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Does the wealth tax discourage individual savings?

Evidences from Norway

João Vitor de Souza Simão

Supervisor: Floris Zoutman

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Abstract

Wealth taxation is a widely debated topic, especially in the context of rising inequality. Empirical research covering the behavioural effects of this tax is relatively new, and the results in a Norwegian context are mixed. This thesis provides an empirical assessment of the effects that wealth taxation has on the Norwegian saving patterns. It estimates the effect of taxation on individual savings using panel data gathered from Norwegian tax returns from 2009 to 20016. A fixed-effects study is used to estimate the effect that paying an amount of tax has on the yearly accumulation of wealth. The analysis results suggest that for every 10 000 NOK paid on the wealth tax, an individual reduces savings by 0.225 to 0.2909 log points. Event studies also suggest that the discouragement effect of the wealth tax may linger for up to 3 years. The results suggest that the substitution effect is stronger than the income effect regarding the wealth tax in Norway.

Keywords – Wealth tax, Capital taxation, Fixed effects, Event study, Savings, Norway, Tax reform, NoCeT, Taxation, Behavioural effects

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1 Introduction

In the past few years, the topic of wealth taxation has slowly become more and more prominent with the general public. The debate initially gained traction in 2014 with Thomas Piketty's book: "Capital in the twenty-first century", where rising wealth inequality is put to evidence and wealth taxation is proposed as part of the solution to that problem (Piketty, 2014). In 2020, multiple American politicians proposed different wealth taxation plans for the United States (Warren, 2020; Sanders, 2020).

However, despite the attention that this type of Taxation has gained in its favour in recent years, the years before that saw multiple countries actually drop their wealth tax(OECD, 2018). This low popularity is linked to the concern that this form of Taxation creates behavioural distortions and can be detrimental to a country's economy (Norwegian Ministry of Finance, 2016). In this paper, I aim to investigate one of the adverse effects that wealth tax is said to have: reduced savings.

Despite there being a sound theoretical justification for that claim, much empirical research on the subject has been only been completed in recent years. Moreover, the research done in a Norwegian context is scarce and with conflicting conclusions. This purpose of this thesis is to understand if there is a noticeable effect caused on the Norwegian individual's savings pattern due to wealth taxation. This chapter and the next will provide an introduction to this subject.

First I cover the literature existing on the subject. The literature highlights the research gap in which my thesis aims to cover. In the next chapter I cover the institutional background on how the tax operates in Norway and the economic theory surrounding the tax. Within the context of economic theory, I explain the definition of terms that are used frequently in this paper. Such as substitution or income effects. In the context of this paper, these terms relate to if an individual would stop saving because of increased costs (substitution effect) or try to maintain an equal level of saving as before (income effect). Lastly, before I explain my data and methodology, I explain the definitions of savings which I use in my thesis.

Literature Review

Today, a small variety of papers cover the behavioural effects of wealth taxation in a series of countries that used to or still employs it. Brülhart et al. (2016) studies the effect with evidence from Switzerland, Seim (2017) Sweden, Zoutman (2018) the Netherlands, Duran-Cabré et al. (2019) Spain, Londono-Velez (2019) Colombia, and Jakobsen et al. (2020) Denmark. These papers lay a foundation for the empirical evidence of the behavioural response to wealth taxation in recent times.

Since every country handles the tax differently, it is expected that the effects vary. In general, it is observed that the presence of wealth taxation reduces the accumulated taxable wealth. This implies a stronger substitution effect in average. The explanation for the negative effect varies between papers. However, they tend to gravitate towards the misreporting of the total wealth. Seim (2017) and Duran-Cabré et al. (2019) even makes that the focus of their conclusions, mentioning that the Swedish and Spanish models allowed for loopholes and that self-reporting creates an incentive to misreport. These findings suggest that how the country implemented its wealth tax and how easy it was to misreport may have a strong effect on the results of the empirical analysis.

When it comes to Norway, the ongoing changes to the wealth tax led to a growing interest in the topic. Recently, there have been a small number of papers covering the subject: Berzins et al. (2019) on the effect that the wealth tax may have on the illiquidity of shareholders and companies; Bjerksund and Schjelderup (2019) on the impact of the tax on investor behaviour; Bjørneby et al. (2020) covering the effects on small and medium-sized businesses; Ring (2020) also covering the impact on savings, albeit with a different approach than this paper. In addition, there is also a slightly older thesis on the topic, Bruer-Skarsbø (2015), which is a master thesis from 2015 for the course of philosophy Economics at the University of Oslo. This last paper covers the effects of wealth tax on savings with a more similar approach to the one used in this thesis—a difference-in-differences approach, using the changes in the threshold as the event to be studied.

Bjerksund and Schjelderup (2019) uses mathematical models to compare the effects between income tax and wealth tax on investor's behaviours. The paper concludes that investors who face capital taxes have a lower discount rate, thus reducing disposable income. However, their willingness to pay for a company's stock is not affected by these taxes. Berzins et al. (2019) investigates how wealth taxation affects companies' liquidity as a direct result of the reduced liquidity of company owners. The findings of the paper suggest that there are negative spillover effects from household finance to corporate finance. The work also alludes that his negative spillover to companies may reduce the company's investment, growth, and performance.

At odds with previous findings is Bjørneby et al. (2020), which analyses the impacts of the wealth tax on employment and investments in small and medium-sized family-controlled firms. Contrary to other papers, this paper finds a positive employment effect due to wealth taxation. The article explains that this is likely due to a substantial income effect and how the wealth tax has a portfolio composition effect. The portfolio composition effect alludes to what previous papers have mentioned. When wealth tax is imposed, taxpayers prefer to allocate their wealth to places where it is difficult for authorities to assess the true market value. In this case, non-listed firms not traded in the market.

Due to this effect, firm owners have a tax-based incentive to place their wealth in these firms, particularly by increasing employment, and this incentive becomes more potent the higher the (marginal) wealth tax. However, it should be noted that the paper also finds that although the portfolio composition effect is strong, credit constraints may generate adverse employment effects in firms owned by household with inferior liquidity. This adverse effect falls in line with the findings by Berzins et al. (2019). Lastly, Bjørneby et al. (2020) also notes that there is a difference in behaviour depending on whether the change to the wealth tax is the tax rates or threshold.

Ring (2020) along with Bruer-Skarsbø (2015) are the papers that most fall in line with this one. They both specifically study the effect of wealth tax on savings, albeit using varying techniques and at different periods. Curiously, both papers find a positive impact between wealth taxation and savings in Norway. Ring (2020) examines geographic discontinuities in household exposure to wealth taxes. This method means that the findings focus on distortionary effects arising in the household sector. Therefore the consequences in the corporate sector are not considered.

The relationship between wealth taxation and savings found by Ring, is different from the existing empirical literature mentioned above. The findings suggest a stronger income effect. Ring (2020) cites that the likely explanation is that the setting used in his paper, with primarily third-party reported measures of savings, comes closer to estimating savings effects rather than strategic tax responses. This conclusion is important since, as mentioned, the setting in previous literature made it so misreporting could substantially impact the findings. Another important aspect to Ring's paper, is that him alongside Jakobsen et al. (2020) use a definition of savings which adjusts for the mechanical effects of the wealth tax. This inspired me to use multiple definitions of savings to observe if there is a significant difference between them.

Finally, Bruer-Skarsbø (2015) investigates the same question as me, with similar data. A smaller sample of the Norwegian population from 2008 to 2011. What sets our papers apart is that this paper benefits from coming after other research has already been done on the subject. Thus there are more empirical investigations to use as a point of comparison. They influenced me on how I tailored my data and which controls were important to include. Another difference is how we define savings. My paper uses multiple definitions based on what has been used in other papers. Lastly, Bruer-Skarsbø (2015) uses a standard difference in differences approach, while I use a regression with fixed effects and a continuous treatment variable.

The difference in these approaches is that a DiD uses a dummy variable to analyse the effect on savings, given that the threshold increased in a single period. The continuous treatment variable I use analyses the effect of the taxes throughout the entire period analysed through several changes in the threshold. In addition to the DiD, Bruer-Skarsbø (2015) also has a regression discontinuity design analysis, which shows a small negative effect of the wealth tax on active savings for non-married households and an inconclusive result for married couples. The DiD, on the other hand, shows that after the wealth tax relief in 2010, those who did not have to pay wealth tax actually reduced their active savings by 3-3.5 per cent, suggesting an income effect. This falls in line with the findings from Ring (2020) and Bjørneby et al. (2020).

As can be seen, the work done in the Norwegian context shows contradicting results which leads to an inconclusive debate. The gap in the literature is a necessity for more empirical study on the subject to confirm if Norway is an anomaly when it comes to the behavioural response to wealth tax. Or, more arguments which align the Norwegian context with the international literature. My thesis has proven to be the latter.

2 Background

The purpose of this chapter is to introduce the concepts necessary to understand my research. I begin by outlining how the wealth tax functions in Norway. I explain how the tax is calculated and how the calculation has changed over time. I then explain the economic theory behind the effects of the wealth tax and savings. I cover some economic models which serve as the basis for the conclusions drawn from my research. Finally, I close the chapter by explaining how I have defined savings in this paper. I split savings as the change in three definitions of wealth: Gross Financial Wealth (GFW), Taxable Net Wealth (NW) and Broad Wealth (BW).

2.1 Institutional setting

Wealth tax in Norway (as of 2021)

Present in Norway since 1892, the wealth tax system has undergone many changes and is one of the few still around today (OECD, 2018). Currently, according to Skatteetaten (2021b), the tax is calculated on all tax residents' net wealth past a threshold of 1.5 million NOK for single taxpayers and 3 Million for married couples. A tax resident of Norway is a person who spends more than six months of the year in the country. The calculation is applied to a person's assets regardless of where in the world it is held. However, If a person has already been taxed abroad, there is a double tax treaty to resolve the issue of being taxed twice.

The calculation of the net wealth is done on top of all the worldwide assets a person owns minus their deductible debt on the 31st of December in each calendar year. A person's assets can be, for example, bank deposits, shares, vehicles or property. A series of rules define how to calculate these assets' value. Some assets are subjected to valuation discounts. One of the more relevant assets subjected to this discount is property, which can be seen on table 2.1. The fact that this type of asset is subjected to discount is relevant, as property is usually a significant fraction of an individual's wealth. The discount, together with debt, are the most significant contributors to the difference in value between NW and BW.

The primary residence of a person is calculated at only 25% of its value, and the secondary residence is calculated at 90% of its value. A primary residence is where taxpayers have their address registered at the National Registry at the end of the year. It is not possible to have more than one primary residence. The national land register will typically state what is regarded as a leisure home. Finally, all other residential properties are considered secondary homes. Other assets subjected to valuation discount are any property used for commerce or land used for agriculture. These were valued at 65% of its market value in 2020. Different types of shares are also subjected to a 35% valuation discount. (Skatteetaten, 2021a)

If you have any debts, the deduction for debt will be reduced proportionately between the value of certain assets after the valuation discount and the value of your total wealth. If you have a spouse or registered partner, the deduction for debt will be reduced based on both your total assets and debt and those of your spouse/partner (Skatteetaten, 2021a). After the deductible debt is subtracted, you arrive at the Taxable Net Wealth (NW). The value of NW above the threshold is subjected to a 0,7% tax directed to the kommune (municipality) the individual resides. 0.15% of tax is paid to the state. These values have been subjected to changes throughout the years, and wealth taxation has been gradually decreased as visible on table 2.1.

Mathematically the wealth tax can be written as:

$$wtax_{i,t} = \tau_t * (NW_{i,t} - Threshold_t) \quad \forall\, NW_{i,t} > Threshold_t, \tag{2.1}$$

s.t.

$$wtax_{i,t} > 0 \quad \forall\, NW_{i,t} > Threshold_t,\ 0 \text{ otherwise}$$

Where,

$wtax_{i,t}$ is the amount of wealth taxes incurred during year t by person i

τ_t is the total tax rate,

$Threshold_t$ is the threshold which varies according to t,

$NW_{i,t}$ is the Taxable Net Wealth, which is the sum of taxable assets after valuation discounts minus liabilities of a person i, in year t.

Recent Wealth Tax Reforms

On the 15th of March 2013, the Stoltenberg II Government appointed a commission to review taxation in Norway (Regjeringen, 2014). Upon revision, it was decided that some changes should be applied to incentivise investment, labour supply, and savings. Among the many taxation changes that the reform brought came changes in the wealth tax.

"The net wealth tax has several weaknesses. It undermines incentives to save, and the skewed valuation of different assets distorts saving away from business activity to residential property. This reduces the total return on savings, and the level of total saving falls." -Norwegian Ministry of Finance (2016).

These changes came mainly in 3 different forms: a gradual increase on the threshold, a gradual decrease in the tax rate, and changes in how assets and debt value are calculated with alterations on the valuation discounts. The initial idea behind this change is that the alterations in how the value of assets is calculated would give real property greater weight in the tax base. The changes in the threshold and the rates would make it so that the revenue generated by this tax remained unchanged. These changes were applied in part gradually.

In 2015-2016 the Norwegian ministry of finance published a report which served as a response to the 2014 report. This piece outlined the ministry's thoughts on the suggestions made by the commission. It was decided that the wealth tax was to be altered, with the notable difference that the valuation on primary residences would not have such a sharp increase as initially proposed. The reason for that is that if the discount valuation for primary residences dropped from 75% to 20%, as it was originally proposed, the number of people paying the net wealth tax would increase drastically. As so, the valuation discount for primary residences remained at 75%. (Norwegian Ministry of Finance, 2016)

Table 2.1: Historical tax rates, threshold values and valuation discounts

	Tax rates and thresholds (in nok)			**Valuation Discount**				
year (t)	Tax Rate	Threshold (single)	Threshold (married)	Primary dwelling	Secondary dwelling	Leisure home [2]	Business property	Listed and unlisted shares
2009 [1]	1.1%	470 000	940 000	10% adj.	10% adj.	10% adj	60%adj. /60% *	0
2010	1.1%	700 000	1 400 000	75%	60%	10% adj.	60%	0
2011	1.1%	700 000	1 400 000	75%	60%	-	60%	0
2012	1.1%	750 000	1 500 000	75%	60%	10% adj.	60%	0
2013	1%	870 000	1 740 000	75%	50%	-	50%	0
2014	0.85%	1 000 000	2 000 000	75%	40%	10% adj.	40%	0
2015	0.85%	1 200 000	2 400 000	75%	30%	-	30%	0
2016	0.85%	1 400 000	2 800 000	75%	20%	-	20%	0
2017 [3]	0.85%	1 480 000	2 960 000	75%	10%	-	20%	10%
2018 [3]	0.85%	1 480 000	2 960 000	75%	10%	-	20%	20%
2019 [3]	0.85%	1 500 000	3 000 000	75%	10%	-	25%	25%
2020 [3]	0.85%	1 500 000	3 000 000	75%	10%	-	35%	35%

[1] Before 2010, housing was valued based on historical costs, with adjustments (adj.) made based on the previous year's tax value. Since 2010, assessed market values of housing are based on values of comparable properties. The assessed market value of business properties is based on rental values (of comparable properties if not rented).

* In 2009, the rented business property was valued with a 60% discount, while the tax value of non-rented business property was adjusted by 60%.

[2] The tax values of leisure homes remain based on historical costs

[3] Since 2017, the valuation discount apply to the specific asset and associated debt owned directly by the individual taxpayer. Operating assets (except for Business property) are valued equally to shares.

2.2 Economic Theory

In the next following points, I will briefly present what is considered to be the framework behind the effects of taxation on savings, as explained in the book "Public Finance and Public Policy" by Jonathan Gruber(Gruber, 2005).

Economic effects of taxes on savings

The primary idea behind the effects of taxation on savings is that the added cost of taxation makes the return on savings lower. A lower return on saving can create one of two scenarios: either the individual will save less, or the individual will have to spend less today to maintain the same effective level of future income. However, which scenario will come to play is not clear, and different models explain the effects of taxation—the critical difference between which model is how they define the purpose of savings (Gruber, 2005).

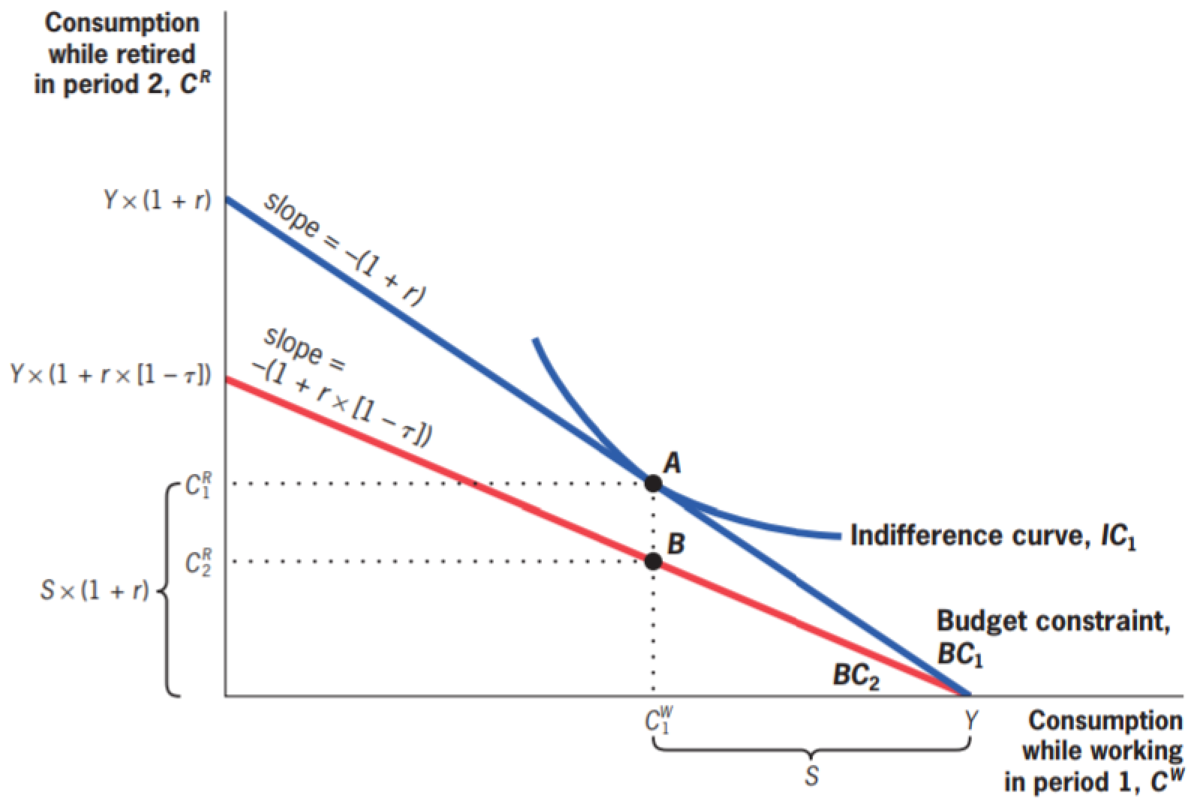
First, the classic model, which is known as the intertemporal choice model, assumes that savings' primary purpose is to smooth an individual's consumption curve throughout time. This effect is demonstrated through a budget constraint curve where the two goods that the individual must choose from are "consuming products today" or "consuming products in retirement." This can be seen in more detail in graph 2.1. The blue line shows the budget constraint without taxes, which tangents the initial indifference curve, also marked in blue. The line in red shows the budget constraint after taxation is introduced. Which point in the red line the individual would choose to allocate money would depend on which is more powerful, the income or substitution effect.

This model interprets the downsides of taxation on savings by how taxes effectively make the consumption while retired more costly and therefore shift the slope of the budget constraint curve. This change would force the individual to reconsider how their money is invested. Depending on which effect is more potent, the substitution effect or the income effect, the individual may be encouraged to allocate all the loss in acquisitive power on savings to maintain the same consumption level today. In addition to the behavioural effects, paying the taxes automatically reduces an individual's wealth, as the money needs to be taken from somewhere. The non-optional reduction to wealth is known as the mechanical effect of the wealth tax on savings. Since this effect has nothing to do with how the taxes affect behaviour, it is adjusted for our analysis. You can find a similar adjustment in (Ring, 2020) and (Jakobsen et al., 2020).

Another way to interpret the problem would be the precautionary model, which focuses on savings as insurance against bad luck. This model introduces the idea that savings are used as a buffer against unexpected adverse shocks in an individual's life. If taxation on wealth is introduced, the price for that buffer is increased. Depending on how much an individual value that insurance, they would be willing to reduce spending today to save more and compensate for the additional cost introduced by taxes. This increase in savings would explain a potential income effect caused by taxing wealth.

A third model is the self-control model, which separates individuals between those who have a higher propensity of spending money today versus individuals who will see the benefits of holding on to the money for a better effect tomorrow. One evidence

Figure 2.1: This image is figure 22-1 in Gruber (2005). It shows *the intertemporal consumption decision.*



of this model is how people often have more money saved in forms that are harder to liquidate than easily accessible accounts (Thaler and Benartzi, 2004). This effect creates an incentive for individuals to hold on blindly to savings. This model would also explain a potential income effect after the introduction of taxes. According to this logic, even if the profitability is decreased, individuals still have the incentive to invest in assets that are harder to liquidate.

With all these models in mind, it is essential to note that there is no real consensus on how the effects play outside of theory. One scenario is that the substitution effect is strong, and individuals feel the need to allocate their wealth to a more profitable solution, which is spending their income today. This effect is strengthened by the notion that Norwegian investors already have little incentive to save as they do not need the money as a buffer against some negative impacts. The other way the wealth tax can play out is that the income effect is stronger, and the overall feeling is that there is just less money to spend once wealth is taxed. The self-control model can partially explain this effect.

2.3 Defining Savings

As this paper aims to analyse the empirical effects of the wealth tax on savings, it is essential to define what is meant by savings. Following the same explanation presented in Bruer-Skarsbø (2015), savings has two theoretical definitions, which yield the same result. The first definition is that savings are the part of income that is not consumed and is accumulated.

The second definition is that savings are the difference in total wealth between two subsequent years. This paper will use the second definition due to the nature of the data available. Savings, therefore, is defined by the difference of the sum of assets that an individual holds between two years; I will use log differences. This sum of savings can be split into different categories, depending on what assets compose the sum.

I split the total savings into three categories. The first being Gross Financial Wealth (GFW), as presented in Ring (2020), which is composed of the sum of domestic deposits, foreign deposits, bonds held domestically, listed domestic stocks, domestically held mutual funds, non-listed domestic stocks (e.g., private equity holdings), foreign financial assets (stocks, bonds and other securities), and outstanding claims.

The second category is the sum of all Assets without any valuation discount. This definition will be referred to as Broad Wealth (BW). BW, therefore, is composed of the full value for all property (primary, secondary, leisure, and others), shares, cash, pension, movables and business assets, plus GFW. Finally, the third definition, Taxable Net Wealth (NW). NW is BW after the valuation discount and debt are removed.

I have chosen to analyse these definitions of wealth to investigate if there is a difference between the saving responses of an individual based on how difficult it is for the state to price each component of the tax base. As explained by Ring (2020): *financial wealth may be assessed at third-party reported market values (which limits the scope for evasion through misreporting).* The other definitions of wealth are used as a point of comparison.

I also apply some transformations to aid the interpretation of my results and account for the mechanical effects of the wealth tax. These transformations are as follows:

- **One-year log-differences of savings:** Log-differencing wealth variables is standard in the wealth tax literature (Zoutman, 2018; Brülhart et al., 2019; Ring, 2020).

- **One-year log-differences of adjusted savings:** This adjustment was created following the logic in Ring (2020). It is made to take into account the "mechanical effects" of increased wealth tax exposure. The adjustment is significant because higher wealth tax exposure mechanically reduces wealth by lowering the net-of-tax rate of return. Since this effect is not behavioural, it is of our interest to omit it from our analysis. The way it works is that I add wealth taxes incurred during $t-1$, and thus payable during period t, to savings at time t, for all individuals. This adjustment is defined by formula 2.2. The Sav variable can be whatever is defined as savings for analysis (GFW, NW or BW).

$$Adjusted\Delta log(Sav_{i,t}) \equiv log(Sav_{i,t} + wtax_{i,t-1}) - log(Sav_{i,t-1}) \approx \frac{\Delta Sav_{i,t}}{Sav_{i,t-1}} + \frac{wtax_{i,t-1}}{Sav_{i,t-1}} \tag{2.2}$$

3 Data

This research is quantitative in nature. For that purpose, I have been given access to an extensive dataset with information from individual's tax filings in Norway from 2009 to 2016. This data was provided to me by NoCeT (Norwegian Centre for Taxation) from Skatteetaten (the Norwegian tax authority). Before jumping into the identification strategy, this chapter will cover the details of the data used.

Firstly, I explain the steps taken to reduce my sample size. These steps were necessary to anonymise the data, reduce variations in the sample, and make it easier to compute. I then cover the control variables and how they were constructed. I explain the controls at this stage because they appear in the descriptive statistics. The controls are Income, Age, a "Difficult to Value Ratio" (DVR) and Decile of Broad Wealth. Lastly, I present the descriptive statistics of the sample where my research was conducted. Due to the criteria chosen to shorten my data, the individuals left for the analysis are slightly above the average wealth and around the age of 65.

3.1 Sample Selection

Due to the nature of the data used, before I had access to it, some steps were taken to keep the data anonymised:

- All individuals are represented by ID numbers. If the individual is married, the ID number of their partner will be shown.
- The age is represented as an individual fixed value of a multiple of 10 closest to the individual's age in 2015. (e.g. If the individual were 19 in 2015, they would appear 20 throughout the eight years of data.)
- There will be no individuals that have reported more than 5 million NOK in wealth. (This was 1.5% of the sample)
- There will be no individuals that have reported more than 1.5 million NOK as income. (This was 0.5% of the sample)
- All monetary amounts are represented in 10,000's of NOK and are rounded.

- Multiple variables have the foreign and domestic numbers aggregated, such as stocks, bonds, business assets and deposits.

With these criteria, the data I have been given access to had 31,804,386 observations. This information consists of 4,615,992 unique individuals across a period of 8 years. These individuals are people who paid their taxes in Norway at least once between 2009 to 2016. Further steps were taken in order to refine the sample of individuals. The steps are as follows:

- I removed individuals that do not have data for the entire period of 2009 to 2016. This is done to remove deaths and births and ensure I am working with a balanced panel data.
- I removed individuals that have had negative Netwealth throughout the period analysed. The reason for this removal is because we are more interested in individuals around the wealth tax threshold. If an individual climbs from a negative net wealth and surpasses the threshold, it likely means an unusual shock to the individual's wealth.
- I only kept individuals that remain with the same partner or single for the entire period analysed. This ensures I am not dealing with individuals that suddenly change their threshold and wealth due to marriages or divorces.

After applying the first step, to keep only individuals present throughout the eight years, my observations drop from 31,804,386 to 24,085,674 observations. Out of these observations, 15,66% paid the wealth tax. 26.55% of the observations were older than 70 years in 2015 out of the total. 55.13% out of the observations that paid the wealth tax in this sample were older than 70. Once I remove individuals with negative Net wealth and individuals who changed marriage status, the data reflects the tables shown in 3.1 and 3.2.

3.2 Defining Control Variables

Control variables are a crucial part of the identification process. They ensure that the effects attributed to a variable of interest ($Z_{i,t}$) are appropriately calculated. They help reduce omitted variable bias. Here I define them and explain their relevance in regards to my data.

- **Decile of the Broad Wealth** ($Decile\ of\ BW_{i,t}$)

  The decile of broad wealth represents how much wealth an individual i at time t has compared to other individuals in the same period. This variable separates the values of BW into bins containing 10% of the observations in each, in increasing order. The value of $Decile\ of\ BW_{i,t}$ grows in increments of 0.1. The number ranges from 0.1, with the lowest 10% of observations, to 1, with the highest 10% of observations. This variable controls for effects that scale together with an individual's wealth. Binning individuals based on their broad wealth shows some good insight on my data, as can be seen in figure 3.3.

- **Age** ($Age_{i,t}$)

  As can be visualised in figure 3.4, Age plays a big role in how an individual saves. Therefore it is in my interest to control for it. However, due to the nature of the model I use, the controls cannot be individual fixed or time fixed. This means that the controls must vary between individuals and throughout time. In my data, age is individual fixed. In order to control for it, first, I need to construct a variable that interacts age with a time fixed variable:

  $$Age_{i,t} = Age2015_i * year_t \tag{3.1}$$

  This transformation interacts the variable $Age2015_i$ with the time variable $year_t$. Effectively it makes it, so each individual's age scales with the year. This variable does not accurately reflect the actual age of my observations. However, on scales of 10, it helps determine the age group of individuals.

- **Income** ($Income_{i,t}$)

$Income_{i,t}$ is how much income an individual i has reported in year t. It is possible to define savings as what is left of income that an individual has not spent at time t and becomes part of wealth at $t+1$. So, it is reasonable to assume that the larger the individual's income, the more prone to saving.

- **Difficult to Value Ratio** ($DVR_{i,t}$)

  $DVR_{i,t}$ is how much of the broad wealth of an individual i at year t is composed of challenging to value assets. It is a way to control how much an individual invests in assets known to facilitate misreporting. The calculation is as follows:

$$DVR_{i,t} = \frac{(BusinessAssets_{i,t} + UnlistedShares_{i,t})}{(BW)_{i,t}} \tag{3.2}$$

  Unlisted companies, on average, are valued well below their market value. Investment in unlisted firms is a well-known strategy to reduce taxable wealth, such that some of the countries' wealthier individuals has low or no taxable wealth. (Bjørneby et al., 2020) A similar logic can be applied to Business assets. It is in my interest to have a control that accounts for misreporting.

3.3 Descriptive Statistics

Figures 3.1 and 3.2 are the summary statistics tables of the sample which was used in my analysis. In addition, the tables subsample the observations in individuals that are paying the wealth tax in a given year and those who are not. In figure 3.2, the rows in *Asset* and *Debt* are calculated based on the figures individuals declared in their tax filings at the end of the year. All assets are an aggregation of foreign and domestic values. The values shown are before any valuation discount. All monetary values are denoted in 10,000's of NOK.

Figure 3.2, uses the same sample and subsamples as the table above it. *# Observations* is the number of observations in each subsample. *# Individuals* is the number of unique ID's that appear in each subsample. The variables with "*(%)*" are a fraction of the number of individuals present within the subsample. *GFW as % of broad wealth* and *Netwealth as % of broad wealth* compare GFW and NTW to Broad Wealth, respectively. *GFW* is, on average, around 50% of an individual's broad wealth. *Netwealth* is around 90% of an

Figure 3.1: Mean and Standard deviations (SD) of sample, values are in 10,000's of NOK

		Total		Pays Wealth Tax		Does Not Pay Wealth Tax	
		Mean	SD	Mean	SD	Mean	SD
Asset	Primary Dwelling	33.92	42.76	59.21	54.60	21.49	28.16
	Business Assets	5.35	25.14	11.56	38.69	2.30	13.37
	Movables	3.64	9.88	6.84	14.08	2.07	6.37
	Holiday house	2.62	8.67	4.87	12.33	1.52	5.80
	Pension	1.40	9.66	3.19	15.86	0.52	3.65
	Secondary Dwelling	0.38	4.29	0.70	6.18	0.22	2.94
	Cash	0.01	0.69	0.02	1.15	0.00	0.25
	Deposits	34.86	50.19	73.05	67.79	16.09	20.73
	Listed Shares	4.07	16.35	9.50	26.29	1.40	6.11
	Non-listed shares	2.21	18.50	5.69	30.69	0.51	6.24
	Bonds	0.63	6.06	1.46	9.99	0.23	2.28
Debt	Debt	11.32	30.72	14.58	38.43	9.72	25.96
Control Variable	Age	60.00	16.61	64.75	13.46	57.67	17.49
	Income	26.79	21.80	35.27	25.93	22.40	17.80
	Decile of Broad Wealth	0.55	0.29	0.85	0.14	0.40	0.22
	Difficult to Value Ratio	0.05	0.16	0.08	0.19	0.04	0.15
Wealth	Gross Financial Wealth	41.78	58.30	89.69	76.25	18.22	22.99
	Net Wealth	78.35	79.83	162.74	82.44	36.88	30.73
	Broad Wealth	89.09	87.65	176.09	91.65	46.34	42.21
	Adj. ΔLog(GFW)	0.06	0.63	0.12	0.59	0.03	0.64
	Adj. ΔLog(Netwealth)	0.10	0.52	0.16	0.38	0.07	0.58
	Adj.Δ Log(Broad Wealth)	0.08	0.45	0.13	0.33	0.06	0.49
	LogΔ(GFW)	0.06	0.61	0.11	0.59	0.04	0.62
	ΔLog(netwealth)	0.10	0.51	0.16	0.38	0.07	0.56
	ΔLog(Broad Wealth)	0.08	0.44	0.12	0.33	0.06	0.48
Tax	Wealth Tax paid	0.26	0.57	0.79	0.75	0.00	0.00

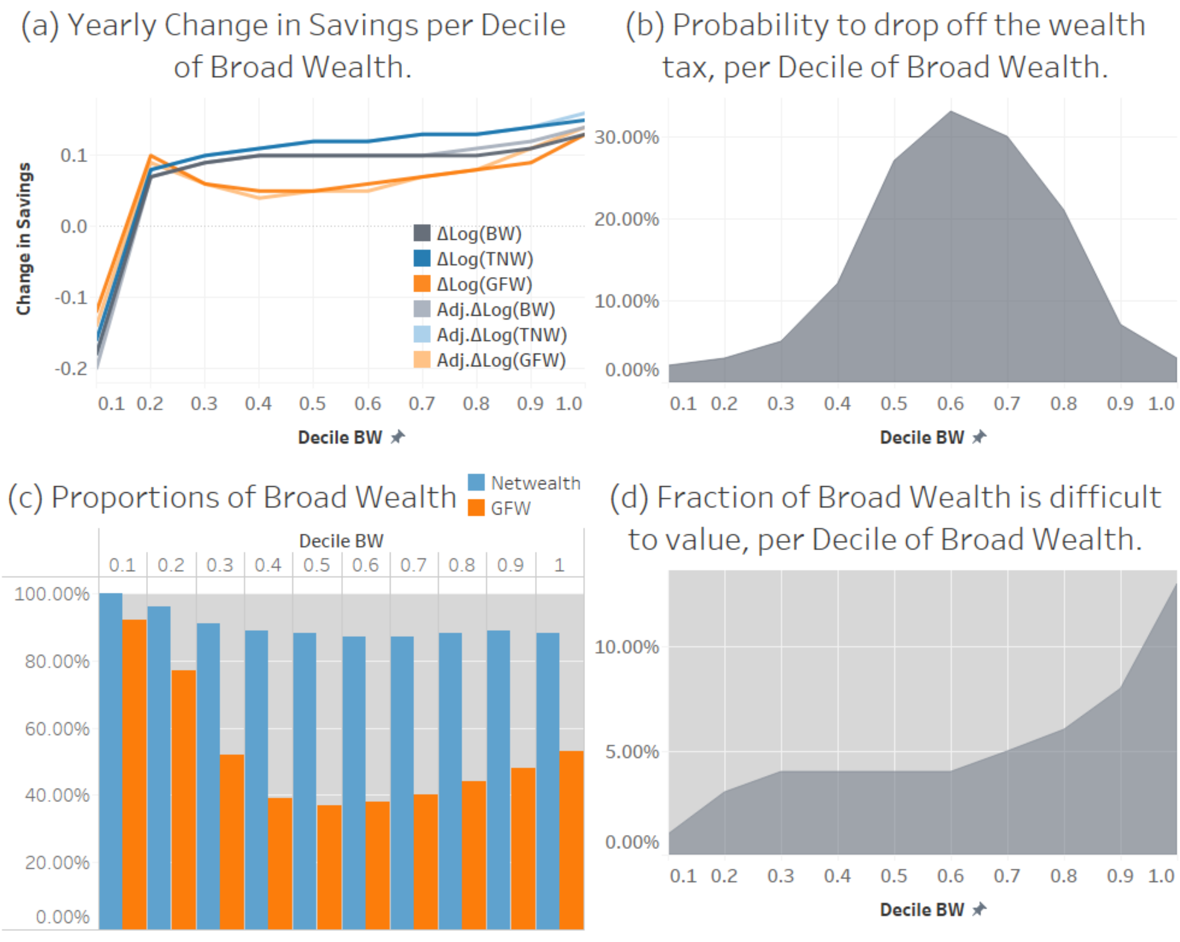
Figure 3.2: Counts and percentages of sample

	Total	Pays Wealth Tax	Does Not Pay Wealth Tax
# Observations	10,039,255.00	3,308,440.00	6,730,815.00
# Individuals	1,254,959.00	644,057.00	1,045,859.00
Non-Married (%)	0.98	0.99	0.97
30 or older (%)	0.94	0.99	0.91
70 or older (%)	0.48	0.60	0.42
Male (%)	0.39	0.51	0.33
GFW as % of broad wealth	0.51	0.49	0.52
Netwealth as % of broad wealth	0.90	0.94	0.88

individual's broad wealth.

In 3.1, it is possible to see that the primary dwellings and bank deposits are the individual's most significant assets. These two assets should compose a majority of the average individual's wealth. On average, individuals who pay the wealth tax have higher debt than individuals who do not pay the tax. The Age variable shown in this table is an average taken before it interacted with the year. The reason for that is to make it clearer to see the average age. Even so, the number shown is not reliable information on the exact average age of my sample. It is an approximation of the age of the individuals, as the actual ages were anonymised. The average age being around 60 to 70 years falls in line with other research on wealth taxation (Ring, 2020; Jakobsen et al., 2020).

Figure 3.3: Analysing the Deciles of Broad Wealth



Note: This graph was made with the sample of 10,419,47 observations used in my analysis.

On average, those who pay the wealth tax are within the top 15% of the wealthiest people in my sample. The average individual is somewhere between the 5th decile and the 6th decile. Figure 3.3 contains four graphs that break down some essential details on the difference between the deciles of broad wealth. Since the deciles of broad wealth separate my data into ten equal parts, it also visualises the sample I analyse.

Graph (a) shows the differences in saving patterns. The graph reveals that the first decile of the data has, on average negative savings. It highlights the importance of adding deciles as a control. I also ran the analysis on a version of the data which excludes the first decile. That analysis can be foun in the appendix (A0.1,A0.2). That analysis shows similar results to the analysis I present, but a far more restricted sample.

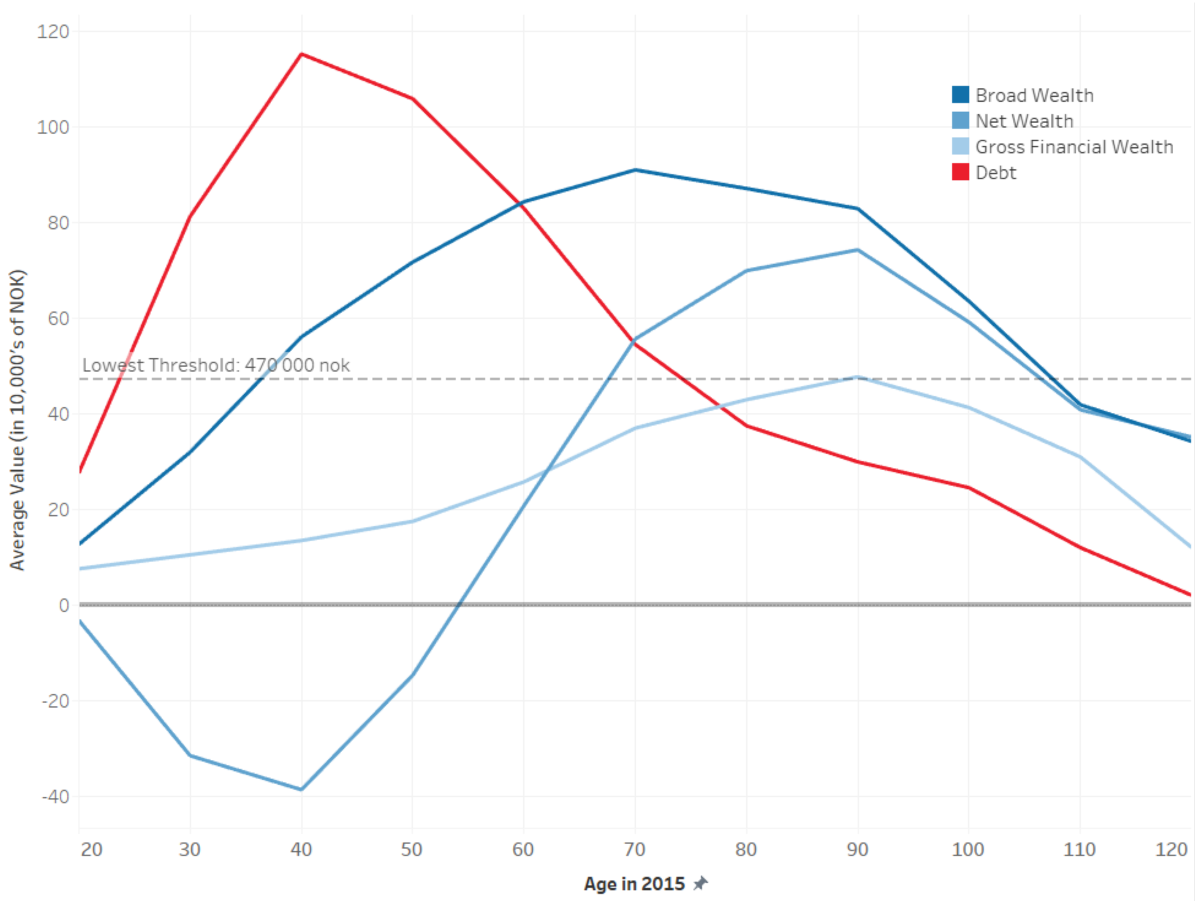
Graph (b) shows the probability of an individual dropping off the wealth tax. This probability was calculated by taking the average of a dummy variable equal to 1 if an individual used to pay the tax and no longer does. And equal to 0 if the individual either never paid the tax or never stopped paying. The graph reveals that around the 6th decile is where individuals are likely closest to the threshold, and therefore chances to drop off the tax is higher. The average taxpayer in my sample is between the 8th and 9th decile. This reveals that it is more likely that those who pay the wealth tax remain paying for the entire period.

Graph (c) illustrates the different size of all three definitions of wealth. The grey background ends at 100% and indicates broad wealth. The blue columns show that NW decreases the more wealth an individual has. Given that the difference between NW and BW is debt and valuation discounts, this decrease implies that the richer a person is, the more debt or housing a person acquires. A similar pattern can be seen with the orange columns, GFW, albeit with a slight increase towards the wealthier end. Since the largest non-financial asset is housing, it is likely that the drop seen from the first to the third deciles shows the likelihood of a person owning a house. Past the third decile, GFW maintains itself around 40% and 50% of a person's wealth.

Finally, graph (d) shows a clear pattern of the wealthy composing more of their wealth out of assets that are difficult to value. Bringing the attention back to figure 3.1 the DVR is twice as big for people who pay the wealth tax. Given that the ratio scales for broad wealth, it suggests that those paying the wealth tax allocate their wealth to assets that are difficult to value, as expected given the conclusions by Bjørneby et al. (2020).

Regarding the sampling method I used, removing negative Net wealth caused the most significant impact on my observations. This impact is evident in how it changed the number of individuals who are 70 or older. Before the change was applied to my data, 26.55% of the individuals were 70 or older. Now, 48% of the observations are 70 or older. With 60% of the people that pay the wealth tax being 70 or older. The reason for this

Figure 3.4: Age and Wealth



Note: This graph was made with the entire data set of 31,804,386 observations.

effect can be better visualised in figure 3.4.

On average, the Norwegian population acquire large amounts of debt around their 30's to their 50's. This debt offsets the net wealth, despite the broad wealth having a continuous increase until the individual is in their 70's. Only around 65, the debt decreases, and the net wealth grows large enough to be around the threshold. This behaviour explains why the average person that pays the tax in my data is around 65. The data shows that in my total sample, 39% are male. However, of those who pay the wealth tax, 51% are male. To summarize this chapter, the taxpayers which I will be analysing are on average older than 60, equal proportion in gender, and between the 8th and 9th decile of broad wealth.

4 Methodology

To understand the effects of the wealth tax on the Norwegian population's saving behaviour, I use a quasi-experiment approach. This approach is better understood in contrast to a true experiment. An ideal hypothetical experiment would first need a context without any wealth tax. Then, a randomly assigned treatment group would be forced to pay for the tax, while a control group would not. The savings behaviour of both groups would be measured over time. Then, the average causal effect could be calculated by using the average value for one group as the counterfactual for the other.

Putting this experiment to practice is neither ethical nor feasible. On the other hand, a quasi-experiment uses data gathered from a pre-existing event. This event assigns subjects to non-random treatment groups. With an identification strategy, it is possible to infer an average causal effect from the patterns found in the data. The difference is that the interpretation of that effect needs to consider the circumstances of the non-random treatment selection. The identification strategy, therefore, needs to be built around these circumstances. In addition, controlling for extraneous variables while not overfitting the model is an integral part of the process (Wooldridge, 2015).

In the case of my research, the event is the existence of a wealth tax in Norway. The treatment is applied if an individual's Taxable Net Wealth (NW) is above the threshold. In my study, the treatment variable is $z_{i,t}$. It shows how much tax an individual i is paying at time t, or is 0 if the individual is not paying the tax. Since the treatment scales with the amount of tax paid, this variable can also be called a continuous treatment variable. Thinking back to figure 2.1 in chapter 2, this variable should represent the distance between the initial blue budget constraint line from the red one. In other words, the bigger the $z_{i,t}$, the bigger is the slope drop in the intertemporal consumption budget constraints.

I have been given access to an extensive panel dataset from the Norwegian tax authorities. In the previous chapter, I have explained how I tailored this data to contain only observations relevant to my research. To leverage this type of data, I use a fixed-effects regression analysis with my continuous treatment variable. This method allows me to control for unobservable time and individual fixed effects. Controlling for these effects is essential as many individual fixed effects are immeasurable but may be necessary for explaining savings behaviour. Examples of such effects are cultural background or fixed personality traits. In addition, I have also controlled for other variables. These were defined in chapter 3, and in this chapter will be referred to collectively as the vector $\vec{X}_{i,t}$.

The last important thing for my identification strategy is savings. To make sure I get a broader view of the effect, I have constructed six variables that measure different definitions of savings. These are $Adj.\Delta Log(BW)$, $Adj.\Delta Log(NW)$, $Adj.\Delta Log(GFW)$, $\Delta Log(BW)$, $\Delta Log(NW)$ and $\Delta Log(GFW)$. I will use these variables as my dependent variables in the regressions I run. While explaining the regressions, the dependent variable will be denoted at $Y_{i,t}$.

4.1 Challenges and solutions

As with any identification strategy, some issues must be taken into considerations when designing the research. Since the model was designed with these challenges in mind, I will first list the challenges. Then, I will proceed to explain how my model resolves each.

- *Confounding policy changes.* There might be an issue where other policy changes may affect the saving habits of our observed groups. In specific, the simultaneous changes in the tax rates and threshold may affect the analysis.
- *"Lottery winner problem".* This problem arises when a household has a sudden increase in wealth and sees itself paying the wealth tax. This situation creates a reverse causality problem, as the purpose of the study is to analyse the effects of taxation on wealth and not the effects of wealth on taxation.
- *"Incidental parameters problem".* Fixed effects are not estimated consistently in a panel where the number of periods (in this case years) is fixed, while the number of individuals tends to infinity. This problem occurs by including individual fixed effects as parameters, as that would mean our data contains a number of parameters that grows with the sample size. This issue is not a great problem, as other parameters in the fixed effects model are consistently estimated. (Angrist and Pischke, 2008)
- *Independence of observations.* This is an OLS assumption that may be violated since the observations before and after the treatment have some characteristics which will

persist—making these observations dependent on each other. This issue may affect the standard errors of our estimates.

4.2 The fixed effects regression with a continuous treatment variable

To address the first issue, it is important to include in the analysis an independent variable which serves as a function of the tax rate and threshold. This variable is given as follows:

$$T^t(NW_{i,t}) = \begin{cases} \tau_t, & \text{if } NW_{i,t} > Threshold_t \\ 0, & \text{otherwise} \end{cases} \tag{4.1}$$

Where T^t takes on the value of the given tax rate τ_t at year t if the taxable net wealth $NW_{i,t}$ of individual i at year t is larger then the $Threshold_t$ at year t. The values for τ_t and $Threshold_t$ for each respective year t can be found in the appendix under 2.1.

For the second issue, the lottery winner problem, I intend to use a synthetic instrument as advised in Gruber and Saez (2002). The instrument is the tax rate to be applied under the newest set of tax rules, but with the old amount of wealth. Thus, taking into account the reaction prior to the sudden increase in wealth. The instrument is given by:

$$z_{i,t} = T^t(NW_{i,t-1}) \tag{4.2}$$

Where T^t is a function similar to the one denoted in 4.1, with the exception that it takes into account the lagged taxable net wealth.

With these variables in mind, the regression to be run in its simplest form would be given by the following fixed effects regression:

$$Y_{i,t} = \alpha_i + \eta_t + \beta_1 z_{i,t} + \beta_2 \vec{X}_{i,t} + \epsilon_{i,t}, \tag{4.3}$$

Where,

$Y_{i,t}$ Can be the $adj.\Delta log$ or Δlog of a definition of savings,

α_i is the individual-fixed effects,

η_t is the time-fixed effects,

$\vec{X}_{i,t}$ is the vector of control variables,

$\epsilon_{i,t}$ is the error term.

The effect that this approach calculates is most comparable to the ones calculated by Bruer-Skarsbø (2015) in his difference-in-differences (DiD) approach. The main difference is that the standard DiD regression would use dummies as the variables of interest, unlike equation 4.3, which has an interest rate. These reasons make equation 4.3 more flexible and with better controls than the traditional DiD regression (Gruber and Saez, 2002).

4.3 The *within variation* model

The regression package I used in R, *lfe* (Gaure, 2013) automatically solves the incidental parameters problem. This feature is standard for most panel data regressions packages. Usually referred to as a within variation model, essentially, the regression *absorbs* the fixed effects. The technical explanation is that they automate the deviations from the estimator of the mean, with an appropriate standard error adjustment for the degrees of freedom lost in estimating N individual means. This modification ensures that the standard errors are right, with a homoscedastic, serially uncorrelated residual (Angrist and Pischke, 2008). Once the within model is applied, I am left with the following equation:

$$Y_{i,t} = \beta_1 z_{i,t} + \beta_2 \vec{X}_{i,t} + \epsilon_{i,t}, \tag{4.4}$$

4.4 Cluster robust standard errors

Next, there is the issue of non-independent observations. As mentioned, this is a challenge that distorts the standard errors of panel data analysis. This distortion arises because, in panel data, the within-cluster error correlation decreases as the time separation increases, so errors are not equicorrelated (Cameron and Miller, 2015). The cluster robust standard errors are calculated together with my regressions to solve that. The calculations are also done through *lfe* (Gaure, 2013). This calculation performs best with large amounts of data. I believe that the amount of data I am using is large enough so that the cluster robust errors resolve the issue of non-independent observations.

4.5 Event study

Finally, as an extra check, I perform an event study, also known as a lag-lead analysis. I use this analysis to observe how the variation of the wealth tax paid affects the savings behaviour over time. For this, first, I calculate $\Delta z_{i,t}$, which is the first difference of $z_{i,t}$. Then I include in the regression the lags and leads of that value, defined as $\Delta z_{i,t-1}$ and $\Delta z_{i,t+1}$ respectively. At its most basic form, the analysis looks like this:

$$Y_{i,t} = \beta_1 \Delta z_{i,t+1} + \beta_2 \Delta z_{i,t} + \beta_3 \Delta z_{i,t-1} + \beta_4 \vec{X}_{i,t} + \epsilon_{i,t}, \tag{4.5}$$

Where,

Δ is the first difference in the independent variable,

β_1 is the effect that the change in wealth tax paid next year has on this year's savings,

β_2 is the effect that the change in wealth tax paid this year has on this year's savings,

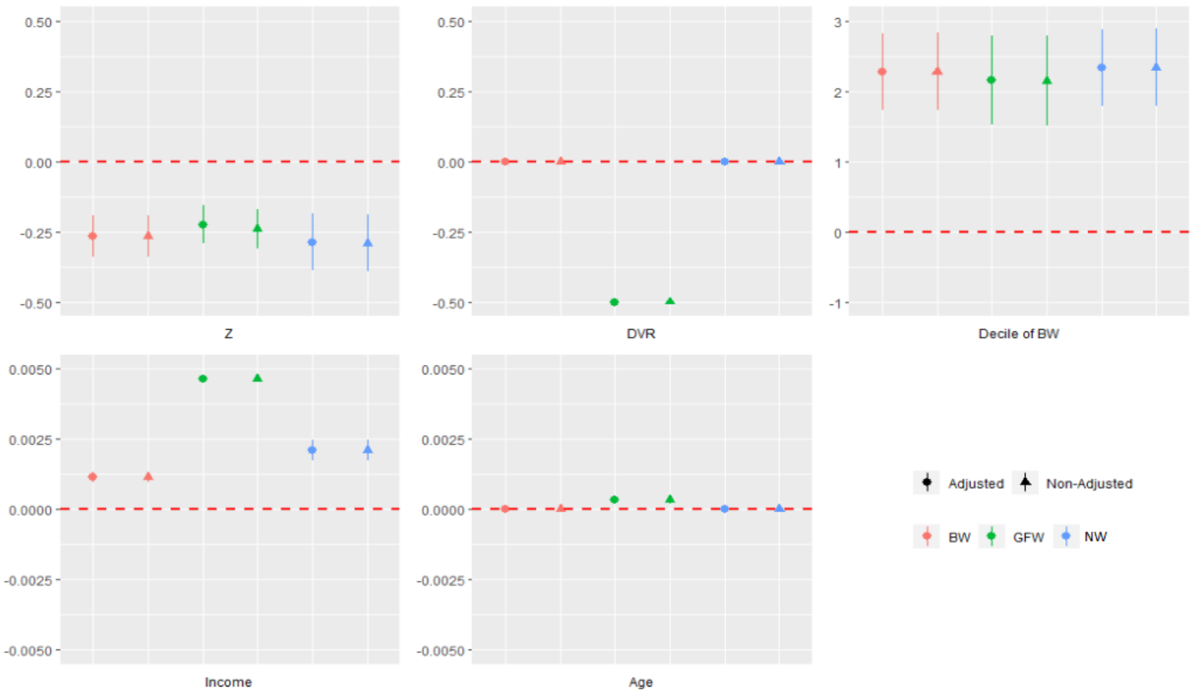
β_3 is the effect that the change in wealth tax paid last year has on this year's savings,

This analysis allows me to see the variation in the slope of $z_{i,t}$ through time. β_3 reflects the time it takes for the changes in wealth tax paid to affect an individual's saving response. β_2 and β_1 are harder to interpret. I experiment with performing this analysis different numbers leads and lags. The issue with adding more leads and lag is that I lose one year of data for each one added.

5 Analysis

Fixed Effects

Figure 5.1: Visualization of the Fixed effects regression with all 4 controls



This graph relays the information in table 5.1. The scales have small adjustments so the effects can be better visualized. The whiskers convey the confidence interval at 95% confidence. This number is based on the cluster robust adjusted errors. The values which are not statistically significant at the 1% level are shown as 0.

Table 5.1: Fixed effects, all 4 controls

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$Z_{i,t}$	−0.2250***	−0.2405***	−0.2647***	−0.2669***	−0.2872***	−0.2909***
	(0.0342)	(0.0343)	(0.0369)	(0.0371)	(0.0501)	(0.0503)
Decile of $BW_{i,t}$	2.1528***	2.1487***	2.2739***	2.2807***	2.3334***	2.3372***
	(0.3172)	(0.3185)	(0.2744)	(0.2752)	(0.2744)	(0.2753)
$DVR_{i,t}$	−0.4998***	−0.4996***	0.0311	0.0312	−0.0298	−0.0272
	(0.0771)	(0.0786)	(0.0323)	(0.0326)	(0.0312)	(0.0318)
$Income_{i,t}$	0.0046***	0.0046***	0.0012***	0.0012***	0.0021***	0.0021***
	(0.0004)	(0.0004)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
$Age_{i,t}$	0.0003***	0.0004***	0.0005**	0.0005**	0.0007**	0.0007**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Observations	6,829,891	6,818,558	7,208,821	7,208,821	7,174,048	7,173,607
R^2	0.2046	0.1962	0.2990	0.2992	0.2479	0.2485
Adjusted R^2	0.0340	0.0236	0.1542	0.1545	0.0918	0.0925
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5.2: Fixed effects, 3 controls, no Decile of $BW_{i,t}$

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
Zt	−0.0539*	−0.0706**	−0.0802*	−0.0818*	−0.0979	−0.1013
	(0.0231)	(0.0232)	(0.0384)	(0.0387)	(0.0521)	(0.0522)
$DVR_{i,t}$	−0.2601***	−0.2568***	0.2474***	0.2482***	0.1932**	0.1968**
	(0.0411)	(0.0418)	(0.0580)	(0.0584)	(0.0546)	(0.0554)
$Income_{i,t}$	0.0065***	0.0065***	0.0031***	0.0031***	0.0041***	0.0041***
	(0.0007)	(0.0007)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
$Age_{i,t}$	0.00002	0.00003	0.0002	0.0002	0.0004	0.0004
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Observations	6,829,891	6,818,558	7,208,821	7,208,821	7,174,048	7,173,607
R^2	0.1388	0.1288	0.1525	0.1526	0.1416	0.1417
Adjusted R^2	−0.0459	−0.0582	−0.0225	−0.0224	−0.0365	−0.0365
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5.3: Fixed effects, no controls

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$Z_{i,t}$	−0.0007	−0.0351	−0.0239	−0.0400	−0.0353	−0.0521
	(0.0309)	(0.0210)	(0.0434)	(0.0368)	(0.0544)	(0.0488)
Observations	7,978,831	7,962,525	8,420,788	8,418,570	8,385,296	8,382,715
R^2	0.1194	0.1094	0.1329	0.1312	0.1181	0.1167
Adjusted R^2	−0.0384	−0.0504	−0.0164	−0.0184	−0.0345	−0.0361
Note:						*p<0.1; **p<0.05; ***p<0.01

All of the regressions performed have the cluster robust standard errors already incorporated. The analysis was done on the final sample of 10,039,255 observations. However, that number may be reduced due to first differencing, lagging/leading, or missing values. The value of the coefficients is the expected impact on the individual's savings in log points. Savings are defined as the change of an individual's wealth from one year to another.

Out of the regressions I ran, including all 4 controls produced the most reliable results. The results for that regression are expressed on table 5.1 and can be visualized in graph 5.1. I also included the table for other regressions to demonstrate the effects that the controls have had in my analysis. These regressions are expressed on tables 5.3 and 5.2.

The fixed effects analysis indicates a statistically significant, negative relationship between wealth tax and savings on all six definitions I have used. $Z_{i,t}$ is the effect that every 10 000 NOK paid as wealth tax has on the amount of money saved by an individual. The first row of table 5.1, can be interpreted as follows: for every 10 000 NOK paid on the wealth tax, an individual reduces their adjusted gross financial wealth by approximately

0.225 log points; their non-adjusted gross financial wealth by 0.2405; their adjusted broad wealth by 0.2647; their non-adjusted broad wealth by 0.2669; their adjusted net wealth by 0.2872; and their non-adjusted net wealth by 0.2909.

The size of the coefficients of $Z_{i,t}$ in table 5.1 shows that the adjusted values are slightly smaller than their non-adjusted counterparts. All values are around the same size. The size of the values of BW is slightly smaller than the values for NW. Moreover, the size of the values of GFW is smaller than BW. In 5.1, all values of my variable of interest, $Z_{i,t}$, were statistically significant. This is thanks to the controls added, as can be seen by comparing table 5.1 with tables 5.3 and 5.2.

When comparing table 5.1 with 5.2 it is possible to see the impact that controlling for broad wealth had in the analysis. In table 5.2 the coeficients for $Z_{i,t}$ are considerably smaller and less statistically significant. With the effects on NW not being significant on the 10% level. With no controls, no results were statistically significant. In table 5.3 the effects are even smaller, and none are statistically significant.

According to table 5.1, the adjusted R^2 suggest that the values for GFW are the most accurate. When looking at figure 5.1, the differences between the adjusted and non-adjusted variables are hardly noticeable. The graph also shows how GFW interacts differently to some controls. DVR, Income and age seem to have a stronger effect on the value of GFW than BW or NW.

Decile of $BW_{i,t}$ has the most substantial impact out of the controls measured. This variable can take the value from 0.1 to 1 in increments of 0.1. The value is 1 when the individual's broad wealth is in the top 10% of the sample. Interpreting the exact meaning of the coefficients of this variable is not simple, partly due to how the first decile contains negative expected savings. When it comes to the size of the coefficients, the patterns are the same as for $Z_{i,t}$. NW shows the most significant values, followed by NW, followed by GFW.

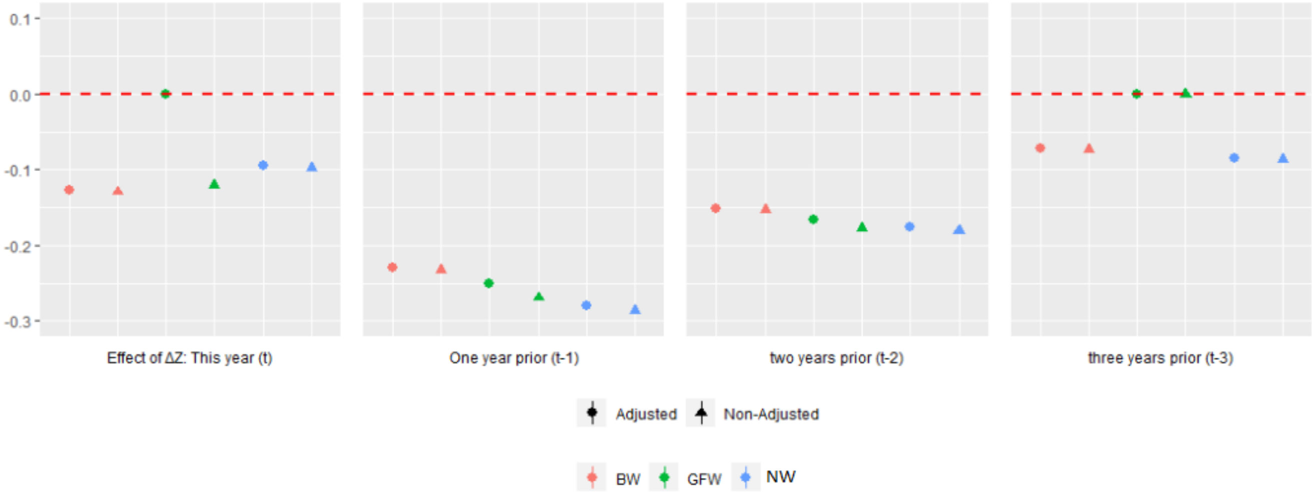
$DVR_{i,t}$ is only statistically significant in regards to financial wealth. It shows a negative relationship with financial savings. The size of the values is considerably large in comparison with the other variables. $DVR_{i,t}$ is more statistically significant when I do not control for wealth.

$Income_{i,t}$ has a relatively small positive impact on savings. Unlike the first two variables covered, income has a more substantial effect on GFW, followed by NW, with

BW being the smallest. $Age_{i,t}$ also has a relatively small positive impact on savings. It is strongest on NW, followed by BW, with GFW being the smallest.

Event study

Figure 5.2: The lingering effect of wealth tax on savings



This graph relays the information in table 5.6. Each panel represents the coefficient calculated for $\Delta Z_{i,t}$, $\Delta Z_{i,t-1}$, $\Delta Z_{i,t-2}$ and $\Delta Z_{i,t-3}$ in this order. The whiskers convey the confidence interval at 95% confidence. This number is based on the cluster robust adjusted errors. The values which are not statistically significant at the 1% level are shown as 0.

Table 5.4: 1 Lag, 1 Lead, 4 controls

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Z_{i,t+1}$	0.2316***	0.2372***	0.1525***	0.1535***	0.2099***	0.2110***
	(0.0182)	(0.0184)	(0.0182)	(0.0183)	(0.0205)	(0.0207)
$\Delta Z_{i,t}$	0.0900*	0.0822*	0.0183	0.0188	0.1025*	0.1014*
	(0.0318)	(0.0319)	(0.0318)	(0.0320)	(0.0331)	(0.0332)
$\Delta Z_{i,t-1}$	−0.0985***	−0.1042***	−0.1058***	−0.1071***	−0.1302***	−0.1321***
	(0.0069)	(0.0071)	(0.0067)	(0.0066)	(0.0094)	(0.0093)
Decile of $BW_{i,t}$	2.3181**	2.3065**	2.4971**	2.5047**	2.4568**	2.4616**
	(0.4505)	(0.4556)	(0.4716)	(0.4738)	(0.4807)	(0.4824)
$DVR_{i,t}$	−0.6550**	−0.6547**	0.0577	0.0573	−0.0104	−0.0073
	(0.1176)	(0.1188)	(0.0405)	(0.0411)	(0.0350)	(0.0361)
$Income_{i,t}$	0.0040***	0.0040***	0.0006***	0.0006***	0.0014***	0.0014***
	(0.0004)	(0.0005)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
$Age_{i,t}$	0.0007***	0.0008***	0.0007***	0.0007***	0.0008***	0.0008***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	4,588,655	4,581,638	4,826,539	4,826,539	4,808,640	4,808,389
R^2	0.3022	0.2921	0.4045	0.4049	0.3565	0.3566
Adjusted R^2	0.0565	0.0427	0.2013	0.2019	0.1360	0.1362
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5.5: 2 lags, 1 lead, 4 controls

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Z_{i,t+1}$	0.1978***	0.2025***	0.1227**	0.1232**	0.1716**	0.1725**
	(0.0188)	(0.0189)	(0.0212)	(0.0214)	(0.0199)	(0.0199)
$\Delta Z_{i,t}$	0.0529	0.0445	−0.0187	−0.0185	0.0542	0.0533
	(0.0393)	(0.0398)	(0.0395)	(0.0397)	(0.0419)	(0.0419)
$\Delta Z_{i,t-1}$	−0.1264***	−0.1353**	−0.1330**	−0.1348**	−0.1608**	−0.1632**
	(0.0123)	(0.0151)	(0.0194)	(0.0194)	(0.0189)	(0.0194)
$\Delta Z_{i,t-2}$	−0.0663**	−0.0698**	−0.0680**	−0.0687**	−0.0777***	−0.0783***
	(0.0077)	(0.0081)	(0.0078)	(0.0078)	(0.0055)	(0.0057)
Decile of $BW_{i,t}$	2.7116**	2.7045**	2.9963**	3.0069**	2.9753**	2.9819**
	(0.5665)	(0.5732)	(0.6177)	(0.6207)	(0.6348)	(0.6379)
$DVR_{i,t}$	−0.7251**	−0.7204**	0.0884	0.0879	0.0161	0.0194
	(0.1463)	(0.1460)	(0.0370)	(0.0377)	(0.0358)	(0.0357)
$Income_{i,t}$	0.0044**	0.0044**	0.0007**	0.0007**	0.0016**	0.0016**
	(0.0005)	(0.0005)	(0.0001)	(0.0001)	(0.0003)	(0.0003)
$Age_{i,t}$	0.0008*	0.0009**	0.0007**	0.0007**	0.0008**	0.0008**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Observations	3,452,140	3,446,980	3,625,839	3,625,839	3,613,044	3,612,867
R^2	0.3811	0.3691	0.4981	0.4985	0.4424	0.4420
Adjusted R^2	0.0570	0.0387	0.2423	0.2429	0.1571	0.1566
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 5.6: 3 lags, no lead, 4 controls

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Z_{i,t}$	−0.1072**	−0.1196***	−0.1294***	−0.1297***	−0.0962***	−0.0975***
	(0.0018)	(0.0018)	(0.0009)	(0.0009)	(0.0013)	(0.0013)
$\Delta Z_{i,t-1}$	−0.2509***	−0.2687***	−0.2307***	−0.2330***	−0.2821***	−0.2863***
	(0.0020)	(0.0020)	(0.0010)	(0.0010)	(0.0015)	(0.0015)
$\Delta Z_{i,t-2}$	−0.1657***	−0.1770***	−0.1520***	−0.1534***	−0.1775***	−0.1802***
	(0.0019)	(0.0019)	(0.0009)	(0.0009)	(0.0014)	(0.0014)
$\Delta Z_{i,t-3}$	−0.0718**	−0.0783**	−0.0719***	−0.0726***	−0.0847***	−0.0860***
	(0.0014)	(0.0015)	(0.0006)	(0.0006)	(0.0010)	(0.0010)
Decile of $BW_{i,t}$	3.3706***	3.3702***	3.7641***	3.7781***	3.7692***	3.7805***
	(0.0113)	(0.0113)	(0.0069)	(0.0069)	(0.0080)	(0.0081)
$DVR_{i,t}$	−0.8565**	−0.8502**	0.1172*	0.1162*	0.0379	0.0391
	(0.0189)	(0.0191)	(0.0117)	(0.0118)	(0.0136)	(0.0136)
$Income_{i,t}$	0.0052**	0.0052**	0.0010**	0.0010**	0.0021**	0.0021**
	(0.0001)	(0.0001)	(0.00004)	(0.00004)	(0.0001)	(0.0001)
$Age_{i,t}$	0.0014**	0.0013**	0.0010**	0.0010**	0.0010**	0.0010**
	(0.00003)	(0.00003)	(0.00002)	(0.00002)	(0.00003)	(0.00003)
Observations	2,306,734	2,303,695	2,420,137	2,420,137	2,411,894	2,411,784
R^2	0.5293	0.5173	0.6424	0.6427	0.5864	0.5847
Adjusted R^2	0.0432	0.0192	0.2801	0.2808	0.1663	0.1630
Note:						*p<0.1; **p<0.05; ***p<0.01

When looking at tables 5.4, 5.5 and 5.6, it is important to note I am no longer looking for $Z_{i,t}$. Instead, in the event study, the variables of interest are $\Delta Z_{i,t}$, $\Delta Z_{i,t+1}$ and $\Delta Z_{i,t-1}$. These variables tell me the effect that a change of 1 NOK of tax from one year to another has on savings.

Figure 5.2 is a visualization of the effects observed in table 5.6. I have chosen to make the visualization out of that event study because it has the best adjusted R^2 and the largest amount of lags. The graph shows that there is a diminishing lingering negative effect between wealth tax and savings. The effect is strongest going one year back, around -0.25 log points. It reduces to around -0.15 log points two years back. Lastly, three years back the effect seems die down and is around -0.05 log points.

In table 5.4, $\Delta Z_{i,t}$ shows the effect that the increase in taxes has in the current period. The effect is positive under all definitions of savings. Albeit this effect is not very statistically significant with all the controls added. The positive relationship can also be seen in $\Delta Z_{i,t+1}$, with a much larger size. $\Delta Z_{i,t+1}$ is statistically significant even with all controls added.

$\Delta Z_{i,t-1}$ reflects a similar pattern in signs as the ones observed for $Z_{i,t}$ on table 5.1. A negative effect on savings, the larger the wealth tax paid. In tables 5.5 and 5.6, it's noticeable that adding extra lags show a diminishing effect on the size of the coefficients the further back in time we go. For financial wealth, the effect becomes less statistically significant after three years.

Within the event study, the other controls display similar behaviour as seen in the first fixed-effects analysis. One exception is the Decile of $BW_{i,t}$, which becomes less statistically significant if $\Delta Z_{i,t+1}$ is present in the regression. A similar pattern can be seen with $\Delta Z_{i,t}$. $Income_{i,t}$ and $Age_{i,t}$ also lose significance if too many lags are added.

6 Discussion

The main findings from the previous chapter were that for every 10 000 NOK paid on the wealth tax, an individual reduces wealth by 0.225 to 0.2909 log points. A negative relationship between wealth tax and saving was to be expected. That expectation comes from the conclusion of the studies done on this subject in different countries (Seim, 2017; Zoutman, 2018; Brülhart et al., 2016; Duran-Cabré et al., 2019; Jakobsen et al., 2020). This result might suggest that the substitution effect is also stronger in Norway.

My research measures the effects on savings caused by the amount of NOK paid as wealth tax. To compare my values with the other papers, I can use some values found in my summary statistics to make some approximations. On average, a wealth-tax payer pays around 792,700 NOK in taxes. If applied to the results, this implies an average loss of savings ranging from 0.178 log points ($Adj.log\Delta GFW_{i,t}$) to 0.231 log points($Log\Delta NW_{i,t}$) per individual.

Given that the average tax paid in my sample was around 1%, one could say that for every 0.1 percentage-point paid in the wealth tax, there is an approximate reduction in accumulated wealth from 1.78% to 2.31%. Zoutman (2018) finds that a 0.1 percentage-point increase in the Dutch wealth tax leads to a reduction in household savings of 1.38%. Brülhart et al. (2019) finds that a 0.1 percentage-point increase in the Swiss wealth taxes lowers reported wealth by 3.5% in aggregate. Both values are similar to the ones extrapolated from my analysis.

Event study

The event study further supports my findings. $\Delta Z_{i,t-1}$ shows that if a person has been subjected to tax changes in one year, their reaction is only reflected in the following year. This reaction seems to echo as far back as three years prior, as seen with the extra lags. The first lag shows a drop of savings of around 0.25 log points, the second lag around 0.15 log points and the third lag around 0.05 log points.

$\Delta Z_{i,t+1}$ and $\Delta Z_{i,t}$ are interpreted very differently from $\Delta Z_{i,t-1}$. It is expected that $\Delta Z_{i,t+1}$ would be approximately 0 or statistically insignificant. That's because the wealth tax paid next year should not affect this year's savings. The most likely explanation is that there is inverse causation between savings and $\Delta Z_{i,t+1}$. The reason is likely because growth in wealth should grow in tandem with a growth in the tax paid, especially regarding net taxable wealth. The loss in statistical significance when controlling for $\Delta Z_{i,t+1}$ and Decile of $BW_{i,t}$ at the same time suggest that they are both trying to explain the same thing: how rich an individual is.

Analysing the controls

The behaviour of $DVR_{i,t}$ is also worth mentioning. The difficult to value ratio was expected to reduce savings. Because it is expected that the more a person invests in assets that are difficult to value, the amounts reported in their wealth would appear to be lower. However, the way this was controlled in my paper does not seem to show anything statistically significant. There are two reasons for that.

First, the reason why it loses statistical significance when *Decile* of $\mathrm{BW}_{i,t}$ is controlled can be visualized in chapter 3.3, figure 3.3, graph (D). There is a clear relationship between broad wealth and $DVR_{i,t}$, which seems to follow a cubic function. This function can be approximated to a linear function and should disappear once broad wealth is controlled.

For GFW, however, that is not the case. The reason may be because $DVR_{i,t}$, like GFW, is a proportion of the broad wealth. The largest asset that composes $DVR_{i,t}$ is business assets, which is non-financial. This explanation does not prove that $DVR_{i,t}$ does not affect savings but makes its impact unreliable. To be sure, I ran a regression without that control. It is included in the appendix (A0.4, A0.3). It shows that with or without $DVR_{i,t}$, the results are pretty much the same. I decided to keep the control since I find it important to account for misreporting.

$\mathrm{Age}_{i,t}$, like $DVR_{i,t}$, is only statistically significant at the 1% level for GFW. Unfortunately, the age variable in my data is not the most reliable since it has been modified many times. First, it was approximated to the nearest ten and was transformed into an individual fixed variable. Then, it was transformed once more when it interacted with time so it would no longer be individually fixed. Like $DVR_{i,t}$ I decided to keep the variable since it appears it is likely to explain saving behaviour.

The six different definitions of savings

Analyzing the six definitions of savings revealed the following insights. First, the changes between adjusted and non-adjusted savings are hardly noticeable. Out of the two, I believe the adjusted values are the most reliable. Because, without the adjustments, it would be more challenging to capture the income effect.

However, even with the adjustments, all my variables show a negative relationship, strengthening my findings. When it comes to the different definitions of savings, BW and NW are reasonably similar. GFW, however, shows a more visible interaction with the controls. Possibly for that reason, it has a better R^2. An explanation might be that GFW is much more liquid than BW and NW, making it more flexible. The same can be said about the event study. Given that GFW is the only one that becomes not significant after the third year.

Internal validity and external validity

To summarise the discussion chapter, I would like to discuss my research's internal validity and external validity. The internal validity is whether the estimated causal effects in a sample are representative of the population under study. Moreover, external validity is the ability to use these results to conclude about other populations (Stock et al., 2012).

The internal validity of a fixed-effects model is reasonably strong. It is a model that allows me to control for unobserved individual effects, which often are immeasurable. Controlling for time fixed effects also allows me to observe the changes in behaviour through the different tax reforms that have taken place in Norway during the period analysed.

I also control for important explanatory variables which are not time or individual fixed. The importance of these controls have been explored by running multiple regressions and observing their effects. The most important of which were presented in the analysis segment. Moreover, I have treated my data to best accommodate my model and eliminated observations that could generate issues. The main issue being events that could drastically change an individual's wealth, like deaths or divorces. For the same purpose, I use a synthetic instrument in the form of $Z_{i,t}$.

When it comes to external validity, a factor that makes my model strong is that the data I use is a substantial sample of the Norwegian population. As a point of comparison, my data originally had 4.615 million unique individuals for eight years. The population of Norway in 2015 was 5.166 million. Even after sampling my data, I still had 1.254 million. With that in mind, it should be said that the effects found in this study cover the behavioural effects of wealth taxation on the group more prone to paying the wealth tax in Norway. The group is composed mainly of people over the age of 60.

My results are also make sense with regards to the economic theory. An argument that might explain why wealth tax reduces savings relate to the intertemporal choice model. The model explains that individuals are motivated to save to have money for retirement. However, the individuals paying the wealth tax in Norway are, on average, already retired. Therefore they already have a reduced incentive to save. The results also make sense in regards to the precautionary model. The model explains that individuals are motivated to save as a buffer from adverse effects. Norway has a robust welfare system, suggesting that they also have a reduced incentive to save for that specific purpose.

Finally, the fact that the size of the effect found in my analysis is comparable to the effect found in other countries also contributes to this study's external validity. One issue is that my results go against the results found by Bruer-Skarsbø (2015) and Ring (2020). In the case of the first, Bruer-Skarsbø (2015) found a negative impact in his data with a regression discontinuity design. However, that result contradicted the results of the difference in differences analysis. In his conclusion, he mentions that the diversity of his results makes it difficult to draw any clear answers. Ring (2020) is more puzzling, as I have modelled my adjustment to mechanical effects and definition for financial wealth with his work as inspiration. Nevertheless, our results are pretty different. Most likely, the difference in methodologies used led us to different results.

7 Conclusion

Wealth taxation is said to play a significant role as a form of reducing inequality. In economic theory, it is uncertain how taxation on wealth affects an individual's saving behaviour. Nevertheless, even without much empirical evidence, policymakers have been assuming the effect is negative. The more recent literature shows that the effect indeed seems to be negative in many countries worldwide. In Norway, the results are mixed. My research adds empirical observations that matter, with reason to believe that the wealth tax has been negatively impacting Norwegian savings.

For a broader understanding, my thesis covered six different definitions of savings. In all six definitions, the tax had a negative effect on the individual's saving behaviour. According to my results, for every 10 000 NOK paid on the wealth tax, an individual reduces wealth by 0.225 to 0.2909 log points. This finding suggests that the substitution effect is also stronger in Norway.

To compare my values with the other papers, I extrapolate that for every 0.1 percentage-point paid in the wealth tax, there is an approximate reduction in accumulated wealth from 1.78% to 2.31%. These values are within the range of the values found by Zoutman (2018) and Brülhart et al. (2019), which find a reduction in household savings of 1.38% and 3.5% respectively.

I believe the reason for this behaviour may lie behind the individuals who are paying the wealth tax. They are on average older than the retirement age in Norway, which means there is a natural discouragement to save. The reason taxpayers are, on average, so old can be visualised in my data. It seems that Norwegians acquire large amounts of debt in their early life. The debt and high valuation discount for primary residences shield the younger Norwegians from the wealth tax, as their net wealth is significantly lowered. This raises some follow up questions: does the wealth tax encourage debt? What are its effects on the housing market? Both are a suggestion for future research.

A potential issue with my analysis is that the variable I use to control for misreporting did not seem to capture any significant effect. The lack of control for misreporting is why my justification for decreased savings hinges on age. Other papers on the subject emphasise that misreporting may be the biggest driver of the effects between capital taxation and wealth (Seim, 2017; Duran-Cabré et al., 2019). Despite not capturing the effects of misreporting, my methodology seems to capture the effect I aimed to investigate quite effectively.

In sum, this thesis advances the literature because it adds a more conclusive relationship on the effects of wealth tax and savings in a Norwegian context. My findings suggest a noticeable negative effect caused on the Norwegian individual's savings pattern due to wealth taxation. The most important contribution of this paper is that it adds more knowledge to the pool of research regarding the behavioural effects of wealth taxation. In this time of increasing inequalities, it is vital to understand the consequences of the policies suggested.

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Appendix

The codes in R used to calculate my variables will be submitted as an appendix.

Removing the first Decile

Table A0.1: Fixed effects, all 4 controls, without first Decile

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$Z_{i,t}$	−0.2269***	−0.2419***	−0.2316***	−0.2339***	−0.2579***	−0.2618***
	(0.0324)	(0.0326)	(0.0337)	(0.0339)	(0.0482)	(0.0483)
Decile of $BW_{i,t}$	1.8962***	1.8938***	1.6669***	1.6710***	1.7562***	1.7600***
	(0.2798)	(0.2804)	(0.1938)	(0.1945)	(0.1989)	(0.1997)
$DVR_{i,t}$	−0.5410***	−0.5489***	0.0212	0.0220	−0.0453	−0.0439
	(0.0913)	(0.0918)	(0.0323)	(0.0325)	(0.0346)	(0.0356)
$Income_{i,t}$	0.0043***	0.0044***	0.0010***	0.0010***	0.0020***	0.0020***
	(0.0004)	(0.0004)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
$Age_{i,t}$	0.0003**	0.0003**	0.0005*	0.0005*	0.0007*	0.0007*
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0003)	(0.0003)
Observations	5,810,643	5,800,093	6,117,733	6,117,733	6,105,684	6,105,310
R^2	0.2014	0.1911	0.3443	0.3441	0.2403	0.2412
Adjusted R^2	0.0354	0.0228	0.2130	0.2129	0.0880	0.0890
Note:						*p<0.1; **p<0.05; ***p<0.01

Table A0.2: Event Study, without first decile

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Z_{i,t+1}$	0.2317***	0.2375***	0.1512***	0.1522***	0.2112***	0.2123***
	(0.0162)	(0.0164)	(0.0149)	(0.0150)	(0.0174)	(0.0175)
$\Delta Z_{i,t}$	0.0873*	0.0802*	0.0330	0.0331	0.1191**	0.1176**
	(0.0294)	(0.0298)	(0.0252)	(0.0253)	(0.0272)	(0.0272)
$\Delta Z_{i,t-1}$	−0.0932***	−0.0986***	−0.0848***	−0.0860***	−0.1101***	−0.1120***
	(0.0076)	(0.0079)	(0.0066)	(0.0066)	(0.0097)	(0.0097)
Decile of $BW_{i,t}$	1.9748**	1.9655**	1.7579**	1.7613**	1.7415**	1.7449**
	(0.3976)	(0.4023)	(0.3444)	(0.3461)	(0.3599)	(0.3613)
$DVR_{i,t}$	−0.7219**	−0.7294**	0.0537	0.0547	−0.0133	−0.0109
	(0.1345)	(0.1349)	(0.0366)	(0.0370)	(0.0306)	(0.0315)
$Income_{i,t}$	0.0035***	0.0036***	0.0003**	0.0003**	0.0012***	0.0012***
	(0.0004)	(0.0004)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
$Age_{i,t}$	0.0006***	0.0006***	0.0004**	0.0004**	0.0005**	0.0006**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	3,887,657	3,881,229	4,078,542	4,078,542	4,073,694	4,073,480
R^2	0.3001	0.2882	0.4691	0.4690	0.3572	0.3572
Adjusted R^2	0.0594	0.0433	0.2922	0.2920	0.1426	0.1426
Note:						*p<0.1; **p<0.05; ***p<0.01

Not controlling for DVR

Table A0.3: Fixed effects, 3 controls, no DVR

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$Z_{i,t}$	−0.2257***	−0.2416***	−0.2642***	−0.2668***	−0.2870***	−0.2911***
	(0.0340)	(0.0342)	(0.0371)	(0.0371)	(0.0505)	(0.0503)
Decile of $BW_{i,t}$	2.1449***	2.1199***	2.3053***	2.2823***	2.3631***	2.3376***
	(0.3106)	(0.3134)	(0.2743)	(0.2767)	(0.2736)	(0.2767)
$Income_{i,t}$	0.0047***	0.0047***	0.0012***	0.0012***	0.0021***	0.0021***
	(0.0004)	(0.0004)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
$Age_{i,t}$	0.0004***	0.0004***	0.0005**	0.0005**	0.0007**	0.0007**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Observations	6,830,427	6,818,559	7,209,446	7,208,821	7,176,526	7,175,470
R^2	0.2049	0.1943	0.3024	0.2992	0.2508	0.2483
Adjusted R^2	0.0343	0.0213	0.1584	0.1545	0.0953	0.0923
Note:						*p<0.1; **p<0.05; ***p<0.01

Table A0.4: Event study, no DVR

	Dependent variable:					
	$Adj.log\Delta GFW_{i,t}$	$Log\Delta GFW_{i,t}$	$Adj.log\Delta BW_{i,t}$	$Log\Delta BW_{i,t}$	$Adj.log\Delta NW_{i,t}$	$Log\Delta NW_{i,t}$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Z_{i,t+1}$	0.2300***	0.2362***	0.1520***	0.1536***	0.2092***	0.2109***
	(0.0187)	(0.0186)	(0.0185)	(0.0183)	(0.0209)	(0.0207)
$\Delta Z_{i,t}$	0.0898*	0.0808*	0.0202	0.0190	0.1040*	0.1013*
	(0.0324)	(0.0321)	(0.0324)	(0.0319)	(0.0337)	(0.0331)
$\Delta Z_{i,t-1}$	−0.0993***	−0.1046***	−0.1062***	−0.1071***	−0.1307***	−0.1321***
	(0.0066)	(0.0071)	(0.0065)	(0.0067)	(0.0091)	(0.0094)
Decile of $BW_{i,t}$	2.3083**	2.2710**	2.5363**	2.5075**	2.4937**	2.4635**
	(0.4435)	(0.4496)	(0.4731)	(0.4752)	(0.4824)	(0.4841)
Income	0.0041***	0.0041***	0.0006***	0.0006***	0.0015***	0.0014***
	(0.0005)	(0.0005)	(0.0001)	(0.0001)	(0.0002)	(0.0002)
Age	0.0008***	0.0008***	0.0007***	0.0007***	0.0008***	0.0008***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	4,589,048	4,581,639	4,826,986	4,826,539	4,810,189	4,809,497
R^2	0.3026	0.2899	0.4097	0.4049	0.3609	0.3563
Adjusted R^2	0.0570	0.0397	0.2083	0.2018	0.1420	0.1358
Note:						*p<0.1; **p<0.05; ***p<0.01