in the real interest rate when the central bank changes the nominal rate. It is in turn the real interest rate that shape consumption behaviours and the aggregated demand. When the policy rate is increased, the real rate gets increased, leading to a drop in aggregate demand, followed by a drop in aggregated output and demand for factors of production. As production costs gets cheaper, adding to the rest, the overall pricing level follows and creates a downward spiral in inflation and economic activity.

The credit channel concerns the reduction in net present value from an increasing discount rate, creating a pricing decline in assets. As the declining value on collaterals cause a compensation through the relatively higher raise in lending rates, the banks get more restrictive in their lending.

When the policy rate is increased, the exchange rate channel strengthens the national currency, holding the world state fixed. This have implications on the demand for domestic and foreign goods as it generates an advantage to the import sector, and a disadvantage to the export sector, given the sticky inflation assumption.

The cost channel addresses that the economy is not only indirectly affected by the change in aggregate behaviour, but also directly in the financing costs. The channel predicts an opposite firm-reaction compared to the other channels, since increasing costs normally is compensated by higher prices, thus creating a higher price level and boosted inflation. Still, this is an effect that tends to be dominated (Hopkins et. al., 2009).

Trade-off Theory of Capital Structure

Modigliani and Miller (1958) argue that in a perfect market without taxes, the capital structure is irrelevant for firm value. In a frictionless world we thus expect an increasing cost of capital to affect the capital structure of firms homogeneously. As we include market imperfections, the policy rate would increase the discount rate as it gets transmission through the cost of debt, and refrain firms from investments financed by debt, due to new optimal capital structure.

According to the trade-off theory (Robichek and Myers, 1965) the firm has to do a trade-off between the tax advantages of debt (in form of interest tax shields) and the marginal cost of the disadvantages of leverage (includes costs of financial distress). When doing this trade-off, firms will find their optimal capital structure. Kraus and Litzenberger (1973) further evolve this theory by defining the cost of financial distress as the present value of bankruptcy costs times the corporate tax rate. A firm would then increase its leverage until the interest is equal to its EBIT. By this theory follows that tangible assets, firm size and profitability has a positive association with leverage, and that growth has a negative association with leverage. This implies that one should control for tangibility, profitability, tax, and growth while investigating what impact monetary policy has on leverage.

Risk-shifting

Stiglitz and Weiss (1981) point toward a gambling tendency to deal with the increasing debt burden for firms that are more financially distressed, due to the increasing financing costs and probability of default. In a model of credit rationing, there is a proposed consequence of adverse selection inviting the risk of a lemons and plums situation. The model predicts an inhibition in the likelihood of firms to invest themselves out of the leveraged situation, because the banks interpret the signal of firms willing to accept a higher credit as negative. The model is in line with the financing difficulties faced by firms with debt-overhang (Myers, 1977). It is consistent with the purpose of the monetary policy, i.e., that firms will decrease their debt, but it suggests that firms at the higher end of the debt spectrum will have an easier time selling assets to decrease the exposure to financing costs, rather than undertaking projects with positive net present values. This could imply a similar leverage ratio, but with a smaller balance sheet. The risk-shifting literature therefore predicts a decrease in total debt, but not necessarily a decrease in leverage. This propose a liquidity or solvency measure as a contributing determinant in the capital structure.

Pecking Order Theory

The pecking order theory (Myers, 1984: Majluf and Myers, 1984) rejects the idea of an optimal capital structure, and instead focuses on information asymmetry in the financial market. They mean that signalling and costs associated with adverse selection affect how firms choose their capital structure. They find that there is a certain order in how firms choose their source of

financing. Firms choose retained earnings as their prime source and external financing, debt and equity issue, as a second source of financing. Among the alternatives of external financing, firms will choose debt over equity. This is the case because debt is a safer security than equity, implying that debt holders will be less sensitive to the information asymmetry than equity holders, thus requiring a lower premium. According to this theory, profitability is negatively associated with leverage.

According to Huynh et. al (2018) the preference towards debt is even stronger among private companies. The reason is that the information asymmetry between managers and investors is larger when the firm is private than when it is public. One could expect that a change in monetary policy would have a more significant impact on the capital structure on public firms, since the private ones use their retained earnings on a higher degree.

Borrowing Costs and Financial Friction

Fernström and Qi (2019) show that the debt and equity holder conflict gets worse for firms with debt maturing in a period of a high interest rate. The highly leveraged firms suffer from debt overhang and decreases their investments. This suggests that firms can take actions to favour equity holders and excessive risk-taking, highlighting how financial friction both limits and refrains firms from leveraging, with regards to the optimal capital structure. Additionally, this implies that anticipated moral hazard problems puts further difficulties in obtaining financing. If the change in interest rate is anticipated by the firms, this motivates a relatively more flexible stance to leverage for highly leveraged firm. With an unexpected increase, we would expect both that these firms are incentivized to deleverage more in the beginning of a sudden forecasted interest upturn, and that they are in a worse condition to do so. This suggest a relatively stronger association in unanticipated policy settings.

Ottonello and Winberry (2018) find that the responsiveness to monetary policy changes is largely affected by the distance to default. Firms characterized by lower debt and higher credit ratings shows e.g. greater tendencies to invest in periods of expansionary unanticipated monetary policy. Kashyap et. al. (1994) and Gertler and Gilchrist (1994) argue that firm size and degree of financial constraints influence the response in capital structure. Further, Ihuissier and Szczerbowicz (2018) show that conventional monetary policy easing increases firm's

external financing through bank loans and that unconventional monetary policy easing increases firm's external financing through issue of bonds. One could thus expect that less financially constrained firms are those that deleverage the most or more immediate if the policy change was unanticipated due to being more flexible.

Macroeconomic Conditions´ Effect on Capital Structure

Korajczyk and Levy (2003) investigate how different types of firms respond to macroeconomic conditions. They show that the leverage of unconstrained firms follows a counter-cyclical pattern, while the leverage of constrained firms follows a more pro-cyclical pattern. From this follows that the actual macroeconomic conditions may have a larger effect on leverage than monetary policy following those conditions. This means that one must control for changes in other macroeconomic factors such as GDP when investigating what effect a change in the key interest rate has on firm leverage. Due to the difference in behaviour between constrained and unconstrained firms, one should also add a measure of liquidity as a proxy for how financially constrained the firm is.

Bernanke and Gertler (1995) use firms interest coverage ratio as a measure of firms' financial health and find a strong correlation between the federal funds rate and the interest coverage ratio. They show that after an increase in the federal funds rate, the inverse interest rate coverage ratio raises almost at the same time. They find that short-term borrowing increases after a tightening in monetary policy and because of this increase, interest expenses remain high several quarters even though short-term interest rates themselves are dropping.

Variance Analysis on Capital Structure Determinants

The research field of capital structure determinants has traditionally put emphasis on the firm-characteristics in variance analysis (e.g. Jermias and Yigit, 2019). Gungoraydinoglu and Öztekin (2011) include country-characteristics to the analysis by adding observations from 37 countries. The empirics show that firm-characteristics tell for two thirds of the variation in leverage and country-characteristics for one third. The more prominent firm-features that constituted for 96% of the variation was attributed to industry specifics, tangibility, firm size, liquidity and profitability, and the weakest impact came from depreciation, taxes and research and development. The findings regarding the impact of firm-characteristics strengthens the evidence on the association between firm-specific factors and leverage variation from earlier

studies which mainly focused on the U.S. market (Frank and Goyal, 2009), and the importance of time-invariant characteristics (Lemmon et al., 2008). These four factors highlighted will be taken into consideration when investigating the potential effects monetary policy has on leverage.

The Unanticipated Monetary Policy Setting

The period that is argued to be a period of unexpected increases in the Swedish policy rate (repo rate) is the years 2010 and 2011. First, from a global perspective the world was in a recovery phase from the financial crisis of 2007-2008, and in the European Union the debt crisis was still at a critical stage. In the Swedish economy, it was possible to see some signs of recovery. As of 2010 Sweden had left the high-mark of unemployment and it had declined slowly, but it was still only a promising indicator.[1] Promising signs could also be seen in an increasing inflation, nonetheless, both were still at a relatively abnormal level.[2] Svensson (2018) argues that if we put this in a context where we assume Sweden to be classified as a small open economy with great dependence on the export sector and thus a strong exchange rate channel, the Swedish Central Bank´s (Riksbanken) decision to lean against the wind was unexpected, as the recovery was in an early stage and not certain.[3] To add further, other central banks such as the Federal Reserve and European Central Bank kept the policy rate low, despite similar forecasts in June.[4] Svensson (2014) also argues that the reason for tightening monetary policy in Sweden was mainly due to concerns over household debt-to-income ratio and not a result of inflation or unemployment.

Second, the decision to raise the policy rate had not reach consensus between the board of governors, with deputy governor Lars E.O. Svensson as a major opponent to the perceived looming path, as he advocated a more expansive direction (King, 2015). Further, the decision raised international attention (e.g. Krugman, 2014).

Third, in December 2011 the central bank reversed direction. Svensson (2014) argues that the reason of it was that leaning against the wind was proven too premature. The growth prospects

[1] See fig.1 in appx. for monthly historical unemployment rate in Sweden.
[2] See fig.2 in appx. for historical inflation rate in Sweden.
[3] Leaning against the wind, "implies a bias toward a somewhat tighter policy than justified by stabilizing inflation and unemployment, in order to avoid financial `imbalances` and threats to financial stability" (Svensson 2014). p. 104
[4] See fig.3 in appx. for historical federal funds rate, repo rate and refi rate.

for the GDP in the euro area in 2012 was sharply revised, from 0,7% to 0,2%, together with other down adjustments in the Swedish GDP and Exports, and up-adjustment in unemployment (King 2015).

Sandström (2018) uses an instrument approach to define a shock-setting. High-frequency identification (HFI) on market data was combined with local projections IV to study the effect that monetary policy had on household borrowing in Sweden. The results from the HFI indicated that the repo rate increases 2010-2011 were in line with the market expectations, but the results from the recursive VAR indicated the opposite. The VAR results were however criticized for indicating that altogether too many policy changes were unanticipated. With respect to that, there were signs in the market that could have been picked up by the instruments.

Research Contribution

As addressed by previous literature, the existing theories predicts, holding the surrounding fixed, that the changes in the policy rate would have a negative correlation with leverage. Though, given the difficult setting to test a causal relation, we expect a tendency in the more long-term leverage to relate positively to policy rate changes due to its role in shaping economic fluctuations. The association with macro conditions are nonetheless not as common when observing how it relates to capital structure at a micro level. In our study, we try to observe this association between the key interest rate and firm-leverage by broadening the empirics of the transmission of monetary policy, and the field of capital structure determinants, to the Swedish economy. Current research often examines the bank lending in general, instead of looking at a micro level. Bernanke and Gertler (1995) argue that the impact on firms´ balance sheets is one of the main channels that monetary policies affect the real economy, since it affects firms´ access to credit and thereby investments decisions.

The observations used in this paper contrasts with previous science where a large focus is on the U.S. market and other larger economies. Further, by including firm observations during a period when the Swedish repo rate had passed through the zero lower bound, the negative interest rate data is a unique feature in this paper. Another unique consideration, with regards to the research design, is the sub-period where we will try to question the anticipation of the repo rate.

Hypotheses

The research questions and the previous literature propose the following hypotheses:

H1a: The repo rate is associated with firm leverage.
H0a: The repo rate is not associated with firm leverage.

H1b: There is an association between the repo rate and firm leverage in a period when the changes in the repo rate is unanticipated, compared to the average association over a longer period.
H0b: There is not an association between the repo rate and firm leverage in a period when the changes in the repo rate is unanticipated, compared to the average association over a longer period.

3 Data and Methodology

Data

To test our hypotheses, we have acquired yearly panel data on financial statements from privately and publicly held Swedish non-financial firms over the years 2000-2017. The data in our sample is retrieved from the Serrano Database that compiles historical financial statements from the Swedish Companies Registration Office (Bolagsverket) and general company data from the Statistics Sweden (SCB). Other studies that touch upon the same subject have used quarterly data, but since privately held firms typically do not provide publicly available quarterly reports, the study will only focus on annual data. This is made with considerations to the otherwise limited sample size and to get a better representation of the economy's whole business enterprise.

In the sample selection process, we have excluded microenterprises from the sample.[5] This is motivated by the intention of having a firm sample that will react on policy rate changes.

[5] A microenterprise is defined by the European Commission as an enterprise that (1) employs fewer than 10 persons, (2) sales and annual balance sheet that totals to less than EUR 2 million (Liikanen, 2003) The exchange rate between EUR to Swedish krona (SEK) is assumed to be 10 SEK = EUR 1.

Following this line of reasoning, we have excluded firms with observations in the 1th and 99th percentile of data on the leverage proxies. The policy rate used in the analysis is represented by the Swedish Central Bank´s repo rate. We follow common practice in this type of quantitative study and exclude financial companies. Further, we have excluded missing observations for all variables.[6] The cleaned overall sample contains data on 5 049 firms from 10 different sectors, and totals to 42 771 firm-year observations.[7]

Methodology

The hypotheses use the same standard panel regression on capital structure determinants for both Ha and Hb. All the explanatory variables are lagged by a year. The regression models can be seen below.

(1) $$LEVERAGE_{it} = \alpha_i + \beta_0 + \beta_1 RR_{i,t-1} + \beta_2 GDPG_{i,t-1} + \beta_2 PRF_{i,t-1} + \beta_3 SIZE_{i,t-1} + \beta_4 TANG_{i,t-1} + \beta_5 TAX_{i,t-1} + \beta_6 GROWTH_{i,t-1} + \beta_7 LIQ_{i,t-1} \beta_8 INDUSTRY_{i,t-1} + year_{i,t} + \varepsilon_{i,t}$$

(2) $$LEVERAGE_{it} = \alpha_i + \beta_0 + \beta_1 RR_{i,t-1} + \beta_2 GDPG_{i,t-1} + \beta_2 PRF_{i,t-1} + \beta_3 SIZE_{i,t-1} + \beta_4 TANG_{i,t-1} + \beta_5 TAX_{i,t-1} + \beta_6 GROWTH_{i,t-1} + \beta_7 LIQ_{i,t-1} \beta_8 INDUSTRY_{i,t-1} + \beta_9 D_- * RR_{i,t-1} + \beta_{10} D_- * GDPG_{i,t-1} + \beta_{11} D_- * PRF_{i,t-1} + \beta_{12} D_- * SIZE_{i,t-1} + \beta_{13} D_- * TANG_{i,t-1} + \beta_{14} D_- * TAX_{i,t-1} + \beta_{15} D_- * GROWTH_{i,t-1} + \beta_{16} D_- * LIQ_{i,t-1} + \beta_{17} D_- * INDUSTRY_{i,t-1} + \varepsilon_{i,t}$$

Eq. (1) is illustrating the equation for the standard panel regression together with an added time dummy. To estimate the association between the repo rate (RR) and firm leverage (LEVERAGE), the following explanatory variables are included: economic growth (GDPG), profitability (PRF), firm size (SIZE), tangibility of assets (TANG), tax (TAX), growth (GROWTH), liquidity (LIQ) and the industry median of the leverage measure (INDUSTRY). We predict a positive coefficient on RR.

[6] We have also excluded observations containing missing values for the number of employees.

[7] The sectors are defined by Serrano as energy & environment, materials, industrial goods, construction industry, shopping goods, convenience goods, health & education, IT & electronics, telecom & media, and corporate services. See fig.4 in appx. for distribution of firms over the sectors.

Eq. (2) is illustrating the equation for the standard panel regression including the interaction terms. The prefix (D_) multiplied to the variables in Eq. (1) indicate that there is an interaction dummy. The dummy will be equal to 1 if the year is 2010-2012, 0 otherwise. The year 2012 is included to acknowledge potentially lagging repercussions of the repo change and to contain observations on both a raise and decline in the repo rate. This is to capture the monetary policy environment characterized as unanticipated. We predict a negative coefficient for D_*RR considering its aim to cause a more reactive response in leverage. Cluster standard errors will be applied to both estimations.

We justify the lagged explanatory variables mainly by three reasons. First, we expect changes in debt to show tendencies of inertia.

Second, lag effects are common with monetary policy shocks. As shown by Ippolito et.al (2017), the effects of monetary policy shocks are persistent for up to six quarters on the interest coverage ratio, with an effect especially sizeable for more leveraged firms. We expect the adjustment of the leverage to show similar tendencies, as it implies a new optimal capital structure.

Third, the lack of perfect transmission between the policy rate and the market rate might cause a delay when the policy rate gets internalized by the market. The issue is touched upon by Inklaar and Wang (2013) as the frequency that the commercial banks respond to can be both immediate and in a couple of quarters. A final remark is also our inability to control for a narrower implementation or announcement of monetary policy, than the fiscal year. Therefore, the regression cannot adjust for differences in effect from a potential policy change that occur in the beginning versus the ending of the fiscal year.

Dependent Variables

There is a spread in the usage of leverage proxies by researchers due to a lack of consensus in a universal metric. One side of the spectrum argues that book leverage is useful due to it being closer connected to changes in assets, and that is a better collateral than being supported by growth opportunities. Also, as market leverage is thought to be more influenced by the market expectations than the firm decisions, it is deemed unreliable (e.g., (Frank and Goyal (2009):

(Gungoraydinoglu and Öztekin (2011): (Lemmon et al. (2008): Myers (1977)). The other side of the research field address the issue of, for instance, book leverage acting as a balance post in the financial statements. Limited by the data selection process, no market leverage will be included. We follow common practice and use multiple proxies for leverage: short-term debt, long-term debt, and total book leverage. The definitions and notations of the leverage proxies are summarized in table 1.

Table 1
Definition of Dependent Variables

Dependent Variable	Notation	Definition	Variable Source
Book Leverage	BL	Totals debt as a fraction of total assets	Serrano Database
Long-Term Book Leverage	LTBL	Long-term debt as a fraction of total assets	Serrano Database
Short-Term Book Leverage	STBL	Short-term debt as a fraction of total assets	Serrano Database

The table presents the definition of the dependent variables. Total debt is calculated as the sum of long-term and short-term debt.

Explanatory Variables

Previous work in the field of capital structure determinants (e.g. Gungoraydinoglu and Öztekin (2011)) have recognized the importance of economic growth, profitability, firm size, growth opportunities, tangibility of assets and the industry median leverage. The regression will use conventional definitions for these variables as explanatory variables. The repo rate is defined as average yearly changes in the repo rate expressed in basis points. We expect the association with the repo to be positive for long-term leverage, while the short-term leverage is expected to be harder to fit in the model, motivated by the preference to have a more flexible stance in economic downturns.

Economic growth is defined as the change in the Gross Domestic Product. Profitability is measured as earnings before interest and tax as a fraction of total assets. The firm size is measured as the natural logarithm of net sales. Tangibility of assets is defined as the fixed fraction of assets in total assets. The computation of growth opportunity is inspired by Wald (1999) and defined as a growth in sales. The industry leverage median is created by grouping the sample into 10 overall sectors over the years. Additional explanatory variables added are tax as a fraction of earning as a proxy for the interest tax shield and liquidity defined as total

current assets as a fraction of total current liabilities. Table 2 summarize the notations, definitions, and source for the explanatory variables.

Table 2
Definition of Explanatory Variables

Explanatory Variables	Notation	Definition	Source
Repo Rate	RR	Average yearly changes in the repo rate expressed in basis points	The Riksbank
Economic Growth	GDPG	Growth in nominal Gross Domestic Product	Statistics Sweden
Profitability	PRF	Earnings before interest and taxes as a proportion of total assets	Serrano Database
Firm size	SIZE	The natural logarithm of net sales deflated by the Producer Price Index	Serrano Database, Statistics Sweden
Tangibility	TANG	Fixed assets as a proportion of total assets	Serrano Database
Tax	TAX	Current income tax as a fraction of income before income taxes	Serrano Database
Growth	GROWTH	The growth of the firm captured by the change in total revenue.	Serrano Database
Liquidity	LIQ	Total current assets as a fraction of total current liabilities	Serrano Database
Industry Median Book Leverage	INDB	The industry median on book leverage over the time period	Serrano Database
Industry Median Long-Term Book Leverage	INDLTBL	The industry median on long-term book leverage over the time period	Serrano Database
Industry Median Short-Term Book Leverage	INDSTBL	The industry median on short-term book leverage over the time period	Serrano Database
Interaction term 1	D_*RR	Interaction term of repo rate and the unanticipated setting	The Riksbank
Interaction term 2	D_*GDPG	Interaction term of economic growth and the unanticipated setting	Statistics Sweden
Interaction term 3	D_*PRF	Interaction term of profitability and the unanticipated setting	Serrano Database
Interaction term 4	D_*SIZE	Interaction term of firm size and the unanticipated setting	Serrano Database
Interaction term 5	D_*TANG	Interaction term of tangibility and the unanticipated setting	Serrano Database
Interaction term 6	D_*TAX	Interaction term of repo tax and the unanticipated setting	Serrano Database
Interaction term 7	D_*GROWTH	Interaction term of growth and the unanticipated setting	Serrano Database
Interaction term 8	D_*LIQ	Interaction term of liquidity and the unanticipated setting	Serrano Database
Interaction term 9	D_*INDBL	Interaction term of industry median book leverage and the unanticipated setting	Serrano Database
Interaction term 10	D_*INDSTBL	Interaction term of industry median long-term book leverage and the unanticipated setting	Serrano Database
Interaction term 11	D_*INDLTBL	Interaction term of industry median short-term book leverage and the unanticipated setting	Serrano Database

The table presents the definition of the explanatory variables. D_ represents the years 2010-2012. The firms are grouped into ten overall sectors based on the primary SNI code according to currently applicable SNI07. For years prior to 2007, the code according to the SNI02 system is translated into to the current SNI07 system by Serrano database. We use the following sectors: energy & environment, materials, industrial goods, construction industry, shopping goods, convenience goods, health & education, IT & electronics, telecom & media and corporate services. The Producer Price Index captures the average price level at the producer and import stage for the product groups in accordance with SPIN 2015

4 Analysis and Results

Descriptive Statistics and Correlation

The descriptive summaries on the financial items and composed variables can be seen in table 3. The panel data for firms in this sample is not complete for all panel variables. This leads to the statistical analyses presented being unbalanced, as we are partly dealing with missing information in our sample. Panel A and B provide descriptive statistic over the different ratios used as explanatory variables. As shown in panel A, there is a spread in the leverage ratios for each of the proxies.[8] The statistics shown in panel C are data on the financial statements after the sample selection process. The values are displayed in thousand SEK, and firm size is deflated by the inflation level, using the year 2000 as base year.[9]

Table 3
Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
Panel A: Dependent Variables				
BL	0.57	0.21	0.09	1.00
LTBL	0.16	0.20	0.00	0.87
STBL	0.41	0.23	0.03	0.97
Panel B: Explanatory Variables				
RR	0.02	0.02	-0.01	0.04
GDPG	0.00	0.00	-0.01	0.07
PRF	0.06	0.22	-14.71	16.69
SIZE	20.52	1.10	18.90	26.33
TANG	0.23	0.27	-0.01	1.00
TAX	0.08	96	-5790	18555
GROWTH	396	20406	-1.00	3052847
LIQ	3.50	67	0.00	10273
INDB	0.63	0.07	0.46	0.80
INDLTBL	0.16	0.12	0.00	0.43
INDSTBL	0.34	0.10	0.15	0.59

Item	Mean	Std. Dev.	Min	Max
Panel C: Financial items				
Total assets	3110000	16100000	200000	602000000
Material assets	911000	6120000	0	304000000
Long-term debt	711000	4730000	0	202000000
Short-term debt	1000000	4880000	9761	178000000

[8] See fig.4 appx. for graphical illustration of the yearly change in each leverage proxy.
[9] The first of January 2017, the exchange rate for Swedish krona (SEK) to EUR was SEK 1 = EUR 0.1044

Number of employees	1260	6654	10	287732
Sales	2680000	10700000	200000	335000000
Sales adj. for inflation	2340000	9370000	162000	274000000

The table presents descriptive statistics for the dependent and explanatory, and for financial items in the sample. The numbers related to financial items are expressed in thousand SEK.

Table 4 shows the pairwise correlation between the variables. Consistent with previous research, profitability, tangibility, liquidity, and industry (with mixed results) have the relatively largest correlation with the leverage metrics. The results are relatively low compared to the previous research that have influenced the composition of the variables (e.g. Jermias and Yigit, 2019). The correlation between the repo rate and the leverage ratios indicate that there is a positive relationship between the leverage proxies and the repo rate for the proxies that contain more long-term debt, while the opposite holds for the short-term debt. The correlation between repo and firm size, tangibility, and the industry variables can be a problem. The remaining dependent variables provide no significant correlations with the proxies.

Table 4
Correlation Matrix

	BL	LTBL	STBL	RR	GDPG	PRF	SIZE	TANG	TAX	GROWTH	LIQ	INDBL	INDLT
BL	1												
LTBL	0.3861*	1											
STBL	0.5946*	-0.5121*	1										
RR	0.0119	0.0442*	-0.0274*	1									
GDPG					1								
PRF	-0.0598*	-0.0978*	0.0296*			1							
SIZE				0.0285*			1						
TANG	-0.1384*	0.2638*	-0.3588*	0.0507*		-0.0181*		1					
TAX									1				
GROWTH										1			
LIQ	-0.0222*		-0.0234*					-0.0260*			1		
INDBL		0.0130*		0.0895*			0.0107					1	
INDLT		0.0138*		0.1086*			-0.0189*	0.0127*				0.5301*	1
INDST				-0.0660*			0.0258*					-0.0642*	-0.8043*

The table presents pairwise correlations between all variables. There is a 5% significance level for displaying coefficients and a 1 percent significance level for displaying coe
with a star.

The Static Model

To test our developed hypotheses, we will first examine and compare the results from three different approaches to static panel regression to get the model that is more fitting with the sample. The different estimators that we obtain are from a pooled OLS, fixed effects (FE) regression and random effects (RE) regression. The discussion regarding the suitable method will be based on the results from the developed equation, Eq. (1). The results from the test are compiled in table 5.

We will use a F test to help decide between the pooled OLS and the FE regression. If the null hypothesis on the F test for the FE estimators are rejected, i.e., the observed and unobserved fixed effects are not equal to zero, then the FE regression is to prefer over OLS. The results in table 5 indicate that we should pick the FE regression over the pooled OLS, since the null hypothesis is significantly rejected for all the dependent variables.

To decide between the estimators from the pooled OLS and the RE, we turn to the Breusch-Pagan Lagrangian Multiplier-test (LM), testing the null hypothesis that the variances across entities is zero. If rejected, the test suggests that there is no panel effect, i.e., the RE estimators are more suitable than those computed from the pooled OLS. The data suggests that the pooled OLS is less fitting for our analysis. Table 5 shows that the null hypothesis is significantly rejected in all panels.

Finally, we will let the result from a Durbin–Wu–Hausman test (Hausman test) determine whether we should use the FE or RE regression. We test the null hypothesis that there is no correlation between the explanatory variables and the individual errors. If rejected, it implies that the FE regression provides more consistent estimators and therefore is to prefer. The results in table 5 show that the null hypothesis is rejected, indicating that the RE regressions on our sample does not provide consistent estimators. As the null hypothesis is rejected for all of the dependent variables, the FE regression is most suitable for our research question.

Table 5
Estimator Selection

	2000-2017		
	Pooled OLS	Random Effects	Fixed Effects
Panel 1: Book leverage (BL)			
Model test	42.03*	520.43*	19.35*
R^2	0.0249	0.0127	0.0132
N	42771	42771	42771
Effect test		130000*	23.51*
Hausman test			207.6*
Panel 2: Long-term book leverage (LTBL)			
Model test	147.95*	1412.92*	50.38*
R^2	0.0826	0.0326	0.0336
N	42771	42771	42771
Effect test		110000*	22.79*
Hausman test			441.12*
Panel 3: Short-term book leverage (STBL)			
Model test	252.14*	585.53*	18.01*
R^2	0.133	0.0106	0.0123
N	42771	42771	42771
Effect test		120000*	25.50*
Hausman test			726.77*

The table compiles the results from the tests used to decide the appropriate regression approach based on Eq.(1), together with the test statistics used in the estimator selections process. The model test row represents the test statistic from the F test for the pooled OLS and the FE. For the RE regression the model test is represented by the Wald chi2. The R^2 that is reported is based on the within statistics for the models that use fixed effects. For the pooled OLS the R^2 is adjusted for the number of explanatory variables. The number of firm observations that the panel testing consists of is represented by N. The effect test reports the results from the LM test together with the F test for the FE estimator. In subscript, a star indicates a significance level of 1%.

Results

As developed in the previous section, the estimators and relevant statistics from the FE regressions are summarized in table 6 and table 7. The results compiled in table 6 are based on Eq.(1) to test Ha. The results compiled in table 7 include the interaction terms and are used to test Hb. The regression is adjusted from the one included in the estimator selection process. In the regression, cluster robust standard errors (regarding firm identification) are applied to deal with serial correlation patterns (including none) and heteroskedasticity of any unknown form. Consequently, there is a difference in the F-value of the models, t-values and standard errors

compared to table 5, but the coefficients of the estimates remaining unaffected. In table 6, the time dummy for year 2000 is dropped to account for multicollinearity.

Table 6
Results of Fixed Effects Estimator with Time Dummies

	BL			LTBL			STBL		
	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.
RR	0.143	0.081	0.08	0.076	0.077	0.32	0.068	0.080	0.39
GDPG	0.427	1.106	0.70	0.412	0.898	0.65	0.012	0.419	0.98
PRF	-0.033	0.011	0.00	-0.021	0.006	0.00	-0.012	0.006	0.05
SIZE	0.000	0.001	0.81	0.000	0.000	0.73	0.000	0.000	0.96
TANG	0.011	0.008	0.17	0.020	0.007	0.01	-0.009	0.007	0.17
TAX	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.01
GROWTH	0.000	0.000	0.96	0.000	0.000	0.36	0.000	0.000	0.61
LIQ	0.000	0.000	0.24	0.000	0.000	0.01	0.000	0.000	0.07
INDB	-0.007	0.008	0.38						
INDLT				0.000	0.004	0.97			
INDST							-0.010	0.006	0.07
2001	0.001	0.005	0.79	0.006	0.005	0.20	-0.005	0.004	0.28
2002	-0.004	0.005	0.49	0.003	0.005	0.62	-0.006	0.005	0.20
2003	-0.015	0.006	0.01	-0.013	0.005	0.02	-0.002	0.005	0.64
2004	-0.015	0.006	0.01	-0.029	0.005	0.00	0.014	0.005	0.01
2005	-0.004	0.006	0.47	-0.034	0.005	0.00	0.030	0.006	0.00
2006	-0.006	0.006	0.33	-0.039	0.006	0.00	0.034	0.006	0.00
2007	-0.003	0.006	0.64	-0.039	0.006	0.00	0.036	0.006	0.00
2008	0.000	0.007	0.96	-0.032	0.006	0.00	0.032	0.006	0.00
2009	-0.014	0.006	0.03	-0.040	0.006	0.00	0.025	0.006	0.00
2010	-0.016	0.006	0.01	-0.048	0.006	0.00	0.032	0.006	0.00
2011	-0.016	0.006	0.02	-0.049	0.006	0.00	0.033	0.006	0.00
2012	-0.018	0.007	0.01	-0.049	0.006	0.00	0.031	0.006	0.00
2013	-0.028	0.007	0.00	-0.051	0.006	0.00	0.023	0.006	0.00
2014	-0.027	0.007	0.00	-0.055	0.006	0.00	0.028	0.007	0.00
2015	-0.029	0.007	0.00	-0.061	0.006	0.00	0.032	0.007	0.00
2016	-0.028	0.007	0.00	-0.063	0.007	0.00	0.035	0.007	0.00
2017	-0.029	0.007	0.00	-0.065	0.007	0.00	0.036	0.007	0.00
F test	8.96*			12.64*			6.82*		
R^2	0.0132			0.0336			0.0123		

The table presents the results from the FE estimation on Eq.(1) with cluster-robust standard errors (by firm). The regression is run on 42 771 observations. The R^2 that is reported is based on the within statistic. Sig. is an abbreviation for the p-value. For the F test, a 1 percent significance level is displayed with a star.

Table 6 is showing a consistent positive association between each leverage measure and the repo rate. The repo rate for total book leverage is the only dependent variable that provides both an economically significant and a relatively statistically significant association, compared to the long-term and short-term regression. For Ha on total book leverage (RR = 0.143, $p < 0.10$).

Everything else held equal, a one basis point increase in the repo rate would on average correspond with an increase of circa 14 percentage of debt financing in total assets. The null hypothesis of non-existent association between the repo rate firm and firm leverage cannot be rejected by an acceptable significance level.

The R squared within statistic reported in the models are low overall, with the biggest value of 0.0336 belonging to the long-term leverage regression. The reported R squared for total book leverage and short-term leverage are 0.0132 and 0.0123, respectively. Having in mind that the primary focus is on the repo rate, and that there is a common preference not to get trapped focusing on the size of the statistic, this is low compared to the findings of Gungoraydinoglu and Öztekin (2011) and Jermias and Yigit (2019). The remaining explanatory variables might bring some explanation to this occurrence, as the variables are shown to have little impact on the leverage ratios. The only variables that show statistically significant coefficients for each leverage proxy are profitability and tax, with profitability being the only economically significant one with a coefficient around 0.01-0.03. Tangibility is showing statistically mixed results but appear as one the more influential explementary variables with (TANG = -0.021, $p < 0.01$) for long-term leverage. The largest impact to firm leverage can be attributed to the economic growth, but the coefficients lack statistical significance. Remaining explanatory variables showed overall insignificant results in describing the variation in leverage. These findings contrast with previous research on capital structure determinants, such as the findings by e.g. Gungoraydinoglu and Öztekin (2011).

The year dummy variables are statistically significantly negative over the years 2009-2017, excluding the short-term leverage regression. This indicate an overall deleverage in total leverage and long-term leverage, compared to the base year 2000. Separately, the long-term leverage and have short-term leverage have respectively decreased and increased, compared to the year 2000. This suggests a shift in preferences from long-term debt to short-term around 2004.

Table 7
Results of Fixed Effects Estimator with Interaction Terms

	BL			LTBL			STBL		
	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.	Coef.	Std. Err.	Sig.
RR	0.628	0.089	0.00	0.999	0.080	0.00	-0.377	0.081	0.00
GDPG	0.415	1.079	0.70	0.471	0.849	0.58	-0.058	0.446	0.90
PRF	-0.030	0.011	0.01	-0.021	0.006	0.00	-0.009	0.006	0.11
SIZE	0.000	0.001	0.57	0.000	0.000	0.47	0.000	0.000	0.85
TANG	0.011	0.008	0.17	0.025	0.007	0.00	-0.014	0.007	0.03
TAX	0.000	0.000	0.00	0.000	0.000	0.00	0.000	0.000	0.00
GROWTH	0.000	0.000	0.87	0.000	0.000	0.67	0.000	0.000	0.72
LIQ	0.000	0.000	0.46	0.000	0.000	0.03	0.000	0.000	0.13
INDB	-0.002	0.009	0.84						
INDLT				0.003	0.005	0.56			
INDST							-0.005	0.006	0.48
Dummies									
RR	-0.719	0.206	0.00	-0.970	0.187	0.00	0.278	0.201	0.17
GDPG	-1.059	1.122	0.35	3.613	0.895	0.00	-4.103	0.575	0.00
PRF	-0.014	0.022	0.53	-0.003	0.009	0.74	-0.011	0.015	0.47
SIZE	0.000	0.001	0.74	0.000	0.000	0.01	0.000	0.000	0.76
TANG	0.005	0.006	0.42	-0.010	0.007	0.14	0.015	0.006	0.01
TAX	0.000	0.000	0.42	0.000	0.000	0.79	0.000	0.000	0.67
GROWTH	0.000	0.000	0.30	0.000	0.000	0.22	0.000	0.000	0.05
LIQ	0.000	0.000	0.75	0.000	0.000	0.08	0.000	0.000	0.25
INDB	0.022	0.016	0.17						
INDLT				0.022	0.011	0.04			
INDST							-0.001	0.014	0.93
F test	9.94*			16.21*			17.54*		
R^2	0.0094			0.0215			0.004		

The table presents the results from the FE estimation on Eq.(2) with cluster-robust standard errors (by firm). The R^2 that is reported is based on the within statistic. Sig. is an abbreviation for the p-value. For the F test, a 1 percent significance level is displayed with a star.

To test hypothesis Hb, the results from the FE regression with the interaction terms from Eq.(2) are compiled in table 7. In general, the estimators show similar tendencies as table 6 with little economical or statistical significance. In a period with repo rate changes characterized as unanticipated, the dummies for the repo rate and economic growth changes provide economically significant results for long-term book leverage, compared to periods when the repo changes were more predictable. With regards to the disproportionate size of the coefficient, there is not feasible to make a plausible interpretation other than acknowledging the statistical significance and direction. For Hb on long-term leverage (RR = 0.999, $p < 0.01$, RR_D = -

0.970, $p < 0.01$). This could indicate that when there is more friction or costs associated with forecasting the changes in the repo rate, the impact of the change is relatively more lagging, as the theoretically positive association appears to be diminished. The findings are consistent with the results of Hb on total book-leverage (RR = 0.628, $p < 0.01$, RR_D = -0.719, $p < 0.01$), but not on the short-term book leverage. The null hypothesis of an on average non-existent association between leverage and the repo in Hb is rejected for total leverage and long-term leverage.

Discussion

The combined overall weak relationship between the leverage proxies and the control variables in the tests, compared to previous research, may partly be to the sample characteristics, to targeted ratios and the economic conditions. As we only have excluded micro-firms in our selection process, the effect on leverage might to some extent be diluted from including firms whose financing decisions lie too far from the policy directions from The Swedish Central Bank. We have tried to capture the very subtle and might have failed to do so with too low thresholds in the data selection criteria, suggested by previous research that mainly targeted larger or listed firms e.g. Huynh et. al (2018).

The second explanation highlighted concerns the ambition of firms to move toward, or target, a leverage ratio. This implies that factors affecting the financing decisions also results in a shift in the asset side of the balance sheet. Either by increasing or decreasing assets, the ratio gets a rigid feature.

The third and final aspect concerns the internalization of the economic environment. By adding multiple variables that essential all are affected by the economic conditions, the individual variation could have been depleted. This is however not supported by the test of the joint significance of the model, but by the correlation matrix.

5 Summary and Conclusion

The aim of this study was to examine the connection between the key interest rate and firm leverage, and how that connection is affected if the changes in the rate is anticipated or not. The

approach to the study was through a static regression model on Swedish firm panel data, and by adding dummy variables to capture the anticipation setting.

We were not able to reject the null hypothesis that the repo rate is not associated with firm leverage, i.e., the repo rate had no significant association with leverage. We were however able to reject the null hypothesis that during a period of friction surrounding the anticipation of the policy rate, there is no difference in changes in the association of policy rate on leverage. Thus, compared to the overall period there is a statistically significant association between the repo rate, and, long-term and total leverage, for the average firm when there is friction in the anticipation.

This study supports the current state of knowledge by shedding light on the consequences of friction when anticipating monetary policy decisions. Less friction in the system would imply a more effectively transmission key interest rate and smoothed out fluctuations in firm leverage. When conducting future studies on how capital structure determinants relate to macroeconomic condition, the institutional climate ought to be controlled for by an alternative method than a dummy approach to make more feasible interpretations of the coefficients.

The study also contributes to the existing literature on capital structure determinants by reaffirming and supporting the negative association between leverage and profitability by broadening the empirics with more recent firm and policy-related data. There is not possible to draw any further conclusions from the remaining variables.

Any interpretation made based on these results should take multiple limitations into considerations. First, the results use a wide set of Swedish firms (both private and public) by only excluding microenterprises. This implies that while there is an on average significant relation between unanticipated policy rate changes and the long-term leverage of the wide mass of firms, little is said about the relation between a firm and the policy rate.

Second, there is a national economic history to have in mind. Sweden is a developed country with strong and trustworthy financial institutions. The regression only make use of one instance defined as unanticipated.

Third, the models provide little explanation value in the variation of leverage. The lack of significant estimates for e.g. firm- characteristics (which is contrary to previous studies), invites potential distortion in the estimation.

Fourth, neither the inherent cultural preference for risk, nor target for leverage, is adjusted for.

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7 Appendix

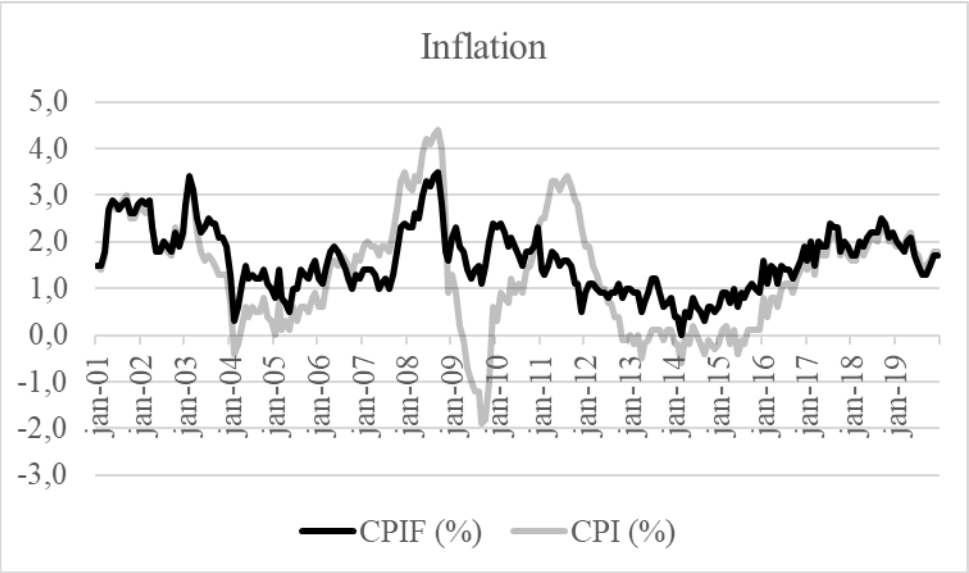
Figures

Figure 1

Source: authors´ rendering of SCB (AKU) data.

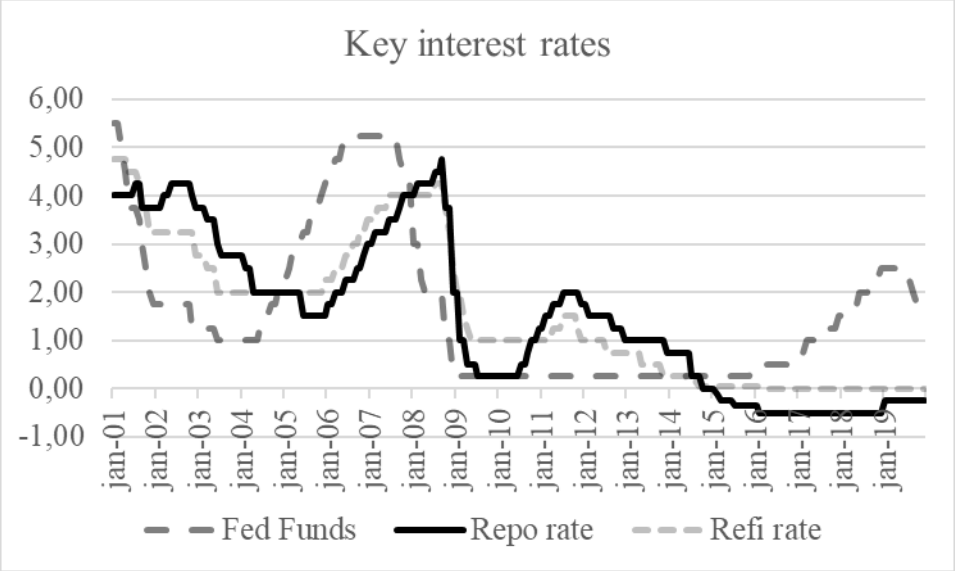
Note, the time series trend is seasonally adjusted. In AKU, a person is classified as unemployed if she currently is unemployed, but, can start working within 14 days, have actively searched for a job in the last 4 weeks or is waiting to work within three months of the measurement week.

Figure 2



Source: authors´ rendering of SCB data.

Figure 3

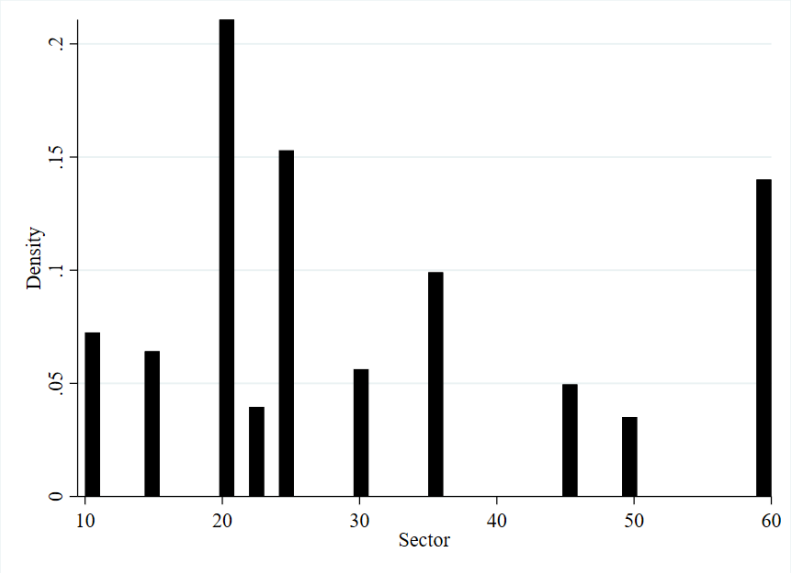


Source: authors´ rendering of data from the Federal Reserve, Riksbanken and the European Central Bank.

Note, the values refer to the last day of the month. Since December 2008, the Federal Reserve has an interest rate corridor for Fed Funds interest rates. The corridor consists of an interval of 0.25 percentage points. The chart shows only the ceiling on the interest rate corridor.

Extended Tables

Figure 4



Source: authors´ rendering of distribution of industry observation in the cleaned sample from Serrano database. The numbers represent the following categories:

10 = Energy & Environment

15 = Materials

20 = Industrial goods

22 = Construction industry

25 = Shopping goods

30 = Convenience goods

35 = Health & Education

45 = IT & Electronics

50 = Telecom & Media

60 = Corporate services