The short-term incidence of the financial activities tax

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Abstract

In 2017 a financial activities tax was introduced in the Norwegian financial sector. Using a difference-in-difference framework and a rich panel data set for all Norwegian banks, this study tests the hypothesis that consumers bear some of the burden of the extra tax on wages in form of increased prices on loans. The effect on four different interest rates are examined; the interest rate on all loans, mortgage loans to the public, mortgage loans to households and commercial loans. For the interest rate on all loans and both markets for mortgage loans, visual and statistical evidence show no indication of a price increase due to the tax. In the market for commercial loans, visual evidence show diverging interest rate trends after the tax is introduced. Regressions on this dependent variable yields a point estimate for the effect of the tax of 0.264 percentage points with a p-value of 0.068.
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1 Introduction

A financial activities tax was introduced in the Norwegian financial sector in 2017. The new scheme consists of two elements: an extra payroll tax of five percent and a one percent higher corporate income tax compared to other sectors. The present study aims to shed light on the incidence of the tax on wages. In theory, there can be many effects of the tax, for example an increase in prices on services, a decrease in firms profit or a decrease in wages. This thesis will investigate whether parts of the new tax has been passed on to consumers through higher interest rates on loans.

As in most other countries, the Norwegian financial sector has traditionally been exempt from value added taxation. The fundamental problem of taxing services such as intermediation is that it is difficult to measure the value added of each transaction on such services. In a standard VAT scheme, the value added is identified by simply subtracting production costs from the unit price. However, in the case of many financial services, it is not always clear which price that should be attached to the product. A loan issued by a bank, for example, is charged for through the margin between lending rates and deposit rates. This difference reflects the value added by the bank, but also a risk premium which should not be included in the tax base for the VAT (Huizinga 2002). Since dissecting the two is practically difficult for the tax authorities, most services provided by the financial sector has been VAT exempt.

The lack of VAT on such services has been discussed by several government appointed committees. A highlighted concern has been a potential higher-than-optimal consumption and production of these services due to the lack of VAT (NOU 2011:1 (2011), NOU 2014:13 (2014)). It is therefore important to examine if the tax decreases demand for financial services, and one channel through which this can happen is an increase in prices. Another benefit of the tax incidence analysis, is that it can be used to evaluate the fairness of the tax system. In most tax schemes,
the notion of fairness is adhered to through the ability-to-pay principle; those who have more wealth can better bear the burden of taxation and should therefore pay more taxes. As has long been known from the theory of taxation, however, it is not given that the subject liable to the tax will bear the burden.

The introduction of an extra payroll tax creates a quasi-experimental setting which allows for isolating the effect of the tax on the outcome of interest. Using panel data for all Norwegian banks, the present study employs a difference-in-differences framework to investigate whether banks have shifted the tax onto consumers. The main concept behind this estimation strategy is to compare means in the outcome variable for the treated and the control group before and after the treatment. By differencing these means, any unobserved time-invariant heterogeneity is removed and an estimate of a causal effect can be obtained. Contrary to the standard DiD model, however, there is no natural control group in this specific setting, as all banks are subject to the FAT. I therefore exploit the fact that banks have variation in their exposure to the extra tax on wages based on how intensive they use labor in production. If there is an effect of the tax on interest rates, the response should be larger for banks with high exposure.

A tax on wages in the financial sector is not a new idea per se. But the concept of using the payroll tax to tax the financial sector’s value added is not widely used. Although the idea of an FAT was introduced by a working group in the IMF already in 2010, only a handful of countries have adopted the scheme. The most notable example is Denmark which has had an extra payroll tax on VAT exempt services since 1988. However, there is to my knowledge no empirical study of this tax’ effects. Previous studies of tax incidence in the banking sector have primarily analyzed the corporate income tax and different forms of bank levies. The present analysis therefore contributes to a scant empirical literature on the effects of the FAT. It is also the first empirical study of the effects of the Norwegian FAT.

Visual evidence show no indication of an effect of the tax on the price for mortgage loans. This is consistent with regressions results using this dependent variable which yields positive but non-significant estimates. In the market for commercial loans, visual evidence show a diverging trend for average prices between high and low exposed banks after the tax is introduced. In this market, an increase in exposure is on average estimated to lead to an increase in the interest rate with 0.264 percentage points. This estimate is significant on a 10 percent level.

This thesis proceeds as follows. In the next chapter, a description of the banking sector and new regulation since the financial crisis is given. Chapter 3 lays out the theoretical foundation for the study and presents the predictions from several
models. This chapter also contains a survey of relevant prior literature. In chapter 4, a detailed description of the panel data used in the analysis is given. Chapter 5 explains the empirical approach for the estimation and chapter 6 presents both visual and statistical results. The last chapter will sum up and interpret the findings.
2  Institutional background

2.1  Market structure

The Norwegian banking sector is characterized by a high number of banks, but also a high market concentration (Norges Bank (2017)). The biggest bank, DNB ASA, alone has a total market share of loans of about 30 percent (ibid). The concentration is markedly higher than in other sectors, but only slightly above the average for banking sectors in the EU (Ulltveit-Moe et al. (2013)).

Notes: Author’s calculations using data from 2016.

Figure 1: Loan market share of the largest banks

Most of the banks in the sector are small saving banks primarily doing business locally or regionally. However, many of the small banks are also members of larger strategic alliances which involves cooperation with technology, procurements etc. Sparebank 1-Gruppen consists of 16 banks, while Eika-Gruppen has 69 banks. 15 banks are on the outside of the alliances (Norges Bank (2017)). The market of loans to the public is mainly comprised by approximately 50 percent housing loans, 26 percent commercial loans and 19 percent other loans (ibid).

In 2015, the Norwegian Competition Authority assessed the competition in the Norwegian mortgage market. The conclusion was that there are several impediments to competition (Konkurranstilsynet (2015)). On the supply side, they found, analyzing data from 2007-2014, that the lending margin went up in this period, while variation in interest rates went down. Based on this, and other structures of the market, the authority raised significant concerns for price coordination. On the de-
mand side, the NCA found a low mobility among consumers. Based on available
literature, they concluded that between 5-10 percent of bank customers change their
bank during a year, and that 2/3 of customers have been in their main bank for
10 years or more. This rate of mobility is lower than other sectors as for example
insurance or electricity suppliance (ibid).

Although estimates of a low mobility may indicate that customers are less price
sensitive, a study by Raknerud and Vatne (2013) found higher price responses for the
long run. Based on data from 2002-2013 they estimate that a one percent increase
in a bank’s loan rate to households lead to a 1.44 percent decrease in demand. For
businesses, the response of a one percent price increase was estimated to induce a
0.65 percent decrease in demand.

2.2 Regulation

In the aftermath of the financial crisis of 2007-2008, there has been some new reg-
ulation imposed on banks. The most important is the mandatory accumulation of
capital to build a countercyclical buffer. At the end of 2013, the central bank of
Norway announced that banks were required to build up a 1 percent buffer by the
time of January 2015. The first increase in the buffer came in June 2016 with a new
rate of 1.5 percent. The second increase, to 2 percent, was announced in December
2016 and enforced from December 2017.

Another new regulation is the requirements for residential mortgage loans. First
introduced in June 2015, the regulation included requirements to cap the loan-to-
value ratio on residential mortgage loans at 85 percent and no deferred payment on
loans with a loan-to-value ratio above 70 percent (Boliglånsforkriften (2016)). In
addition, banks were allowed to disregard the above mentioned rules for 10 percent
of loans per quarter. In December 2016, this regulation was extended with some
regional amendments. Due to a rapid price increase on dwellings in Oslo, the new
regulation curbed the share of exempt loans in the capital to 8 percent. Further,
Oslo-based loans with dwellings in secondary housing now became liable to a loan-
to-value cap of 60 percent.

2.3 The FAT scheme

As in most other countries, the Norwegian financial sector has long been exempt
from value added taxation due to the practical difficulties with implementing such
a tax. The concept of value added taxation is based on taxing the difference be-
tween production costs and output prices for final goods. It is an indirect tax on
consumption applied to each step of the production chain, and the general tax rate in Norway is 25 percent. If a producer pays VAT on inputs used in the production, it will get credits for this.

For most commodities, deriving the value added is a simple task since it is easy to obtain production costs and the output price. However, many financial services, such as loans, are charged for through the margin between lending rates and deposit rates. This margin reflects the value added by the bank, but also a risk premium which should not be included in the VAT base as it is a production cost (Huizinga (2002)). Separating between the two is in practice difficult as the risk premium is information not privy to the tax authorities. If an approximation of the actual value added by the loan somehow could be obtained, another problem would be how to allocate the value added between consumers and producers, where the latter group could be entitled to credits (Boadway and Keen (2010)).

Since the financial crisis, several government appointed committees have evaluated the issues related to the lack of value added taxation in the financial sector. Since the main objective of the VAT is to generate government revenue, and not, for example, mitigate an existing distortion, a natural goal for the government is to minimize any distortions created by the tax. A central concern has been that the VAT exemption leads to a higher-than-optimal consumption of financial services because these services become relatively cheaper to services in other sectors (NOU 2011:1 (2011), NOU 2014:13 (2014)). Another important issue that has been discussed by the committees, is that the lack of VAT credits in the financial sector may distort financial firms’ production decision. Since no VAT credits can be claimed, financial firms have an incentive to save money by producing some services within the firm rather than buying them from others.

In May 2016, the biggest political parties in the parliament agreed to a tax reform which included the intention of introducing a financial activities tax. The FAT was introduced from January 2017 on the whole financial sector.

The scheme consists of two elements: a tax on wages and a tax on corporate income. For the tax on wages, the tax base is wage costs and the rate is five percent. In practice, this is an extra payroll tax. The second element includes a one percent higher corporate income tax relative to other sectors. This change was introduced in form of a CIT decrease in other sectors from 2017. Although the outset is that all firms in the sector are liable to the FAT, there are some exemptions. If a firm’s wage costs related to financial activity constitute less than 30 percent of total wage costs, the firm is exempt. This rule excludes for example many holding companies. The second exception excludes firms where more than 70 percent of total wage costs
originate from VAT-mandatory activity. However, none of these exemptions apply to banks.

The two elements of the scheme was at the time of introduction expected by the government to generate a revenue of 1790 million NOK in 2017 (Prop. 1 LS 2016-2017 (2016)).
3 Theory and evidence

3.1 Short-term theoretical predictions

In a survey of the literature on payroll tax incidence, Fullerton and Metcalf (2002) finds that most researchers have assumed that the tax is borne by workers. This assumption has been thoroughly tested, and a number of studies have found that the payroll tax leads to a reduction in wages, both in Norway (Johansen and Klette (1997), Stokke (2016), Gavrilova et al. (2015)) and in other countries (Gruber (1995)). Although it may be reasonable to believe that the payroll tax will affect the market for the taxed factor, it is likely that wages are rigid in the short run. The reason for this is that earnings usually are based on a long-term agreement between the employer and the firm. Both parts have incentives to make plans with a long perspective, since less uncertainty about the future implies less risk.

Since the FAT was introduced in 2017, there is only one year of post-reform data available. Assuming that wages and the use of labor are given for this period of time, there are only two possible ways in which the tax can be shifted. The first alternative is that banks increase prices on products. A profit maximizing bank has the incentive to pay as little tax as possible. There is no regulation stopping the banks to increase prices on products, but they are obliged to notify customers about a price increase six weeks in advance\(^1\) (Finansavtaleloven (2012)). However, there are other factors that can impede a banks ability to shift the tax. If the competition in the market is very high, the interest rate may not be fully endogenous for the bank as prices would be decided in the market. Another consideration is how much demand falls when the price is raised. The second alternative is therefore that banks do not raise their prices, and experience a reduction in net profits due to the tax.

3.2 Partial equilibrium analysis

A classical result in tax theory is that the largest tax burden will fall on the most inelastic group in the market. The key assumption for this conclusion is that the market has perfect competition. For a market to be competitive, a number of conditions must hold. The commodities must be homogenous so that price is the only factor that matters when buyers decide who they buy from. Further, no seller or buyer can be able to influence the market clearing price, all participants in the market must easily obtain information about prices and there should be free entry.\(^1\)

\(^1\)The intention of introducing a FAT was however publicly announced in May 2016 and the structure of the scheme was presented in the budget proposal in October.
In such a setting it makes no difference if the tax is levied on consumers or producers; it can be shifted on either part.

Following Chetty and Bruich (2012), the result can be derived from the market clearing condition in a partial equilibrium framework:

\[ Q = S(p + t) = D(p) \]

To fit the topic of this thesis, we can imagine that the tax is levied on the producer’s use of labor in the production. Supply is a function of the tax inclusive price and a tax and demand is a function of the market pre-tax price. The clearing condition defines the price as a function of the tax.

The incidence can be illustrated by the market price change induced by the tax. Differentiating the clearing condition with respect to the tax yields:

\[ \frac{\partial S}{\partial p} \left( \frac{\partial p}{\partial t} + 1 \right) = \frac{\partial D}{\partial p} \frac{\partial p}{\partial t} \Rightarrow \frac{\partial p}{\partial t} = \frac{\partial S}{\partial p} \frac{1}{\left( \frac{\partial S}{\partial p} - \frac{\partial D}{\partial p} \right)} \]

From this expression we can obtain elasticities by multiplying through with \( p/Q \) to get:

\[ \frac{\partial p}{\partial t} = \frac{\varepsilon_S}{\varepsilon_S - \varepsilon_D} \]

This is an expression for the demand incidence and it shows how the new market clearing price will depend on both groups’ elasticities. The more inelastic supply, the bigger change in price for the buyers.

Since the producer is the one liable to the tax, the producer incidence is given by:

\[ 1 + \frac{dp}{dt} = \frac{\varepsilon_S}{\varepsilon_S - \varepsilon_D} \]

The result holds for both ad valorem taxes and specific taxes.

Although the competitive market conditions may not hold in many real world markets, the result serves as a benchmark for tax incidence analysis.

### 3.3 General equilibrium results

Extending from the above to a general equilibrium incidence analysis, Mieszkowski (1967) and Goodspeed (2014) describes two separable effects relevant for the incidence of a tax on a factor: the effect on output and the factor-substitution effect. The outset is a model with perfect competition, two sectors and full use of two
factors in production. Given that the demand for the commodity is not perfectly elastic or inelastic, the market price will increase due to a tax on the producer. If the producer faces a downward sloping demand curve, a price increase will in the next step induce a decrease in demand. When demand for the commodity falls, there will be less demand for factors used in the production. If the producer was intensive in the use of one factor of production, the return of this factor will now fall.

In total, the incidence in this framework is predicted to depend on the elasticity of demand, the mobility of the factors of production and the relative intensity.

3.4 Forward shifting and imperfect competition

Several studies have found evidence of economic rents in the financial sector, implying that the competition may not be perfect (Philippon and Reshef (2009), Egger et al. (2012), Goodspeed (2014)). One way of expanding the model above in a more realistic direction is to include imperfect competition. A model with this feature is used by Capelle-Blancard and Havrylchyk (2017), in a paper where the authors conduct a similar analysis to that of this thesis. Specifically, the paper employs a Monty-Klein model with oligopolistic competition.

Following the exposition in Freixas and Rochet (2008), the Monty-Klein model describes a banking sector with a finite number of banks and imperfect Cournot competition. The banks face a downward-sloping demand for loans $L(r)$ and an upward-sloping supply of deposits $D(r)$. The money market rate $r$ and level of equity is exogenous, and the bank chooses an amount of loans $L$ and deposits $D$ to maximize profits. All banks have the same cost function $C(D, L) = \gamma_D D + \gamma_L L$, with parameters assumed to be positive.

A Cournot equilibrium is an $N$-tuple of $(D_n, L_n)_{n=1,..N}$ such that every pair maximizes each bank’s profit. With inverse demand and supply functions we get:

$$\text{MAX}_{(D_n, L_n)} \left[ (r_L(L_n+\Sigma_{m\neq n}L_m^*)-r)L_n+(r(1-\alpha)r_D(D_n+\Sigma_{m\neq n}D_m^*))D_n-C(D_n, L_n) \right]$$

As is standard in Cournot models, a Nash equilibrium can be found when firms share the market equally and sets $D_n^* = \frac{D^*}{N}$ and $L_n^* = \frac{L^*}{N}$. The first order conditions are:
\[
\frac{\partial \pi_n}{\partial L_n} = r'_L(L^*) \frac{L^*}{N} + r_l(L^*) - r - \gamma_l = 0
\]

\[
\frac{\partial \pi_n}{\partial D_n} = -r'_D(D^*) \frac{D^*}{N} + r(1 - \alpha) - r_D(D^*) - \gamma_D = 0
\]

Dividing respectively with \(r_L\) and \(r_D\) and using the rule for inverse function differentiation we get:

(1)

\[
\frac{r^*_L - (r + \gamma_L)}{r^*_L} = \frac{1}{N \varepsilon_L(r^*_L)}
\]

(2)

\[
\frac{r(1 - \alpha) - \gamma_D - r^*_D}{r^*_D} = \frac{1}{N \varepsilon_D(r^*_D)}
\]

The left hand side in (1) and (2) is interpreted as a measure of the bank’s market power (lerner index). The interpretation of the result is thus that the bank’s market power is inverse proportional to the demand and supply elasticity, respectively. The elasticities are weighted with the number of banks in the economy.

From this benchmark, an expansion of the model that fits the analyzed scenario in this thesis is to introduce an add valorem tax, \(\tau\), on the bank’s costs. This leads to the following modified version of (1) (omitting some steps with algebra):

\[
\frac{r^*_L - (r + \gamma_L(1 + \tau))}{r^*_L} = \frac{1}{N \varepsilon_L(r^*_L)}
\]

Solving for \(r^*_L\) yields:
\[ r^* = \frac{(r + \gamma_L(1 + \tau))}{(1 - \frac{1}{N\varepsilon L(r_L^*)})} \]

Differentiating with respect to the tax rate:

\[ \frac{\partial r_L}{\partial \tau} = \frac{\gamma_L}{(1 - \frac{1}{N\varepsilon_L(r_L^*)})} \]

Similar to the result with perfect competition, the change in the market price will depend on the demand elasticity. The Monti-Klein model predicts that an increase in demand elasticity will decrease the induced change in market price. In addition, the inclusion of \( N \) can be interpreted as the effect of competition between firms. A higher number of banks implies more competition which leads to a smaller change in market price.

### 3.5 Prior studies

During the last decades there has been a variety of taxes introduced and abolished in the financial sector in European countries. Among the most popular variants are some sort of securities trade taxation. The financial transaction tax (FTT) is an example of such a tax which typically has imposed a levy on security trades like stocks and bonds (Larking (2012)). Some of the European countries that have tried this tax includes Spain (cancelled 1988), Denmark (cancelled 1999) and France (cancelled 2008) (ibid).

Compared to this, the financial activities tax has been less widespread. An exact definition of the financial activities tax is, however, hard to find in the literature. The IMF separates between three variants; tax on rents, tax on excessive returns and a tax on all profits and remuneration (ibid). The Norwegian version falls in the latter category.

An example of a long-lasting implementation of the extra payroll tax can be found in Denmark, which since 1988 has imposed an extra tax on wages for businesses exempt from VAT. This includes the financial sector. Since the introduction, the rate has been increased and in 2017 it was 14.1 percent for the financial sector. Despite many years of implementation, there has, to my knowledge, been no
empirical assessment of the Danish experience. The closest to a study of the tax’
effects is a presentation held by professor Peter Birch Sørensen at the Brussels Tax
Forum in 2011 (Sørensen (2011)). In this presentation, Sørensen uses aggregated
data for the sector to assess if there are any indications of effects caused by the
tax. The author finds that the average wage growth in the sector has been parallel
to that of the manufacturing sector, implying that the tax has not been shifted to
wages. Further, while the tax rate has increased over the years, the margin between
average loan rates and deposit rates have decreased. However, the data shows that
total labor costs as share of total value added have increased in Denmark, compared
to the EU15 countries. This is interpreted as indicating that the FAT has cut into
the firms’ profits.

Other countries with a FAT, but not much empirical evidence, includes France,
Iceland and Israel.

The body of literature on tax incidence in the banking sector have mainly been
evaluating the effect of the CIT. In an influential paper on the determinants of
interest rates, Demirguc-Kunt and Huizinga (1999) finds that the corporate income
tax has a positive effect on the net interest margin. In the study, net interest margin
is defined as interest income as share of assets. The result is derived by using
a rich dataset with banks from 80 countries in the years 1988-95 and a weighted
least squares estimator. The authors conclude that the CIT is completely shifted
forward. In a similar study, based on an extract from the same database as used by
Demirguc-Kunt et. al., Chiorazzo and Milani (2011) finds that a large part of the
CIT is passed through to customers. Goodspeed (2014) examines how American
banks are able to shift the corporate tax on wages. The author uses U.S. census
data for individuals in 2003 and employs a regression framework with controls on
both individual and state level. The reported results show a positive and significant
effect of the corporate tax on wages.

Contrasting these results, a study by Capelle-Blancard and Havrylchyk (2014)
finds no evidence for the hypothesis that banks on average are able to shift the CIT
onto customers. This study uses data from the same database as the two previously
mentioned papers. The authors use a dynamic panel data approach and argue that
the two other papers respectively suffers from omitted variable bias and an incorrect
specification of the CIT variable.

In a study closely related to that of this thesis, Capelle-Blancard and Havrylchyk
(2017) estimates the effect of a levy on Hungarian banks’ assets introduced in 2010.
The scheme included a sharp cutoff based on a bank’s total assets, such that small
banks faced a tax rate of 0.15 percent while large banks were liable to a tax rate
of 0.53 percent. The authors exploits this change with a general difference-in-differences framework. Using the net interest margin and several interest rates as dependent variables, the researchers find that the tax on assets induced an increase in the net interest margin of 0.84 percentage points. The estimates shows that interest rates where increased on outstanding mortgage loans, but not on new mortgage loans. The interpretation is that these customers have the lowest demand elasticity which makes the banks able to exercise market power.

Kogler (2016) examines the incidence of bank levies on assets and liabilities on almost 3000 European banks during the years 2007-2012. The data used does not contain interest rates, and the author therefore constructed an approximate for this variable by dividing interest income from loans on the share of average loans. The second dependent variable in the study is the income generated by the margin between interest rates on loans and deposits. Using a Fixed effect estimation, the author finds that the approximate for interest rates is estimated to increase with 0.2 percentage points, while the estimate using the second dependent variable is around 0.04. The magnitude of the pass-through is found to increase when the sector is more concentrated.

3.6 Research hypothesis

The theoretical prediction presented in this chapter highlights that the incidence of the tax on wages will depend on several factors such as elasticity of demand and supply, market concentrating and the mobility of factors used in the production. Although previous studies on Norwegian data for other sectors have shown that the payroll tax is mainly shifted on wages, it is not likely that this will be observable in the data used for this thesis, since wages are rigid in the short term. Interest rates may, on the other hand, be changed by the banks on short notice. In practice, banks can increase their prices by adjusting both deposit rates and loan rates. For instance, a response to the tax could be that banks kept loan rates constant while decreasing deposit rates. However, in the time after the financial crisis, deposit rates have been low and nearing the lower bound of one percent. Decreasing deposit rates from this outset is an unlikely option as it would imply that customers would have to pay to deposit their savings. Consequently, this thesis tests the following hypothesis.

Hypothesis: Borrowers bear some of the burden of the tax on wages in the form of higher interest rates compared to the counterfactual outcome without the tax.
4 Data

4.1 Panel data of Norwegian banks

The data used in this thesis comes from a database, named ORBOF, that contains accounting data for the Norwegian financial sector. Data collection and processing for this database is a collaborative effort between Finanstilsynet and Statistics Norway, but the data is also shared with Norges Bank.

This thesis uses an anonymous panel data extract from Norges Bank of the accounting data for all Norwegian banks from year 2002 to 2018. The variables have quarterly bank-level observations and stems mostly from the banks’ balance sheet and income statement.

There are 165 banks in the dataset, which is more than the actual number of banks at any given point in time. The explanation for this is that numerous banks entered and exited the market in the course of nearly two decades. Exits may happen due to a variety of reasons such as bankruptcy or merging with another bank. The dataset used in this thesis consists of Norwegian banks only, so if a Norwegian bank merges and becomes a branch of a foreign bank, it will exit the data. The most notable example of this scenario was when the second largest bank in Norway, Nordea Bank Norge ASA, became a branch of the Swedish parent company from 2017. It follows from these movements that the panel is unbalanced.

Figure 2 below illustrates the distribution of entries and exits in the data. In the whole period, 22 banks enter the market after 2002 and 37 banks exit before 2018.

![Figure 2: Market entry and exit](image)

Among the banks in the data there are mainly three types; commercial banks, savings banks and subsidiary banks. Most of the banks are primarily issuing mortgage and commercial loans, while a handful are dedicated to consumer loans. This last
group offer products that differ significantly from standard mortgage and commercial loans, as consumer loans have a higher risk profile and a higher interest rate. This activity leads to a different business model than the other banks, and it follows that this group may respond differently to economic surroundings, such as changes in the money market interest rate. Since I employ a difference-in-differences framework in the analysis, this deviation in response is a problem. The main identifying assumption in the DiD model is the assumption of a common trend in the outcome variable among the treated and control group. The common trend is plausible for banks that issue the same kind of loans. Prices for high risk loans, on the other hand, may be expected to follow a different trend over time compared to the prices for secured loans.

Since the panel is anonymous, however, I cannot use public information provided by the banks to classify their business model. I therefore identify a group of banks devoted to high risk loans by looking at three central characteristics; share of total loans to the household sector, share of total loans secured on dwellings and average interest rates. A bank dedicated to high risk loans will have a high share of loans towards the household sector, low share of secured loans and high interest rates.

The analysis shows that 12 banks in the data are above the 95th percentile for both total interest rates and total share of loans to households.

**Figure 3:** Trends in average interest rates: 12 high risk banks vs others
Figure 3 above illustrates how the 12 banks with very high interest rates and a very low share of secured loans have increased interest rates since 2013, while the rest of the banks have lowered interest rates. Due to the differences between these groups, these 12 banks will be excluded from all figures and analysis in the following chapters. Since these banks have no or very little activity in the market for secured loans and business loans, this step should not have an effect on these estimates. In the sensitivity checks I will present the results using all banks.

To avoid that outliers drive the results, two additional banks are dropped from the data due to extreme values in the exposure variable. This variable is defined as the ratio of average wage costs and operating revenue in 2016. The first bank has a ratio of 10.6, issues no loans, and enters the data in late 2016. A ratio of 10.6 is above the 99th percentile. The second bank enters the market in 2002 and has a share of 0.08, which is below the 1st percentile.

In sum, the number of banks in the data after the above mentioned steps is reduced from 165 to 151. The exclusion of banks dedicated to high risk loans has implications for the external validity of the estimates. After the changes, the estimates reflect the response from banks mainly issuing loans with low or moderate risk.

4.2 Definitions and descriptive statistics

The interest rates in the panel are calculated as the average interest rate at the end of each quarter, weighted with the size of the loan. There is no separation between new or outstanding loans, but interest rates are differentiated between sectors and between types. In the analysis, I separate between commercial loans and mortgage loans. The former includes mainly intermediation to private companies and self-employed while the latter is mainly comprised of repayment loans secured on dwellings and credit lines secured on dwellings. The data also allows for disentangling sectors. The public sector is defined as including counties, municipalities, non-financial firms and households.
Figure 4: Trends in average interest rates: commercial loans and mortgage

Figure 4 above illustrates the average interest rate for all banks for commercial loans and mortgage loans to the public. The two interest rates follow a similar trend but on different levels. As is well known, the figure illustrates how interest rates in general decreased from 2014 to 2016 and stabilized on a historically low level.

Two important variables for this study are wage costs and payroll tax. The former variable constitutes the tax base, while the latter contains the amount paid in taxes. Figure 5 below show how the banks’ wage costs as share of GDP have increased after the financial crisis, before flattening out from 2014.
Statistics provided by Statistics Norway for the years 2008-2015 show that the number of workers in the financial sector has fallen since 2011 (Statistics Norway (2018)). Assuming that this sector trend also applies to banks, the increase of wage costs implies that the wages for the remaining workers in banks have increased. A possible explanation for these trends may be that the adoption of technology and machines has reduced the need for labor and boosted the productivity in the sector.

Figure 6 below illustrates how banks’ payroll tax as share of GDP also have increased after the financial crisis.
In general, the statutory payroll tax rate varies with different regions in the country. From 2014, however, a new law made the financial sector, among others, liable to the highest rate, 14.1 percent, independent of the firm’s geographical location (Prop. 118 S 2013-2014 (2011)). The next change came in 2017, and the data show that total payroll tax paid by banks increased with 23 percent from 2016 to 2017.

All variables in the dataset are given in 1000NOK. Variables from the balance sheet are given in stocks. The variables from the income statement are given in flows, but converted to stocks to make the data comparable. Table 1 below shows descriptive statistics for important variables, using the 151 banks.
Table 1: Observations, quarterly means and variable definitions

<table>
<thead>
<tr>
<th></th>
<th>Observations</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>8265</td>
<td>21512367</td>
<td>1.29e+08</td>
</tr>
<tr>
<td>Equity capital</td>
<td>8265</td>
<td>1545856</td>
<td>8791626</td>
</tr>
<tr>
<td>Subordinated loan capital</td>
<td>4333</td>
<td>792334</td>
<td>3551760</td>
</tr>
<tr>
<td>Wage cost</td>
<td>8258</td>
<td>22064</td>
<td>108275</td>
</tr>
<tr>
<td>Interest income</td>
<td>8153</td>
<td>189286</td>
<td>925839</td>
</tr>
<tr>
<td>Payroll tax</td>
<td>7425</td>
<td>906</td>
<td>8958</td>
</tr>
<tr>
<td>Credit losses</td>
<td>8029</td>
<td>7285</td>
<td>54767</td>
</tr>
<tr>
<td>Operating cost</td>
<td>8258</td>
<td>55977</td>
<td>281176</td>
</tr>
<tr>
<td>Operating revenue</td>
<td>8258</td>
<td>120976</td>
<td>650043</td>
</tr>
<tr>
<td>Profit before tax</td>
<td>8258</td>
<td>54774</td>
<td>335285</td>
</tr>
<tr>
<td>Net profit</td>
<td>8258</td>
<td>41805</td>
<td>258227</td>
</tr>
</tbody>
</table>

Notes: Assets is the sum of a bank’s stocks, deposits, buildings etc. Equity capital consists of share capital and primary capital. Subordinated loan capital is the sum of hybrid capital and other debt securities classified as subordinated loan capital. Wage cost is for each bank the sum of all wages paid to workers in the quarter. Interest income is the sum of income from deposits, financial derivatives, loans, etc. Payroll tax is for each bank the sum of all payroll tax paid in the quarter. Credit losses consists of losses on loans and debt securities. Operating cost is the sum of labor cost (without payroll tax) and other costs (depreciations, writedowns etc). Operating revenue is the sum of other income and net income generated by interest, commissions and financial instruments. Profit before tax is a variable with the difference of all income and expenses before tax and net profit is the same difference but after tax. More details about definitions and variables from the database can be found at [Statistics Norway Orbof (2016)](https://www.ssb.no).  

A missing value in the dataset reflects that the bank did not have an observation for that variable at that quarter. Most variables in the data have around 8000 observations which implies that the percentage missing for these variables is very low. Subordinated loan capital is the one variable that stands out in this regard with less observations. The share of missing data in this variable is largest in the beginning of the dataset and then decline all years onward.
5 Empirical Approach

5.1 Research design

The introduction of an extra payroll tax of five percent will likely induce exogenous variation in the data since the banks have pre-reform variation in their exposure to the tax, based on how intensive they use labor in production. This creates a quasi-experimental setting that can be exploited with a DiD model. The fundamental problem of causal inference is that we cannot observe the outcome for the same individual both with and without treatment. Hence, we must form a belief of what the counterfactual outcome would have been without treatment.

The DiD approach is based on comparing the outcome before and after treatment occurs. In a standard setup with a binary treatment variable, the estimator gives us the difference of the differenced means between two groups; a treatment group and control group. The crucial identifying assumption is a common trend over time in the dependent variable for both treated and untreated groups. If both groups have a common trend, we would expect the outcome of the treated group to equal that of the control group, had this group not been subject to treatment. If this assumption holds, any effect of confounding variables would be differenced away, and the remaining difference between the two groups is interpreted as the causal effect of the treatment.

To formally illustrate the common trend assumption it is useful to introduce the Rubin Causal Model framework which has become a standard framework for causal inference (see for example Imbens and Rubin [2015]). Let $Y_{it}^d$ be the potential outcome of individual $i$ in period $t$, where $d = 1$ denotes the potential outcome if the individual is treated. Denote assignment to treatment for an individual with the binary variable $D$. For an individual we observe $Y_{it} = DY_{it}^1 + (1 - D)Y_{it}^0$, i.e., we can never observe both outcomes. The common trend can now formally be illustrated as:

$$E[Y_{t1}^0 - Y_{t0}^0 | D = 1] = E[Y_{t1}^0 - Y_{t0}^0 | D = 0]$$

Where $E[Y_{t1}^0 | D = 1]$ is not observed.

One possible strategy for isolating the causal effect of the tax would be to compare banks with other entities that are not affected by the tax. However, most of the natural comparison groups to banks are also subject to the tax. I therefore employ an alternative strategy where I exploit how pre-reform variation in wage costs
leads to variation in exposure to the new tax. The concept of exploiting variation in treatment intensity has previously been used in for example Autor et al. (2004), Duflo (2001) and Willén (2017). A bank with high wage costs in 2016 will ceteris paribus be more exposed to the tax on wages relative to a firm with low wage costs. Contrary to the standard difference-in-differences model, this approach leads to a continuous treatment variable.

The theoretical models presented in chapter 3 predict that the market with less elastic demand will potentially see a greater change in the interest rate. Based on the elasticity estimates by Raknerud and Vatne (2013), the biggest change is predicted in the market for commercial loans. To inspect the potential difference between these groups, I will report estimates for interest rates for both commercial loans and mortgage loans.

5.2 Differences in exposure

A measure of how exposed a bank is to the extra tax on wages can be constructed in several ways. The measure must obviously be based on wage costs, but using only wage costs would be misleading since this would imply that bank size is the only factor that matters. The two main concerns for this measure is to obtain an expression of wage costs relative to bank size, i.e. normalizing, and to avoid that transitory fluctuations distorts the measure. In this study, the first concern is tackled by dividing a bank’s wage costs with its operating revenue. The second concern implies that the measure should be an average over several periods. For the estimation in this study, an average for 2016 will be used. In the sensitivity analysis in the appendix, the period of time will be changed to examine if this choice is important for the results. Consequently, exposure to the tax on wages is in this study defined as the average of a bank’s wage costs divided by operating revenue in 2016.

Figure 7 below illustrates the distribution of the exposure variable.
For a bank to have high exposure it must have high wage costs relative to the operating income. Due to the economies of scale in banking, small banks might be expected to systematically be more exposed to the tax on wages. To examine if this is the case in my data, I divide the banks into two groups based on the median of the exposure in 2016 and calculate group averages for important variables in the data. The result, reported in table 2 below, shows that the means are quite different for all variables.
Table 2: Group averages by the median of exposure in 2016

<table>
<thead>
<tr>
<th></th>
<th>Mean low exposure</th>
<th>Mean high exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assets</td>
<td>62851462</td>
<td>5050352</td>
</tr>
<tr>
<td>Equity capital</td>
<td>5785084</td>
<td>515115</td>
</tr>
<tr>
<td>Subordinated loan capital</td>
<td>1210639</td>
<td>107230</td>
</tr>
<tr>
<td>Wage costs</td>
<td>51517</td>
<td>6583</td>
</tr>
<tr>
<td>Interest income</td>
<td>793930</td>
<td>120940</td>
</tr>
<tr>
<td>Payroll tax</td>
<td>2240</td>
<td>280</td>
</tr>
<tr>
<td>Credit losses</td>
<td>13258</td>
<td>2549</td>
</tr>
<tr>
<td>Operating costs</td>
<td>123977</td>
<td>16351</td>
</tr>
<tr>
<td>Operating revenue</td>
<td>344225</td>
<td>30607</td>
</tr>
<tr>
<td>Profit before tax</td>
<td>178158</td>
<td>12732</td>
</tr>
<tr>
<td>Net profit</td>
<td>331791</td>
<td>36024</td>
</tr>
</tbody>
</table>

Notes: Quarterly means with unit 1000NOK. Only data before 2017 used.

In particular, we can observe that the banks with low exposure on average have more assets, more equity and higher net profit. This implies that the banks with low exposure on average are larger than the banks with high exposure. Although the bigger banks have higher wage costs, they also have a high operating revenue which leads to low exposure. Conducting the same test as above but excluding the 10 biggest banks in the data yields the same conclusion.

Although the DiD estimator is unbiased if the common trend assumption holds, it might be restrictive to assume that small and large banks are affected in the same way by economic changes. This may represent a threat to the crucial common trend assumption for the DiD framework. However, a lack of common trend in the dependent variable is not problem in and of itself if there exists control variables that, when conditioned on, restores a common trend ([Lechner (2011)]). This then requires that the controls capture the cause of different trends in the first place. Including controls may also be desirable even if there is no different trend in the dependent variable, since including them may lead to more efficient estimates. In a study closely related to the analysis in this thesis, [Capelle-Blancard and Havrylchyk (2017)] confronts a very similar situation by adding three control variables: cost-to-asset ratio, logarithm of assets and the ratio of loan loss reserves to total assets. The intuition is that big and small banks are believed to differ in the time trends for total assets, costs and loan loss reserves. Based on this, operating costs divided by assets, log(assets) and the ratio of credit losses and assets will be used as controls.
in the estimation. The log transformation of assets is used because assets have a heavy right skew. Operating costs and credit losses captures variation in the banks costs and by dividing on assets the costs are normalized.

Lechner (2011) highlights that any control variable used in a DiD framework cannot be influenced by the treatment. If there is a correlation between the control and both treatment and outcome, there is a problem of endogeneity and the estimate of the effect of exposure on interest rates will be biased. Since payroll tax is reported as an operating cost in the income statement, including a control variable with all operating costs would lead to biased estimates. Therefore, the operating cost variable used in this study does not include this social security cost. There is no reason to believe that assets or credit losses will be affected by the increase in the tax on wages.

5.3 Econometric specifications

To test the hypothesis presented above, I estimate equations based on the form:

\[ I_i = \delta_t + \alpha (post_t \times exposure_{2016}) + \theta X_{it} + \varepsilon_{it} \]

Where the dependent variable, \( I_i \), is interest rate charged by bank \( i \) in quarter \( t \), \( \delta_t \) is a time dummy, and \( post_t \) is a dummy equal to 1 for observations after 2016. \( X_{it} \) is a vector of controls. Two variants of \( exposure_{2016} \) is used in the estimation. In the first case, \( exposure_{2016} \) is a continuous variable containing the average of wage costs divided by operating revenue in 2016. In the second case, \( exposure_{2016} \) is generated as a dummy equal to one if the bank is above the median in the continuous version. The coefficient of interest is \( \alpha \). The two variants of the exposure variable leads to two different interpretations of this estimate. In the binary case, \( exposure_{2016} \) is equal to 1 for banks above the median in 2016 and zero otherwise. Again making use of the potential outcome framework, the estimate becomes

\[ \alpha = E[Y^1_1 - Y^0_1 | D = 1] - E[Y^0_1 - Y^0_0 | D = 0] \]

, i.e., the causal effect on the interest rate for the high exposure group of banks. Using the continuous version, the estimate describes the estimated response to a one unit increase in the exposure in 2016. In general, a positive \( \alpha \) would mean that the tax is estimated to induce an increase in the interest rate.

I estimate the above equation using the Fixed Effects (FE) transformation (the within estimator). The FE model explains the individual-specific deviations from
their time-averaged values. The estimator is obtained by first subtracting time-averaged means from equation (1) and then estimating the resulting equation with ordinary least squares (OLS). The averaging over time difference away any unobserved time-invariant effects. By including time dummies, I also control for the trends in time.

An alternative specification of equation (1), that can be useful for inspection of the common trend assumption, is to include several year dummies and a measure of exposure for each year. This approach is used by among others Autor (2003), Willén (2017) and Duflo (2001), and allows for mapping out the treatment effect by year, if several years of post-treatment data are available. To estimate this saturated version, I use the following specification:

\[(2) I_t = \delta_t + \sum_{t=2013}^{2018} (\text{exposure}) \alpha_t + \theta X_{it} + \varepsilon_{it}\]

In the estimation of (2) all data for the year prior to the reform, 2016, are dropped such that all estimates are relative to this year. If the trend in the outcome variable is truly common in the pre-treatment period, we would expect all \(\alpha_t\) for \(t < 2016\) to be zero.

5.4 Correcting for biased standard errors

In panel data the error term in the regression is typically believed to include the sum of both unobserved time-invariant effects and a residual dependent on time and individual. While the FE transformation removes all unobserved bank fixed effects, the remaining residual may be biased due to serial correlation and heteroskedasticity. Serial correlation is essentially a correlation between the unobserved factors affecting the dependent variable for a bank across consecutive time periods (Verbeek (2012)). Heteroskedasticity is when the residual vary over the observations (ibid). If these effects are not considered, the statistical inference will not be reliable.

Bertrand et al. (2014) argue that the serial correlation problem may be extra problematic in a DiD framework of three reasons. Firstly, the treatment variable, which in this study is the exposure, changes little within each group over time. Secondly, the panels used are often long and thirdly, the outcome variable is often correlated across periods. A widely used approach for tackling these problems is the use of cluster robust standard errors in the estimation. Bertrand et al. find that clustered standard errors on group level produces reliable standard errors when the number of groups is above 50. The data used for estimation in this thesis consists of more than 100 banks and cluster-robust standard errors will therefore be used in
all estimation.
6 Results

6.1 Graphical evidence

A visual inspection of the outcome variable over time is important in the DiD framework, both to assess the plausibility of the common trend assumption and to substantiate any belief of a treatment effect. In the four figures below, visual trends for four interest rates are shown. The banks in the data are partitioned into two groups based on the median of exposure$_{2016}$ and each line illustrates the group average interest rate normalized to one in 2010.

![Graphical evidence](image)

**Figure 8:** Common trend for groups divided on the median of exposure$_{2016}$

All figures show a fairly convincing common pre-treatment trend in the outcome variable. Both interest rates for commercial loans follow a nearly identical trend for the two groups both before and after the treatment. In the market for commercial loans, we see that there is a small deviation between the two groups from the last
quarter in 2015. After two quarters, however, the two lines are more or less parallel until 2017. When the tax is introduced, banks with high exposure on average increase their price on commercial loans while low exposure banks on average reduce their price, indicating that the tax on wages may have had an affect on price setting in this market. Since mortgage and commercial loans represent the big markets for most banks in the data, total interest rates in figure 8 a) will reflect a combination of the two markets.

To investigate if these trends are sensitive to the division on the median, I explore different partition rules in the appendix. Figure 14 in A1 illustrates the development of interest rates when the groups consist of banks above/below the 90th/10th percentile. If there is an effect of the tax on interest rates, we would expect to clearly see different trends for the outcome after treatment. However, for commercial loans, figure 14 shows that the banks with very high pre-reform exposure does not seem to have a more pronounced shift after the reform, compared the group assigned on the median. In the market for mortgage loans the close trend in interest rates both before and after treatment persists. However, an important limitation of this alternative partitioning is that both groups have fewer banks which can make the group average interest rate more sensitive to deviations.

An alternative way of illustrating the data can be found in Card (1992), where the author graphs the difference in the outcome before and after treatment against the intensity of treatment. In a similar way, I calculate the difference in average interest rates for each bank from 2017 to the average of all years before the reform, and graph them against the $\text{exposure}_{2016}$. 


Notes: The line illustrates the prediction of a linear regression of the difference on exposure2016. The correlation between the two variables is 0.21.

Figure 9: Difference in means against exposure: Mortgage loan public

Notes: The line illustrates the prediction of a linear regression of the difference on exposure2016. The correlation between the two variables is 0.32.

Figure 10: Difference in means against exposure: Commercial loans

If there is an effect of pre-reform exposure, we would expect to observe a positive
correlation between the exposure and the difference in interest rates. In the mortgage loans to the public, there seems to be no indication of a positive correlation. Instead, for given levels of the exposure in 2016, the figure shows big variations in the interest rate difference among banks. This is not consistent with an effect of the extra payroll tax on the interest rate, but it is consistent with previously shown graphical evidence. For commercial loans, the movement is more from bottom left to top right, showing that the banks with a higher exposure towards the tax had a greater difference in average interest rates from 2016 to 2017. Similar figures for the last two interest rates are shown in table 15 and 16 in A1 in the appendix.

Figure 11 below shows estimations based on specification (2) in chapter 5.3. As mentioned in this section, the specification yields relative estimates for the effect of exposure in the prior year on interest rates for all years from 2013 to 2018. For the DiD framework to produce unbiased estimates, there should be no effect of the treatment in the years prior to the reform. In other words, the coefficients before 2016 should fluctuate around zero.
Notes: Estimation done with time dummies, controls and clustered standard errors. The year before the reform is omitted and all estimates are relative to this year.

Figure 11: Results using specification (2) and continuous exposure

The vertical lines in the figure show the width of 95% confidence intervals for the obtained coefficients. For all interest rates we can observe that relative estimates of the effect before the actual reform are close to zero, and that their confidence intervals includes zero. This implies that we cannot reject the hypothesis that these estimates are zero, and that the common trend assumption seems to hold. Figure 11 further illustrates that the relative point estimates for the effect of the reform are not statistically significant at a 5 percent level.

Figure 12 below shows the corresponding result with the binary version of the exposure variable.
Notes: Estimation done with time dummies, controls and clustered standard errors. The year before the reform is omitted and all estimates are relative to this year.

Figure 12: Results using specification (2) and binary exposure

The figure illustrates that the use of the DiD approach is appropriate also with this specification.

6.2 Tax shifting estimates

In this section I present regression results based on specification (1) introduced in chapter 5.5. The effect on the following four interest rates are reported: Interest rate on all loans, all mortgage loans to the public, all mortgage loans to households and commercial loans.
Table 3: Results using specification (1) with continuous exposure

<table>
<thead>
<tr>
<th></th>
<th>all loans</th>
<th>mortgage public</th>
<th>mortgage HH</th>
<th>commercial loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>post*exposure2016</td>
<td>1.38</td>
<td>1.67</td>
<td>1.10</td>
<td>2.66</td>
</tr>
<tr>
<td></td>
<td>(2.02)</td>
<td>(1.37)</td>
<td>(1.04)</td>
<td>(1.66)</td>
</tr>
<tr>
<td>controls</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>N</td>
<td>8253</td>
<td>8193</td>
<td>8193</td>
<td>8146</td>
</tr>
<tr>
<td>Banks</td>
<td>149</td>
<td>147</td>
<td>147</td>
<td>149</td>
</tr>
</tbody>
</table>

Notes: Clustered standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01. Time dummies omitted

Table 3 shows that the tax on wages is estimated to induce an increase in all four interest rates. In line with the theoretical predictions in chapter 3, the largest estimate is obtained in the market for commercial loans. On average, a one unit increase of exposure in 2016 is estimated to lead to an increase of 2.64 in the interest rate for commercial loans. However, an increase in exposure with one unit is not very realistic as it describes a situation where wage costs makes up more than 100 percent of a bank’s earnings before interest and tax, given that the bank had a positive ratio in the first place. Therefore, dividing by 10 yields a more interpretable result. On average, an increase in exposure of 0.1 is estimated to increase the interest rate for commercial loans with 0.264 percentage points.

The second column for each dependent variable shows estimates when two co-variates are included. If the common trend assumption holds, we would expect no or very small changes in the estimates of the coefficient on post * exposure. The first row in table 3 shows that this is the case; the inclusion of controls does not induce very big changes and thus strengthen the plausibility of unbiased estimates. Although estimates for the effect on the interest rate for all loans, mortgage loans to the public and mortgage loans to households are positive, none of the estimates are significant on standard significance levels. Using commercial loans as dependent variable, the estimate becomes significant on a 10 percent level (p-value 0.068) when controls are included.

In general, both table 3 and figure 11 illustrates that the standard error for the point estimates of the tax’ effect are quite large. There are mainly two reasons for this. Firstly, a greater variance in the banks interest rates will lead to bigger standard errors. Figure 13 below shows how the variance for all banks and total interest rates have increased in 2017.
Secondly, the standard error will increase with less data. The number of observations available after the reform is 461 compared to 7800 observations before the tax introduction.

In the second version of specification (1), I create a dummy equal to one if the bank is above the median in exposure in 2016. Table 4 below shows the results using this approach.

<table>
<thead>
<tr>
<th>Table 4: Results using specification (1) with binary exposure2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>all loans</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>post*exposure2016</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>controls</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Banks</td>
</tr>
</tbody>
</table>

Notes: Clustered standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01. Time dummies omitted
Notably, the estimates with this specification are lower compared to the ones obtained with a continuous treatment intensity variable. Using all loans as dependent variable, a negative estimate is obtained both with and without controls. Estimates for the price on mortgage loans for households fluctuates around zero, while mortgage loans for the public and commercial loans are slightly positive. In this version, no estimates are statistically significant on standard levels.

As mentioned in chapter 5.3, the estimates based on the binary indicator variable can be interpreted as the causal effect on the interest rate for the banks above the median of the continuous exposure variable. This variable is constructed as the average of wage costs divided by operating revenue in 2016. Since this variable ranges from around 0.1 to 0.4, the estimates with a binary indicator will reflect the effect of a smaller increase in the exposure, as compared to the continuous case which described the effect of increasing the exposure with one unit. This may explain why the estimates are reduced in the binary version.

A.1 in the appendix presents sensitivity checks for the two estimated variants of specification (1) presented above. Table 5 shows the obtained results using a continuous exposure variable and all available data. As expected, the biggest change is in the estimate using the interest rate for all loans as dependent variable. The explanation is that the excluded banks mainly issue unsecured loans which will for the most part not be captured in mortgage loans and commercial loans. Figure 17 in the appendix illustrates pre-reform trends in the outcome variable when all data is used. When unsecured loans are included, the trend in the interest rate for all loans differ substantially between the two groups. The estimate for this dependent variable may therefore be biased when all banks are used. For the three remaining dependent variables, the inclusion of all banks decrease the estimates and none are statistically significant. Table 6 in the appendix shows the results when all data is used together with a binary exposure variable. With this approach, all but one estimates are negative, low and not significant. As in the continuous version, the biggest change when including all data is the estimate on the interest rate for all loans.

The next four tables in the appendix show results for the two variants of specification (1) with alternative exposure variables and using the 151 banks. In the first case, the two last quarters in 2016 are used to calculate the continuous and binary exposure. Table 7 and 8 show that the results are quite similar to those obtained with the original approach. All estimates are positive and the largest coefficient is found when regressing on commercial loans. When controls are used, the estimate
for the effect on commercial loans is significant at a 10 percent level. In table 9 and 10, the two years prior to the reform are used. Although all estimates are positive, the estimates with a continuous exposure differ somewhat from previously obtained results. Notably, the size of the estimates vary more and the standard errors are larger. These results indicate that the significance of the obtained estimates are somewhat sensitive to the number of pre-reform periods used in the exposure variable.
7 Conclusion

This study has examined the effect of an extra payroll tax on banks’ interest rates. The tax on labor is one of the two elements of the financial activities tax, introduced on the financial sector in 2017. The research hypothesis was that consumers bear some of the burden in form of increased interest rates in the short run. To examine this, a difference-in-difference framework was used on a panel dataset with all banks for the years 2002-2018. Since all banks are subject to the tax, this study used pre-reform variation in exposure to the new tax to estimate the causal effect on interest rates.

Theoretical predictions showed that several factors will determine the size of any tax shift. In a market with perfect competition, the biggest burden will fall on the most inelastic part. In a framework with Cournot-competition, the prediction is that the outcome depends on both elasticities and the level of competition in the market. A result was that higher competition resulted in less shifting of the tax, with the intuition that more competition leads to less market power. Previous studies of incidence in the banking sector in other countries have found mixed results. For the CIT, some studies have found that a large part is shifted onto consumers, but there also exists studies contradicting this result. Papers on bank levies introduced on European banks’ assets or total liabilities have found that banks are able to shift the burden on consumers, but with varying magnitude.

This study has presented regression results from two approaches using different measures of exposure. In the first case, the exposure was calculated as the average of wage costs divided by operating income in 2016. This lead to a DiD model with a continuous treatment variable. Using this setup, regression results showed positive coefficients for four different interest rates; the interest rate on all loans, mortgage loans to the public, mortgage loans to households and commercial loans. In line with the theoretical predictions, the largest estimate was found in the market for commercial loans. In this market, an increase of exposure with 0.1 was estimated to induce a 0.264 percentage point increase in the interest rate on average. While the estimates on all loans and the two dependent variables with mortgage loans were not statistically significant, the obtained estimate in the market for commercial loans was significant on a 10 percent level.

In the second version, banks were divided into two groups by the median of the continuous exposure variable. In this variant, the effect of the extra tax on wages on average prices for all banks above the median is estimated. Regressions with this approach led to a big reduction in the estimates, and all estimates were fluctuating around zero. The biggest estimate was obtained in the market for commercial loans,
but no estimates were significant.

In the market for mortgage loans, both graphical and statistical evidence indicate that there has been no effect on these prices. A possible explanation for this, based on the theoretical foundation of this study, may be that the competition in the market for mortgage loans has been high. The two years prior to the introduction of the tax can be characterized by an increasing demand for mortgage loans among households and a growth in loan debt ([Norges Banks utlånsundersøkelse] (2016), [Statistics Norway Credit indicator] (2018)). In the market for commercial loans, visual evidence show that group average interest rates have the same trend prior to the extra tax on wages and a diverging trend after the introduction. The estimate on this dependent variable using controls and a continuous exposure is significant on a 10 percent level, but the significance is sensitive to the number of time periods used in the measure for banks’ exposure.

If wages and the use of labor is truly exogenous in the short run, the findings in this study suggests that the extra payroll tax has mainly been borne by banks. In the long run, however, it is more plausible that the tax will affect wages and the use of labor, and these dimensions of responses could therefore be a fitting topic for future empirical projects on the FAT.
References


A Appendix

A.1 Sensitivity checks

Figure 14: Common trend: groups divided on the 90th/10th percentile.
Notes: The line illustrates the prediction of a linear regression of the difference on exposure2016. The correlation between the two variables is 0.39.

**Figure 15:** Difference in means against exposure: Interest rate total

Notes: The line illustrates the prediction of a linear regression of the difference on exposure2016. The correlation between the two variables is 0.15.

**Figure 16:** Difference in means against exposure: Mortgage loans HH
Figure 17: Common trend: using all data, groups divided on the median of exposure2016

Table 5: Estimating specification (1) using all data with continuous exposure2016

<table>
<thead>
<tr>
<th></th>
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Notes: Clustered standard errors in parentheses. *p<0.1  **p<0.05  ***p<0.01. Time dummies omitted
Table 6: Estimating specification (1) using all data with binary exposure2016

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Notes: Clustered standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01. Time dummies omitted

Table 7: Estimating specification (1) with continuous exposure2016 from the last two quarters in 2016

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<th>mortgage HH</th>
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Notes: Clustered standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01. Time dummies omitted
Table 8: Estimating specification (1) with binary exposure2016 from the last two quarters in 2016

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<th>mortgage HH</th>
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Notes: Clustered standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01. Time dummies omitted

Table 9: Estimating specification (1) with continuous exposure from 2015 and 2016

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Notes: Clustered standard errors in parentheses. *p<0.1 **p<0.05 ***p<0.01. Time dummies omitted
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