The future of personal wealth and inheritance taxation in Norway

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Summary

Many countries have recently abandoned or experienced significant reduction in tax rates and revenues from personal wealth and inheritance taxation. Today, Norway remains one of the few countries that still tax annual wealth and intergenerational wealth transfers. Both taxes however face a substantial opposition and their future remains uncertain. In this paper, a dynamic microsimulation model MOSART developed by Statistics Norway is used to project and discuss future revenues and distributional effects of the annual wealth and inheritance taxes in Norway between year 2010 and 2040. The main questions discussed are: what are the future revenue effects of these taxes and what effect will they have on the distribution of wealth. Different scenarios are analysed and compared. The model predicts that average taxable wealth will significantly increase within the simulation period, which results in substantial increases in revenues from both wealth and inheritance taxes. In order to measure distributional effect I look how the average wealth will change across different percentiles (10 equal size groups divided according to net amount of wealth owned) and I use Gini coefficient as a measure of wealth inequality. The simulation results show that wealth inequality measured by Gini coefficient is going to decline between 2010 and 2040. Both types of taxes have a significant contribution to overall reduction in wealth inequality in the long run. It is estimated that around 11% of the total decrease in Gini coefficient between 2010 and 2040 under baseline scenario is due to appliance of wealth and inheritance tax. Moreover, it appears that each year higher proportion of total reduction in Gini coefficient under baseline scenario can be attributed to wealth and inheritance taxes. Furthermore, I look what impact the removal of both taxes would have on the wealthiest individuals in Norway. In a current system of capital taxation (a dual income tax) wealth tax is thought to play an important supplementary role to ensure high progressivity on top of the income and wealth distribution. In a direct sense, it appears that removal of both taxes in the long term would mainly benefit the wealthiest individuals and since a substantial amount of their total tax comes from annual wealth taxes it would significantly reduce their tax payments. The likelihood of the projection being correct under this study is however limited to the accuracy of underlying assumptions and depends on various political decisions on national and international level.

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Contents **Page No:**

List of Tables

List of Figures

1. Introduction

Due to widespread criticism and difficulties with taxing capital stocks such as personal wealth, inheritance and gifts, many countries have recently reduced or fully abandoned wealth related taxes. Today, Norway remains one of the few countries in the world still imposing both annual wealth and intergenerational wealth transfer taxes (taxation of inheritance and gifts). Given however the recent international trends and the number of difficulties associated with taxing wealth and bequests, the future of both taxes is uncertain. Norwegian wealth tax is today widely discussed among policy makers and whether it will survive seems to depend on various outcomes on national and international levels. The purpose of the present study is to discuss the future of annual personal wealth and inheritance taxes in Norway. I do this by presenting the contribution from these taxes to tax revenues and tax burden distributions in coming years. In order to do so, a dynamic microsimulation model developed by Statistics Norway MOSART is used. When using the empirical measures and results obtained from the simulation the paper discusses the future economic effects, such as revenues and impact on wealth distribution in the future. The results obtained in this paper may be useful information for social planners as future tax revenues and burden distributions is important information in the planning process.

In addition, the paper outlines the current rates, revenues and latest changes related to both taxes in Norway. Special attention is paid to current rules governing the taxable individuals and asset valuation since some of the rules are believed to valuate some of the main principles of capital taxation. Further, I discuss the wealth and inheritance taxes relation to overall tax system in Norway and present various arguments pro and against these types of taxes. It will be argued for example that recent reforms related to the dual income tax system, with a flat tax rate on capital income and a wealth tax as a supplement, have improved the redistributive effect of capital taxation. I will also refer to the literature on wealth and inheritance related taxes, in order to have a better understanding of their overall economic effects. One of the lessons emerging from this review is that the empirical analysis are not always providing a unified and clear picture on how these taxes work and what are their economic impacts. It will be argued that despite the widespread abolition of both taxes in Europe in recent decade there is still potential for these taxes to be used. Due to highly skewed net wealth distribution in Norway and most of the other European countries, combined with aging population and increasing budget deficits, it is important to preserve a

broad tax base, and to maintain tax redistributional effects. In order to finance the costs of the crisis and reduce budget deficits wealth-related taxes are being discussed in many European countries (DB Research, 2012). The simulation results will be used to discuss to what extent taxes on wealth and inheritance can be used to reduce growing budget burdens and mitigate highly unequal wealth distribution in Norway.

The rest of the paper is organized as follows: Section 2 gives an overview of current schedules and valuation rules related to wealth and inheritance taxes in Norway. It examines the recent changes in both types of taxes and their development over time and outlines both taxes in an international context. In addition the section discusses current and future political challenges related to wealth and bequest taxation on national and international level. In section 3 some of the main weaknesses and distortions of current system are discussed. This section also discusses the supplementary role of annual wealth taxes in dual income tax system. Section 4 reviews the most recent empirical studies related to wealth and inheritance taxes. Section 5 gives a detailed introduction to dynamic microsimulation method, describes the MOSART model and various necessary underlying assumptions and gives a detailed description of wealth and inheritance modeling in the program.
Finally simulation results under different underlying assumptions are provided and discussed. Section 6 summarizes the findings and indicates directions for related future research.

2. Norwegian wealth and inheritance tax

2.1 Schedules and valuation

2.1.1 Wealth tax

In Norway a flat net wealth tax of a total 1.1% (up to 0.7% municipal and 0.4% national) per year must be paid by citizens with net wealth value above the certain threshold, see Table 1. A wealth tax is a tax on the accumulated stock of all taxable assets. The assets include, for example, cash, bank deposits, the value of own house, savings in insurance and pension plans, corporate assets and financial securities. It is the net wealth minus total financial debt that is subjected to taxation. The tax is based on the fair market value of the owner's net assets, as of 1st of January in the year of the tax assessment.

Table1. Norwegian wealth tax – current rates

Wealth tax – 2013 rates	**Individuals**	**Married couples**
Local		
Personal allowance	870, 000 NOK	1, 740, 000 NOK
Rate	0.7%	0.7%
National		
Personal allowance	870, 000 NOK	1, 740, 000 NOK
Rate	0.4%	0.4%

Source: Skatteetaten (2013)

While interest bearing accounts and shares are valued at 100%, different rules apply for example to real estate and individual private pensions (IPS) which are completely exempt. When it comes to owner occupied and rental housing, only a portion of their value is included in the tax base (25% and 40% respectively). Married couples without any other assets to own are permitted to own a debt-free residence worth up to 7 million NOK without having to pay net wealth tax.

2.1.2 Inheritance and gift tax

Both inheritance and gift taxes apply in Norway and are among the main taxes on capital stocks. Unlike estate tax which is assessed on the assets of the deceased and is paid by the donor, inheritance tax is a levy paid by a donee and is assessed on the value of the inherited assets (Gale et al. 2001). The calculation of inheritance and gift tax is based on the total assets that are passed on to the heirs of the deceased and is paid by the heirs. In 2013, wealth transfers and gifts amounting up to 470, 000 NOK are not subject to any taxation. Inheritance or gifts for the next 330, 000 NOK to parents or children are subjected to 6% tax or 8% to others. Above this level the rates are 10% and 15% respectively, see Table 2. The tax is levied when a person dies. Transfers between married or civil partners, whether during lifetime or on death, are generally exempt, as are gifts to charities. The valuation system of the inheritance and gift tax is normally based on market value at the time when the recipient receives the estate or gift. As with annual taxes on wealth, the tax is levied on the net amount and special schedules apply, for example, to unlisted shares, participations in partnerships or farms (Denk, 2012). Some of the exemptions and reliefs are listed in Appendix 1. Both bequests and gifts are accumulated in the calculation of the tax base, otherwise gifts would be a mean of avoiding inheritance tax. Not all gifts are taxable and Appendix 1 gives a list of some exemptions.

Table 2. Inheritance tax – current rates

Inheritance tax	**First 470,000 NOK**	**After next 330,000 NOK**	**Above that**
To each child, foster child or parents	None	6%	8%
To others	None	10%	15%

Source: Skatteetaten (2013)

2.2 Wealth tax - Development over time

Annual wealth tax has been subjected to radical changes over the last few years, see Table 3. Due to the increasing threshold (annual allowance), the number of people affected by the tax has been constantly declining.

Table 3. Wealth tax rule changes over time

Year	Individual allowance (NOK)	Married allowance (NOK)	Equity discount
	Local (0.4%)/National (0.4%)	Local (0.4%)/National (0.4%)	
2005	151,000/540,000	151,000/580,000	35%
2006	200,000/540,000	400,000/1,080,000	20%
2007	220,000/540,000	440,000/1,080,000	15%
2008	350,000/540,000	700,000/1,080,000	0%
2009	470,000/470,000	940,000/940,000	0%
2010	700,000/700,000	1,400,000/1,400,000	0%
2011	700,000/700,000	1,400,000/1,400,000	0%
2012	750,000/750,000	1,500,000/1,500,000	0%
2013	870,000/870,000	1,740,000/1,740,000	0%

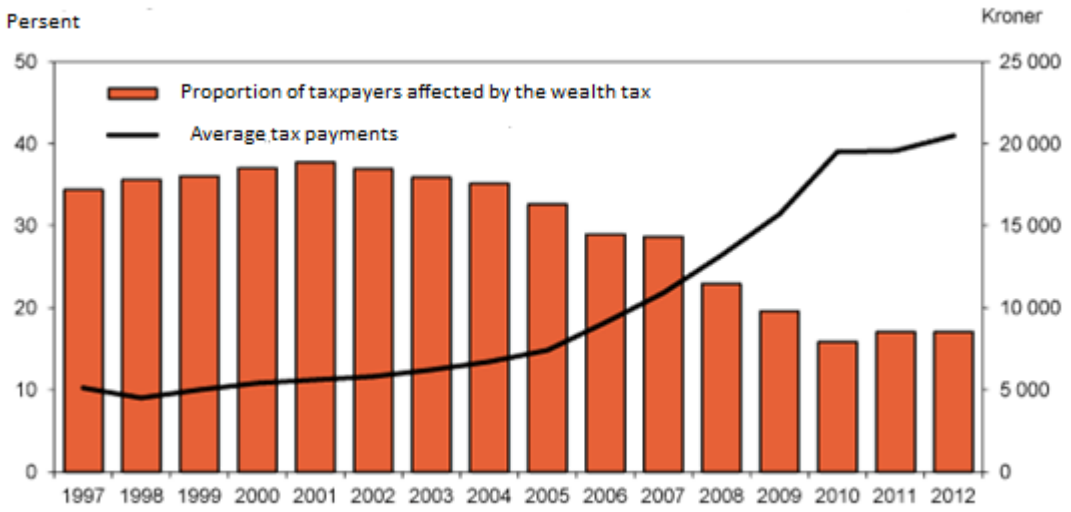
Source: Skatteetaten (2013)

In 2013 the threshold increased by 16% to currently applying 870,000 NOK (1 740 000 NOK for couples) from 750,000 NOK in previous year. According to the Ministry of Finance this will result in reduction in individuals paying wealth tax by around 50,000. It is estimated that the above changes will lead to tax reduction for around 590,000 individuals while the wealthiest individuals affected by the tax will experience higher tax burden. In addition to changing thresholds, the equity allowance that allowed 35% of the total value of equity holdings to be excluded from the tax, and an 80% rule where the tax was applied until the point where the total tax obligations exceeded 80% of the individual's ordinary income was abolished in 2009.

In effect, annual wealth tax today is thought to play a more important role in the redistribution policy. The overall changes in personal allowance and removal of 80% rule has

shifted the tax burden to more wealthy citizens, resulting in more tax being paid by individuals at the high end of the wealth distribution but without necessarily reducing the revenue from wealth taxation, see Figure 1.

Figure 1. Average wealth taxes payment and proportion of tax payers



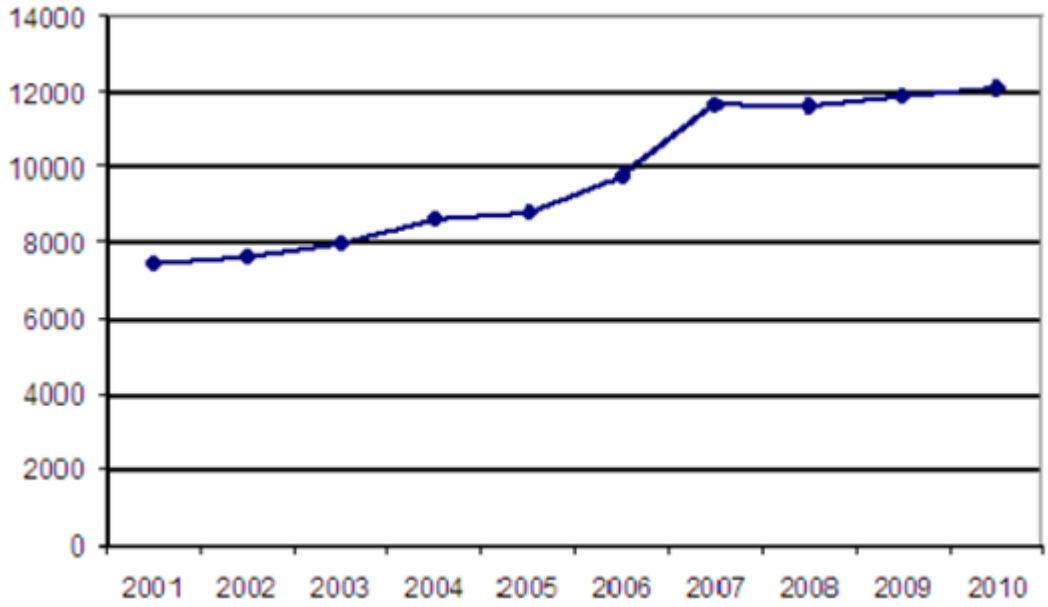
Source: Ministry of Finance (2013)

In 2013, it is estimated that around 16% of taxpayers will be paying wealth tax. Since 2005 the number of taxpayers affected by the tax has decreased by nearly 50%. According to Ministry of Finance (2013) there are relatively few people in Norway paying annual wealth tax. Furthermore, out of 650,000 taxpayers affected in 2011 the vast majority paid a relatively small amount. There were 571,075 citizens who paid less than 25,000 NOK in form of wealth taxation (6,214 NOK in average). More than 22% of total tax revenue however is paid by the wealthiest. In 2011 the wealthiest 852 Norwegian taxpayers paid around 3.3 million NOK on average. For these few wealthiest citizens wealth tax made up of around 81% of total tax obligations. Thus, it seems clear that removal of annual wealth tax in Norway would mainly benefit the wealthiest.

2.3 Current revenues and relation to other taxes

Despite the decreasing number of individuals paying wealth tax in recent years (in 2012 it was estimated that around 17% of Norwegian tax payers paid wealth tax), the total revenue from wealth taxation has been increasing during the last ten years, see Figure 2.

Figure 2. Wealth tax – revenue by year (million NOK)



Source: Edson (2012)

In 2011 the wealth tax generated around 13 billion NOK, together with inheritance and gift taxes the total revenue amounted to around 15 billion NOK. This was slightly more than 1% of total tax revenues.

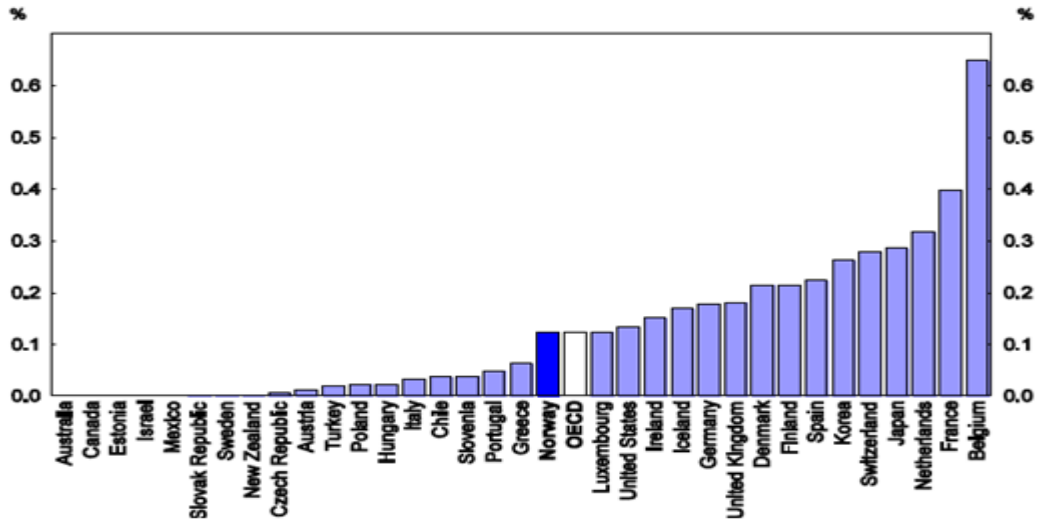
Table 4. Tax revenues in Norway, 2011

A broad tax base (billion NOK)	
Income tax	265
Employee's social insurance	98
Tax on Wealth	13
Business	72
Property tax	7
Employee's social contribution	139
VAT	212
Excises and custom duties	102
Petroleum tax	245
Inheritance and gift tax	2
Other taxes	29
TOTAL	1184

Source: Statistics Norway (2013)

The contribution to national budget from inheritance and gift taxes is very modest, see Table 4. In 2011 the tax generated around 2 billion NOK and in terms of overall contribution to the annual budget the revenues from inheritance taxation are below the Organisation for Economic Co-operation and Development (OECD) average (Denk, 2012).

Figure 3: Revenues from gifts and inheritance taxation in 2010



Source: Denk (2012)

2.4 The international perspective

The wealth related taxes such as periodic taxes on land, live stocks and other forms of visible wealth are believed to be among the oldest sources of government revenue. Annual taxes on wealth were introduced in Scandinavia and then in some other European countries at the beginning of the 20th century. India has also followed in 1957 and today it is one of the only countries outside Europe that still imposes tax on net wealth (Glennerster, 2012). Countries such as Japan or Ireland introduced a wealth tax for a brief period. Other countries such as USA, UK, Australia or Canada have never had wealth tax. Historically wealth tax has been often used as an unordinary or emergency tax for financing the war costs or as a way to mitigate high government debts. It was believed then that wealthy citizens had a duty to contribute and support their governments under certain circumstances (Rudnick and Gordon, 1996). In later years however the tax became permanent and the rates tended to be relatively lower. In the mid-eighties, half of the twenty-four OECD countries imposed a net annual wealth tax. In Norway, at the end of the 19th and beginning of the 20th century property and wealth as well as inheritance taxes were among the most important budget sources. Since then income taxes have become more important, see Table 5.

Table 5. Changing sources of tax revenues in Norway, 1880-1940

Year	Wealth tax	Property tax	Income tax	Total
1880	16,5	42,4	41,1	100
1890	11,2	33,7	55,1	100
1900	12,4	26,6	61,0	100
1910	12,0	23,0	65,0	100
1920	-	-	-	-
1930	10,8	8,0	81,2	100
1940	7,8	7,2	85,0	100

Source: Stranger (2009)

Recently taxes on annual net wealth have been systematically abolished in most OECD countries. Austria, Denmark and Germany abandoned them in 1997; Finland, Iceland and

Luxembourg in 2006, Sweden in 2007 and Spain in 2008. Today, Switzerland, France, Norway and Spain (Spain reintroduced the tax for a limited period in 2011) are among the only OECD countries were wealth taxes still apply, see Table 6, (Bertocchi, 2007). In France so called solidarity tax on wealth has been substantially revised by law in recent years. The tax is imposed on French and non-French residents located in France whose worldwide assets are valued at or above €1,300,000 (Ernst & Young, 2012).

Table 6. Wealth tax in the OECD countries

1985	2012
Austria	Norway
Denmark	France
Finland	Switzerland
France	Spain (reintroduced in 2011 for a limited period)
Germany	
Iceland	
Luxemburg	
Netherlands	
Norway	
Spain	
Sweden	
Switzerland	

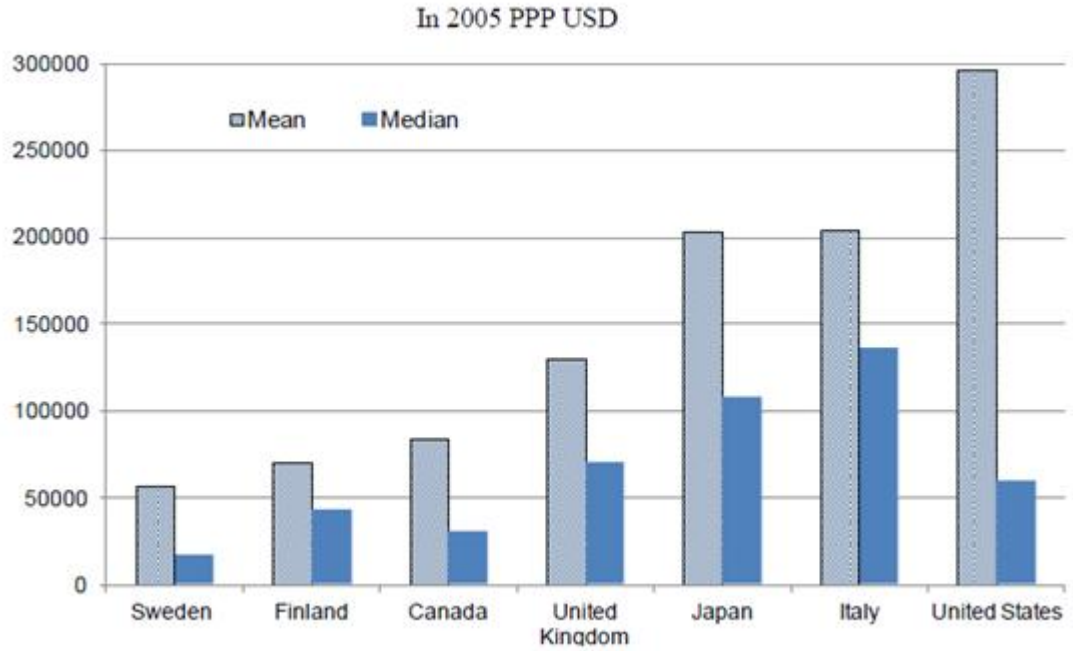
When it comes to inheritance and gift taxes similar pattern however less drastic can be seen. Taxes on wealth transfers are thought to exist since the eighteenth century and are believed to be first imposed in Denmark (Ministry of Finance, 2000). Several countries of the world have recently abolished or significantly reduced their taxes on bequests. Canada, Australia, Austria, Russia, New Zealand, Italy (however re-established in 2006) and Sweden have fully abolished taxes on wealth transfers in recent years and for many others the importance of the tax in terms of Gross Domestic Product (GDP) and total revenues is now at a historical low point. Among 27 EU countries, a majority (15) have an inheritance tax. There are also four EU countries with an estate tax with Denmark as an only country with both taxes (Ernst & Young, 2012).

2.5 Political and international challenges

So far Norway has not conformed to international trends of removing its annual wealth tax but rather reformed it so today it only affects individuals with the highest levels of wealth. The above trends however place the country in a difficult position. First, due to relatively low revenues from both taxes, budgetary concerns should not be an obstacle to remove or substantially reduce annual wealth and inheritance taxes if the trade of between equity and efficiency becomes too unfavorable. Secondly, as fewer countries impose wealth related taxes the possibility of substantial outflow of capital and discouraged investment can become significantly higher. Among three other remaining countries imposing annual wealth taxes, only France (where wealth tax has been causing a lot of controversy in recent years) has higher rates, while in Switzerland the tax is mainly justified by non-existing capital gain taxes (Ernst & Young, 2012).

Norwegian wealth tax is today widely discussed in political circles and its future seems uncertain. The tax is believed to divide Norway equally between its opponents and proponents and whether individuals are for or against it often depends on their social status and political belongings (NHO, 2013). If the ambition of Norwegian government will be to retain both taxes, the future developments on national and international level can be crucially important. Lately, increasing income and wealth inequality and growing budget deficits in many OECD countries have spurred the discussion of reintroducing a wealth tax in a number of countries. In recent years lower marginal tax rates on top labour and capital incomes and removal of wealth related taxes made the accumulation of wealth easier for the rich. In Norway the distribution of net wealth between different social and age groups became very uneven. According to the recent report by Statistics Norway, the distribution of net wealth in Norway is highly skewed. While average wealth per household is equal to around 1.6 million, the median net wealth is 900, 000 NOK. The wealthiest 10% of households is estimated to own around 53% of total wealth and the richest 1% control 21%. Similar imbalances can be also spotted among different age groups. Here while most of the oldest households hold a substantial amount of wealth, the net average wealth among households headed by someone younger than 30 years of age is close to zero (Epland, 2012). In international perspective, the situation seems even gloomier.

Figure 4. Country ranking by mean and median net wealth



Source: Bonesmo (2012)

Furthermore, according to OECD study, due to the population ageing and declining fertility a share of the population older than 65 as a share of population aged "15+" will more than double in most European countries reaching more than 60% in some cases (Johansson, 2012). This in effect is likely to add an upward pressure on already high public spending on pensions and health care and without any tax reforms will further increase public debts.

The above facts raise an obvious question: How according to optimal tax theory should the social planners respond to higher burden without distorting economic efficiency and still maintain high level of progressivity? Today in order to finance the costs of the crises, higher taxes on wealth are being debated in many OECD countries. There is a clear recognition that austerity measures in their own form might not be enough to combat the deficit crises and some tax increases are necessary. Here in some of the countries (especially these strongly affected by the debt crisis) a larger role for general wealth taxes has been advocated increasingly loudly. In 2011 Spain reintroduced (for a limited period of time) its annual wealth tax. In countries such as England or Cyprus where apart of wealth transfer taxes, taxes on annual wealth have never been used the idea of introducing "Mansion tax" or one time capital levy has been recently proposed (BBC, 2013). Reintroduction of wealth tax in order to mitigate increasing income and wealth inequality has been also discussed in Sweden, Denmark and Germany (Bach and Steiner, 2011). Such a policy however often lacks a

political will as its long term impacts on future fiscal policy are quite uncertain. Nevertheless, as more countries are struggling to repay their deficits, the role of wealth taxes as an emergency or eventually permanent means to combat the crises might slowly emerge. If the political ambition of the Norwegian government will be to retain annual taxes on wealth and wealth transfer taxes the further development on an international scale will be of crucial importance. Some of the current rules governing the taxable individuals and asset valuation might however need to be changed. The attempt of the next section is to discuss current issues related to efficiency and equity concerning wealth and wealth transfers taxation. The section will outline both taxes in relation to the current method of capital taxation in Norway and discuss their supplementary role. I will also refer to various empirical and theoretical arguments pro and con wealth related taxes to have a better understanding of their direct and indirect impact on economic performance.

3. Efficiency and equity concerns of the current system of wealth and inheritance taxation

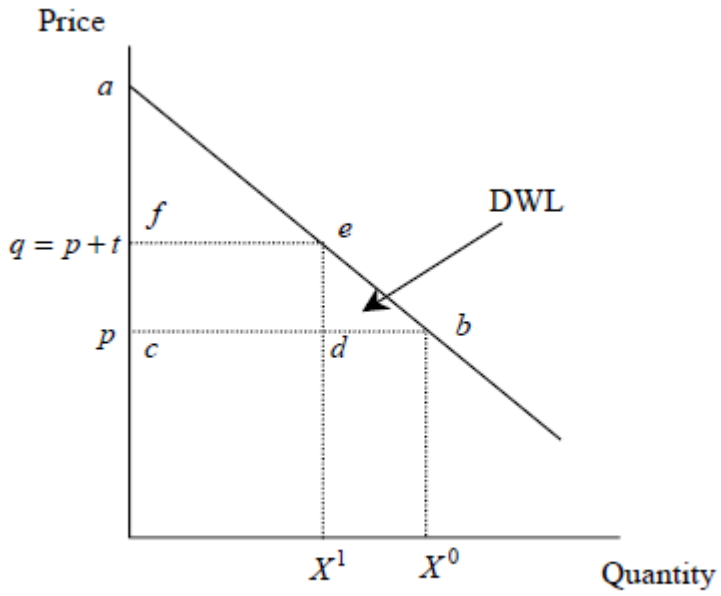
3.1.1 Theoretical background

The equity – efficiency trade off is one of the main challenges facing social planners when designing optimal tax structure. The optimal taxes will usually attempt to balance two conflicting goals of a tax system by achieving smallest efficiency losses with high level of revenues and redistribution of income and wealth. The tax system should be designed in accordance with main principles which in addition to efficiency and fairness (equity) include administrative simplicity, flexibility and political responsibility. Equity implies that people with greater ability ought to pay higher proportion of their incomes in taxes (vertical equity) and that people with a similar ability should pay equal amounts (horizontal equity) (Stiglitz, 2000). In addition, taxes should be neutral with respect to various economic decisions; "A neutral tax can be defined as one which does not change the decisions of the individuals compared to what they would have decided with a lump-sum tax" (Andersson, 1987 pp.5). In principle the tax should not distort the allocation of the recourses and the investment in the economy throughout having an impact on an individual's decisions. In terms of efficiency, lump-sum taxes are often described as ideal as no change in behaviour can affect the level of tax (Hindriks and Gareth, 2006). Such taxes however are almost never used in practice. This is because in order to achieve high level of redistribution they would have to be imposed uniformly on each individual according to his/her ability and preferences. Thus, the fact that lump-sum taxes are levied on private information makes them extremely impractical. Most of the tax instruments that are used in practice are not lump-sum, and they are likely to create welfare loses by affecting individual's behavior and causing various distortions to economic activities. For example, high progressive taxes on income induce individuals to substitute labor for leisure; commodity taxes will usually affect consumption patterns by shifting away from highly taxed goods to low taxed. These marginal responses, which economists call substitution effects, are thought to be the main causes of tax-induced distortions. The excess burden (deadweight loss) caused by such taxes is often described as a difference between total social losses due to tax and the total revenue collected by the government (Hindriks and Gareth, 2006).

The simple graphical expression such in Figure 5 can be used to approximate and illustrate the concept of excess burden caused by the tax introduction. Here, the imposition of the tax

(t) causes price increase from (p) to (q=p+t). This in effect leads to decrease in quantity demanded dX (X^0-X^1) and reduction in consumer surplus from (abc) to (aef). The part of the consumer surplus has been turned into tax revenue (cdef), the other part however (ebd) is the deadweight loss (the extent to which reduction in welfare exceeds the revenue raised).

Figure 5. Deadweight loss



Source: (Hindriks and Gareth, 2006).

The following formula can be used to calculate the deadweight loss (bde). First, the triangle area (bde) is equal to $\frac{1}{2}$ tdX. Second noting that elasticity of demand can be defined as $\in^d = \frac{p}{x}\frac{dX}{dp}$ implies that dX=$\in^d \frac{X^0}{p}$dp, where dp=t. By substituting this into the equation for (bde) it is possible to obtain a formula for deadweight loss which is:

$$DWL = \frac{1}{2} | \in^d | \frac{X^0}{p} t^2$$

The above equation reveals three interesting features. First the excess burden is proportional to the square of the tax rate (it will rise with the increasing rate as the tax rate is increased), second the deadweight loss is proportional to elasticity of demand – it will be larger with more elastic demand. Third, it depends on the size of the market for taxed good. In effect, in

order to minimise the distortion the tax rates should be as low as possible (a progressive tax structure is likely to create higher distortions than a flat rate structure). Furthermore, taxes should be imposed mainly on goods and items which are demand inelastic (for example necessities that are difficult to substitute). Third, the tax bases should be broaden across wide range of goods, services, income etc. One of the key questions when designing optimal tax system is how to minimize this deadweight loss.

3.1.2 Wealth and inheritance taxes in relation to optimal tax theory

Both wealth and inheritance taxes can be judged according to above principles. It is sometimes argued that taxation of capital stocks such as land or immobile properties is closely related to lump-sum taxes (Hindriks and Gareth, 2006). Low tax rates imply that deadweight loss from such taxes should be relatively low. In addition, they are difficult to substitute, for example in case of estate taxes once the person has died he/she is unable to choose any other action. Both taxes are also often regarded as optimal supplements to capital gain taxation by helping to broaden the tax bases across wide range of assets. Thus, on the efficiency ground, it could be sometimes argued that one should use wealth and inheritance taxes rather than progressive taxes on capital income. Unlike lump-sum taxes however both wealth and inheritance taxes are not neutral. Both taxes are likely to affect individual's behaviour and shape individual's investment decisions. They are likely to affect individual's labour supply, saving decisions and investment incentives. Moreover, theoretical efficiency of lump-sum taxes rests on relatively low imposition costs and administrative simplicity. This is however not the case with annual wealth and inheritance taxes as due to measurement and valuation difficulties their collection and administrative costs are usually very high (Anderson, 1987).

The attempt of the next section is to point at some of the distortions and challenges related to current system of wealth and inheritance taxation in Norway.

3.2 Current distortion and undesirable characteristics related to wealth and inheritance taxation

3.2.1 The wealth tax

Current rates and valuation methods are believed to be one of the main forces shaping investment decisions and allocation of assets among Norwegian households (Denk, 2012). Combination of low property taxes and differential treatment of properties in the valuation of wealth tax bases are thought to influence individual's investment and saving decision. The fact that only a small fraction (25%) of property value is subjected to annual wealth taxation and difficulties with estimating the real market value of properties encourages investment in real estates. According to (Epland, 2012, p. 16) "The tax-assessed value of own dwellings registered in the Tax Return in 2009 was 'only' NOK 664 billion NOK which was about 19% of the estimated market value)". In 2009 the estimated gross wealth of Norwegian households amounted to 5,478 billion NOK. The single most important wealth component was the housing wealth which amounted to almost 65% of total gross wealth (Epland, 2012).

In addition, neutrality of the investments implies that effective tax rate (ETR) should be the same across different types of assets. However, the differential treatment of certain assets implies substantial differences in ETR under certain investments. As the recent report by OECD shows, due to excessive effective tax rates, the wealth tax penalises savings and investment and thus might have a negative impact on economic growth. If the base of the wealth tax includes all taxable assets, ETR for wealthy individuals in case of certain investment types might be twice as high as in case of less wealthy investors. This in effect contradicts with the current system of capital taxation where capital is taxed at a flat rate regardless of income and wealth. With 4% nominal rate of return and inflation of 2% the effective tax rate for investors paying wealth taxes on their full asset value was estimated to be as high as 113%, see Table 7. ETR above 100% force individuals to seek avoidance and evasion opportunities and might have strong disincentives to work and savings. Furthermore, large differences in ETR between different asset types influence investment preferences and in effect distort resource allocation in the economy.

Table 7. Effective tax rates on the real income from different assets

	Without wealth tax	With wealth tax
Interest-bearing accounts	56%	113%
Shares	56%	113%
Owner-occupied housing	0%	14%
Rental housing	56%	79%
Individual private (IPS) pensions	37%	37%

Source: Denk (2012)

3.2.2 Inheritance and gift tax

Current method of taxing inheritance and gifts has a number of undesirable characteristics. Similarly as with annual wealth taxation, due to the valuation difficulties properties are the most used form of inheritance or gifts in Norway. According to Statistics Norway (2013) in 2010 the value of private properties accounted for 60% of total inheritance taxes. Further, the tax does not distinguish between different types of recipients, thus a rich person and poor will in effect pay the same amount of tax. The fact that gifts to persons other than children are tax-exempt discriminates against children and creates a problem related to tax avoidance. For example by using a third persons financial gifts can be easily channel to children without tax. Furthermore, it is often argued that wealthy individuals who are more effective in their tax planning are most likely to avoid tax payments. Unlike low income households who have most of their wealth tied up in properties, the wealth of the wealthy households is more mobile which can be helpful for them to avoid their tax payment by careful tax planning. In such cases both vertical and horizontal equity principles are being undermined. In addition, taxing children less than distance relatives encourages concentration of wealth in the hands of one generation. An equal opportunity approach would however suggest the opposite.

The above issues are currently considered as some of the main weaknesses of the present system of capital stock taxation in Norway. In order to avoid major distortions in the long run, important changes to the system will probably be required. Some of the current weaknesses, for example, these related to inheritance taxation might only require minor

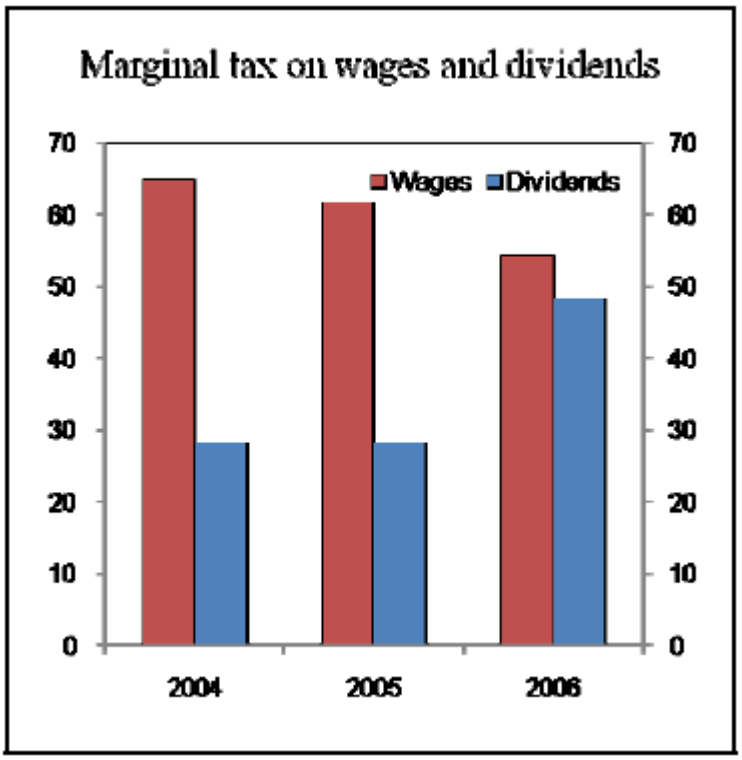
improvements (See for example Denk (2012)). On the other hand valuation of properties is often regarded as the core problems in connection with personal wealth taxation. In some countries such as Germany (where the tax has been declared unconstitutional) difficulties with property valuation was a primary justification behind the tax removal. In Norway the government is fully aware of the problem and therefore some attempts have already been taken to mitigate the distortion. For example, in 2013 the Norwegian government proposes to increase the taxable value of second homes and commercial properties for the purpose of net wealth tax from 40% to 50% of estimated market value, (Ministry of Finance, 2012). Moreover, statistical models that are able to estimate more reliable market values on every single dwelling are slowly being developed (See for example Epland (2012)). The increased tax value of dwellings might however cause further distortion. For example, it may affect low income households and pensioners whose significant portion of wealth is allocated in their own property and thus undermine the progressivity of the tax system. Removing the tax on one hand might significantly decrease ETR differences between various assets but on the other hand due to very low property taxation and lack of other taxes on capital stock it might further encourage investment in real estates and cause additional distortions. Mitigating the above distortion however with preservation of current progressive and redistributive function of both taxes will be a challenging but necessary task for Norwegian social planners in coming years.

3.3 Equity concerns - wealth and inheritance taxation under dual income tax system

Redistribution arguments are often used in favour of wealth and inheritance taxes. One of the main justifications of both taxes is to consider them as additional taxes on capital income. Since 1992, major reforms concerning capital part of taxation have been taking place in Norway. Since then, the progressivity of the tax system has been clearly strengthened and wealth related taxes are believed to play an important part in this respect. Before the reforms, there was a clear recognition that investment and saving allocation were seriously distorted. This was despite the fact that Norway unlike other Scandinavian countries had already lowered a top marginal tax rate on capital before applying a new method (Sørensen, 1998). Under dual income tax (DIT) system that has been used since 1992 income tax is being imposed differently on general income and personal income. This means that capital income earned by an individual is subjected to flat tax rate of 28%, while labour (residual incomes) are taxed progressively. In Norway, these residual incomes consist mainly of labour income, private and public pensions and other government transfers. Capital income is mainly composed of interests, dividends, taxable capital gains and imputed returns to the business assets of the self-employed (Sørensen, 1998). The same 28% tax also applies to limited companies and other corporate tax payers. In order to distinguish labour incomes from capital incomes a method of income splitting had to be used. This means that income earned by self-employed persons, partnerships and limited companies had to be divided between labour and capital income. The DIT system however was highly criticized. Not only it undermined vertical equity principle, since income from capital is often concentrated in upper income brackets but it was also exposed to horizontal equity failures by treating equal individual unequally and in some extent validated the principle of tax neutrality. The splitting method required extra administrative costs and there was strong motivation to find a ways to transform labour income into low-taxed capital income. According to Ministry of Finance (2006) "over the years, the rate differential between taxes on general and personal income increased significantly, from 28.1 percentage points in 1992 to 36.7 percentage points ten years later". At that time it was clear that the method undermined one of the fundamental principles of capital taxation and major changes were required (Erlend, 2011). The reform objective between 2004 and 2006 headed by Skauge Committee was thus to reduce the tax rate differential between labour and capital income and most likely to abolish the split model in full or in part (Ministry of Finance, 2006). The idea of the new model (shareholder income tax model) was to approximate the marginal tax on high share income to a lower marginal

labour tax in order to remove the motivation for income shifting but at the same time preserving the low tax on 'normal' capital income. The model as it has been shown by Sørensen (2005) is neutral with respect to investment allocation, choice of funding and the timing of share realisation (no lock-in effects).

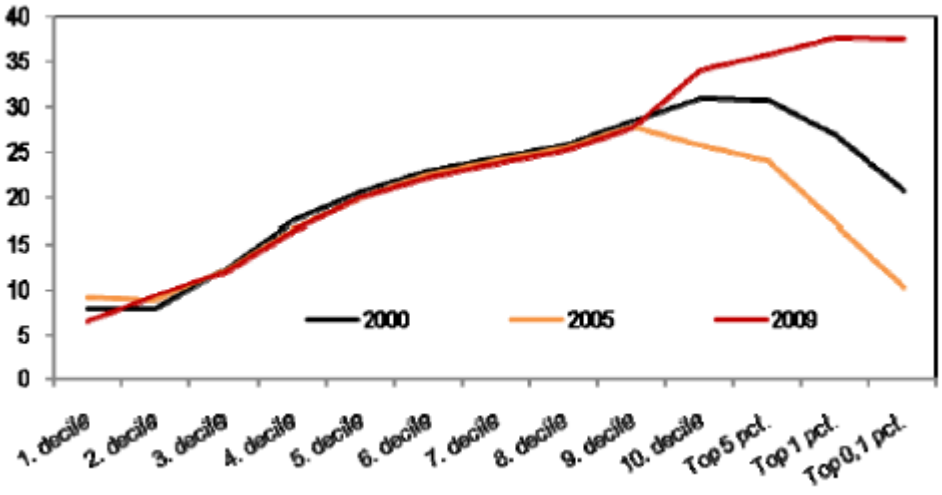
Figure 6. Marginal tax on wages and dividends



Source: Norwegian Ministry of Finance (2011)

After the reform the tax became horizontally more equitable (refer to Bø et al. (2011) for some examples) and substantial strengthening of income redistribution through the taxation system has been reported, see Table 6. The evaluation of the reform by Norwegian government has shown that the new method has substantially strengthened income progressivity in Norway. As the Figure 7 shows before the reform Norwegian tax code has failed to achieve high tax progressivity. Between 2001 and 2005 individual on the top of the income distribution paid almost the same tax in average, as for example the bottom 40%. After the reform however substantial strengthening in tax progressivity has been achieved.

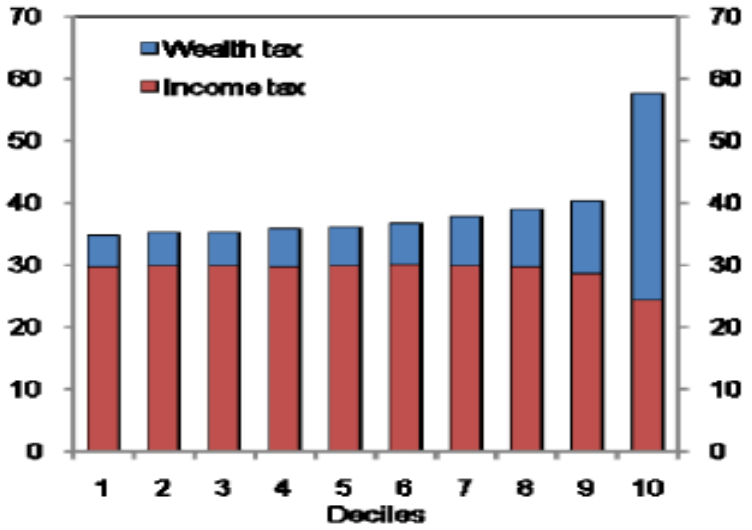
Figure 7. Average assessed tax as a share of gross income



Source: Norwegian Ministry of Finance (2011)

Even though the substantial improvements in tax progressivity after 2006 were attributed to capital flow tax reforms, annual wealth taxes were thought to play an important role in this aspect. Recent changes aimed to improve redistributive role of wealth taxation has managed to move the burden towards more wealthy individuals. As a result substantial increases in average tax payments on top of the income distribution are thought to be achieved with help of wealth taxation. Figure 8 divides the taxes paid by the highest one percent of income earners into income tax and wealth tax. It suggests that the wealth tax plays an important part in ensuring the progressivity at the highest income brackets. For individuals on top of the income distribution the rather high share of tax payments comes from the wealth tax.

Figure 8. Top 1% wealth share divided into 10 equal sized groups according to rising wealth



Source: Norwegian Ministry of Finance (2011)

It is sometimes argued that taxes on capital stocks are inevitable part of the DIT system and if one wish to mitigate the gaps between marginal tax rates on labour and capital incomes and counteract excessive concentration of income and wealth, both taxes are more efficient than higher marginal tax rates on nominal capital incomes. "In a dual income tax system where capital income is taxed at a uniform rate, wealth taxation may be used as an additional policy instrument to achieve redistributive objectives" (The Mirrlees Review, (2010) p.776).

Thus, before any attempt to remove the national wealth tax in Norway, the impact on tax progressivity must be carefully studied as it might highly undermine distributional aspects of the tax system. According to the Ministry of Finance (2012), in 2011 a personal wealth tax amounted to 85% of total tax payment for those 10% individuals with the highest net wealth. Furthermore, the calculations have shown that without the wealth tax, total tax payments for 1,000 most wealthy individuals in Norway would be reduced by nearly 60%. Thus it is clear that its removal would have beneficial effects mainly on wealthiest individuals. However, critics of the tax often argue that various indirect economics effects caused by the tax are too costly in relation to above benefits. For example, it is believed that without the tax, wealthy individuals may be induced to increase their labour supply or hide less of their wealth abroad which in effect would lift revenues from personal and capital taxation (Denk, 2012). The indirect impacts are however difficult to measure and justify. The aim of the next section is to

review the most recent theoretical and empirical studies related to wealth and inheritance taxes in order to have a better understanding of their indirect effects.

4 Review of empirical literature

Both wealth and inheritance taxes are widely discussed in political circles however they are rarely mentioned in textbooks and academic journals. The empirical research concerning taxation of wealth and wealth transfers is limited and there seems to be a clear lack of consensus among economists about the impact they have on economic performance. The aim of this section is to look at previous empirical findings in order to evaluate different arguments in support and against these taxes.

4.1 Wealth tax – economic implication and indirect effects

The most widespread criticism of taxing wealth stocks concerns its impact on economic efficiency such savings, investments, double taxation, tax wages, tax evasion and the outflow of wealthy individuals. Proponents on the other hand often argue that both taxes are an effective way to even out wealth in society and promote equality of opportunity.

4.1.1 Does annual wealth tax lower economic growth?

One important empirical question is to what extent annual wealth tax affect economic growth. Pichet (2007) examines the economic consequences of French "Solidarity wealth tax". According to the paper wealth tax has probably reduced GDP growth by 0.2% per annum and caused an annual fiscal shortfall of around 7 billion Euro. The arguments however are not empirically proven. One of the first studies attempting to empirically examine the impact of annual wealth tax on general economic performance was conducted by Hanson (2002). The author empirically estimates the relationship between the wealth tax and economic growth. Using the data for 20 OECD countries covering period of 20 years and instrumental variable approach in order to control for endogeneity, the author finds supportive evidence that wealth taxes distort economic growth. However, as the author emphasises "the estimated magnitude, is somewhat less alarming than popular account" (Hanson, 2002 p.17).

4.1.2 Does wealth tax reduce investment and entrepreneurial activities?

The wealth tax might also affect economic growth indirectly, for example, by effectively reducing successful entrepreneurship. In order to illustrate it, Hanson (2006) empirically investigates the issue. Using a model of the choice between becoming an entrepreneur or an employee and difference in difference estimation (taking advantage of wealth tax abolishment in recent years) the author investigates the impact of annual wealth taxes on

entrepreneurship activities. Here simple comparison between 22 OECD countries suggests that "countries that do not tax wealth have systematically higher self-employment than countries that do tax individual wealth" (Hanson, 2006 p.12). However, difference in difference estimation indicates that the removal of the tax on wealth has very small positive impact on the boost in self-employment.

Edson (2012) investigates to what extent wealth tax reduces the incentives of business owners to invest in Norway by examining whether firms affected by wealth taxation are more dependent on external credit markets and therefore more vulnerable to capital constrains. The author splits businesses into two samples: those affected by the tax and those not. He determines the difference in capital constrains between two samples by using two models developed for detecting capital constrains among firms. According to the studies "the negative capital constraining effects of the wealth tax are minimal and the tax affects only the private firms least reliant on internal financing" (Edson, 2012, p.28).

4.1.3 Does annual wealth tax influence tax avoidance and outflow of capital?

According to Pichet (2007) wealth tax impoverishes France forcing many wealthy tax payers to leave the country and shifting the tax burden onto other taxpayers. The author claims that total capital flight since the ISF wealth tax's creation in 1988 amounted to approximately 200 billion euro. Seim (2012) investigates the impact of wealth tax in Sweden on tax avoidance. The author argues: "The wealth tax base, involves an element of self-reporting, which makes the wealth tax susceptible to lower compliance rates and tax evasion" (Seim, 2012 p.3). Using a panel dataset, comprising about 58 million observations of individual taxpayers, the author finds supportive evidence, that before it was abolished the Swedish annual wealth tax was subject to evasion. His results indicate that increase in annual wealth tax is likely to stimulate evasion rather than deter savings. In addition to that his findings show that high-skilled individuals who have a better understanding of the tax system are more likely to avoid the annual wealth taxes.

4.1.4 Empirical studies relating wealth tax to future revenues and wealth inequality

Empirical studies relating wealth tax and its future impact on revenues and wealth distribution seems to be limited. Before being removed Cabre and More (2001) attempted to analyse to what extent wealth tax was able to reduce wealth inequality in Spain. The authors conclude that the tax failed to reduce vertical inequality in Spain due to mainly small revenues and compliments. Bach et al. (2011) evaluate the revenue and distributional effects

of a one-time levy on personal net wealth in Germany using a microsimulation model. The authors suggest that due to strong wealth concentration such a levy could raise substantial revenue even with high personal allowances.

4.2 Wealth transfer taxes – economic implication and indirect effects

Any theoretical analysis concerning wealth transfer taxation is usually based on various bequest motives which are thought to be the key building blocks for theoretical analysis of these types of taxes. The literature is also focused on various behavioral responses such as impact on labor supply of the recipient, tax avoidance or savings and investment.

4.2.1 Bequest motives

Four main motives (accidental, strategic, altruistic and joy of giving motive) behind capital accumulation and bequests are often described in literature and understanding these motives is thought to reveal theoretical conclusions regarding these taxes. The standard models of optimal taxation of capital income differ considerably when one assumes different bequest motives. For example, in cases where bequests are accidental (unintended) saving is exclusively motivated by consumption smoothing and retirement concerns. The analysis shows that accidental bequests can be heavily taxed without generating distortion since taxing those does not affects the donor's behavior (Cremer, 2009). However, if people are motivated to work and save with an intention to make a transfer to their children the tax will be distortive. Nevertheless, despite the large literature on different bequest motives there seems to be little consensus among economists as to which motive dominates. Kopczuk (2010) gives a brief review of existing theory and evidence concerning bequest taxation. The author concludes that understanding of the nature of bequest motive is essential to understand optimal transfer taxation.

4.2.2 Estate vs. inheritance taxes

The total economic impact may also different substantially depending on the types of bequest being used. There are two basic types of wealth transfers. One of them is estate tax (often called the dead tax or donor based), which is levied on the entire property and monetary value of the deceased, and is paid by the donor. The other, inheritance tax, is based on the amount received by each heir, and the amount received depends on the number of times the estate is divided into. While donor based system is often regarded as simpler and easier to administrate, donee based method currently used in Norway seem more appropriate on

fairness grounds (The Mirleess Review, 2010). Due to the rate being progressive, the current system encourages the donor to spread his wealth to many individuals. Therefore, the donee based system may be more efficient to mitigate high concentration of wealth and to equalize opportunities in society.

4.2.3 Wealth redistribution

Probably the most widespread support for taxing bequests is their positive redistributive impact. Pikketty (2007) examines the impact of estate and gifts taxes in US on tax progressivity. The paper shows that before being significantly reduced both taxes contributed around 23.4% to the overall average of 74.6% ETR payments from the top 0, 01% individuals in income distribution. In 2004 however the contribution fell to just 2.5% and the average ETR was only 34.7%. According to the author the decline in tax rates from estate and gifts taxes accounted for half of the change in ETR.

4.2.4 Do bequest taxes reduce labour supply and saving?

It is often argued that inheritance makes donees less productive members of society. The Carnegie conjecture showing that large inheritances decrease a person's labour supply is widely studied phenomenon. Kopczuk (2010) gives an overview of empirical studies demonstrating the impact of inheritances on labour supply. The effect is widely supported by empirical studies which show that large bequests are likely to affect labour participation. Holtz-Eakin et al. (1993) gives an overview of empirical evidence of Carnegie conjecture. The evidence shows, for example, that a single person receiving an inheritance of $150, 000 is roughly four times more likely to leave the labour force than a person with lower or no inheritance. In addition, there appears to be a general presumption that higher inheritance taxes reduce savings and aggregate capital accumulation. Gale et al. (2001) discusses the issue in accordance to US estate tax. Their key findings suggest that the effect of estate tax on savings is not clear and depends crucially on the donor's motives for bequests and wealth accumulation. "The overall effect requires analysis of both donor and the potential recipient; and in surprising number of cases, higher estate taxes appear to rise savings" (Gale et al., 2001, p.235). This however might raise some doubts about the conventional wisdom that estate taxes always reduce wealth.

5. The future revenues and distributional effects of wealth and inheritance tax

5.1 Dynamic microsimulation introduced

Microsimulation as a tool for simulating economic reforms has been in use since the 1950s. Nevertheless, due to initial computer constrains and shortage of reliable data, the model's usefulness and precision have been mainly recognised in the past couple of years. With improved data availability over the last decade, the number of microstimulation models has been used in order to study complex real life events such as population growth and impact of policy change on macro and micro level (Fredriksen, 1998). Some of the models recently developed include: PENSIM developed in UK which models the treatment of pensioners by the social security system across the income distribution; DYNASIM – dynamic microsimulation model for USA; NATSEM – developed in Australia; DESTINE – a dynamic microsimulation model for France or MOSART for Norway (Zaidi and Rake, 2011).
Microsimulation is often used as a tool to evaluate a certain effect of intervention before it is implemented. In social science the process of microsimulation uses widely available micro data set in order to provide useful projections at the aggregate level. The data are usually drawn from survey based microdata or are collected by various government institutions. Both sample units and the whole population can be simulated (Fredriksen, 1998). Compared with 'macro' models, 'micro' models are thought to reveal more information on individual's behaviour and are often used as a tool when individual's heterogeneity is complex to overcome. Thus, microsimulation enables social planner to explore heterogeneity and socio-economic diversity within the stimulated population. The models are widely used by government and various public institutions around the world.

The way the data are simulated can be categorised as static or dynamic aging (Fredriksen, 1998). Static models are usually arithmetic models and the units are simply aged by reweighting. In such models constant behaviour is assumed. Static models are widely used for prediction of immediate effects of policy changes. Arithmetical simulation can be, for example, used to evaluate the changes of tax rates or individual allowances and their impact on aggregate financial or welfare effects (who is better and who is worse of). An example of static model currently being used at Statistics Norway is LOTTE. In the long term projections however the static microsimulation is thought to be of little help (Fredriksen, 1998). In the dynamic aging, the characteristics and circumstances of treated units change over time and can be affected by given policy change. The individuals are allowed to change their

characteristics due to external factors within the model. The objective of dynamic simulation is to update each individual and each characteristic for each time interval. The updating can be probabilistic or behavioural. In probabilistic updating, each individual has a certain probability of experiencing transition from one state to another. The probabilities are usually based on historical dataset and whether the individual will experience certain transition depends on person's characteristics. These characteristics determine, for example, whether an individual will continue to live or not, become pregnant or not, work or become unemployed. Probabilistic updating is usually based on transition matrix method or on random processes to simulate changes in individuals' attributes (refer to Fredriksen (1998) for some examples). For instance, in order to calculate whether labour participation of certain individual with certain attributes will change in the second period, first the probability of labour force participation have to be calculated (for example, by using logit regression). Then a random number between 0 and 1 for each unit is dawned. If the number is smaller than the estimated probability of labour participation, the individual is assumed to work; however if larger, the person will be out of the labour force. After this prediction the wage can be generated for each individual considering his or her characteristics. Dynamic aging can also include various behavioural equations which can be processed for example by using Monte Carlo technique. Hence dynamic model might be useful to analyse tax policies due to long term nature of the policy and their behavioural impacts. In the behavioural updating agents' behaviour is mainly affected by endogenous mechanisms within the model. However, the current version of MOSART model is based on probabilistic updating only – no behavioural responses are measured. Behavioral responses that could be of relevance in connection with wealth and wealth transfer taxes are for example: impact on savings, housing demand, wealth accumulation, labor supply or tax avoidance. The behavioural modelling however is complex and the results can be highly influenced by the functional forms and equation chosen (Spadaro, 2007).

One can also distinguish between longitudinal microsimulation where life histories for single cohorts are produced; and cross-sectional dynamic models where life histories for a cross-section of the population consisting of many cohorts are used. In addition, the simulation models can be either deterministic or stochastic. Stochastic simulation assumes that various relationships are influenced by random fluctuation which is not the case in deterministic models.

Before any projections are made, the model needs some underlying assumptions (Fredriksen, 1998). Under different assumptions, the results can be then used to answer many "what-if" questions, that otherwise cannot be answered. Here, the baseline alternative assuming that all probabilities remain at the same level as in the recent year can be compared with different alternatives. In this study, the future trends related to wealth and inheritance taxes could be examined under different economic and demographic scenarios. For example, current personal allowances and economic assumptions can be easily manipulated and compared with different alternatives.

Most of the macroeconomics models are based on the assumption that a representative agent can be used to predict the behavior of the whole household sector. Such models however become less useful when heterogeneity of the population and behavioral complexity is taken into account (Jinjing, 2011). Microsimulation allows splitting the population into large number of units where each individual characteristic is examined separately. The design of a tax system is complicated and affects different individuals differently. In order to calculate future tax revenues from wealth and inheritance taxation it is necessary to know the composition of the population by incomes, current wealth, family characteristics, etcetera. By using microsimulation all of it can be easily taken into account and simulated accordingly to current tax design.

5.2 The MOSART model

The MOSART model is a dynamic microsimulation model used by statistics Norway. The models initial purpose was projection of Norwegian population, education, labour supply and public pension benefits. In addition to research projects in Statistics Norway, The Ministry of Finance and The Ministry of Labor are the main users of the model. The model begins with base population with certain transition probabilities estimated using event history analysis in recent periods (Fredriksen, 1998). The main underlying assumptions with the perspective from 2010 are given below in Table 8.

Table 8. Main underlying assumption with the perspective from 2010

Net immigration of 39 876 persons per year
Life expectancy at birth increases by 4 to 5 years towards year 2050
Total fertility rate of 1.95
Propensity to study as in 2010
Entry into disability pension as average of the last five years
Retirement age remains at 67 years
Labor force participation rates as in 2010
Average labor market earnings as in 2010
Basic Pension Unit and Special Supplement as in 2010
All nominal amounts are measured in 2011 Norwegian Kroner (NOK)

Source: Fredriksen (1998)

Transition probabilities in MOSART model are assumed to be constant throughout the simulation period. The model is based on a discrete time with the calendar year as a time unit. In order to avoid extra uncertainty due to stochastic drawings method, the MOSART model uses a mean-constrained drawing method (described by Fredriksen (1998, p. 113)). In order for a model to start to simulate the next year (t+1), all aspects of the population in year (t) have to be simulated. In addition, before any projection is made the user has to make some underlying assumptions. Usually the base line scenario assuming that all probabilities remain at the same level as in the latest year is compared to different alternatives.

5.2.1 Wealth modelling in MOSART model

Assumptions and information regarding the simulation

All assumptions regarding demography, education, retirement and labour supply are standard. Here, net immigration is high (approximately 40, 000 as in 2010) and all immigrants are assumed to enter Norway with zero wealth. Some tables differentiate between those who have been "always resident in Norway" and the others, labelled "migrants" (including Norwegians who have been registered abroad for a year or more). All amounts are measured in 2011 Kroner. Other parameters in the base line scenario that can be adjusted by user include:

- Inflation is set at 2% per year
- Real wage growth at 2% per year
- Real interest rate at 4% per year
- Interest margin is set at 3% per year, bank deposit with a nominal interest rate of approximately 6% and, loans with 9%
- Real housing values grow by 2% per year (same as wages)
- From one year to the next, financial wealth is deflated by wage growth
- Housing wealth is not deflated, but the rise in nominal value is added to savings
- Total fertility of around 1. 95 is assumed.

The simulation comprises the whole population of Norway from 2010. The model starts with initial population in order to simulate future outcomes based on current transition probabilities. Here, individual's future incomes, labour participation and wealth depend on their characteristics and past performances. The wealth is simply divided by housing and financial wealth:

- Housing wealth is adjusted up to market values, but truncated at approximately 25,000,000 NOK; the remainder is transferred to financial wealth
- Financial wealth is supposed to be held as loans or bank deposits
- Total wealth is truncated at 250,000,000 NOK for several reasons.

An individual's wealth accumulation depends on his earning (whether it is from labour or capital returns). There is a fixed return on capital applying to all asset forms. The interest rate can be manipulated by the program user. Individual's future earnings as well as probability of

future labour market participation depend on individual's history. The current earnings are put into saving equation and the remaining is added to current wealth.

Saving relation in MOSART model

Savings consist of two components:

1) Estimated relation describing financial investment for household with no major movements in real capital assets (housing, secondary housing, cars, etcetera). This may be interpreted as financial savings when applied to the entire population, and is used as such. The simulated financial savings in the base year are 120 billion NOK, corresponding to savings in the public statistics. The savings relation is given bellow.

2) In addition the rise in nominal housing value is added to savings. Real capital is appreciated (or depreciated) in this simulation with wage growth or housing value. At the beginning of the simulation, this is approximately 180 billion NOK per year. Without this component, young persons (i.e. under 50 year old) will hardly accumulate any wealth at all. Capital gains on housing wealth are not included in savings as reported in the public statistics.

Savings are determined according to households or individual characteristics such as age, number of children, disposable income or gender. The following regression is used:

$$S_T = \alpha_H + A_T \times \beta^{age}_{HT} + NC_T \times \beta^{children}_{HT} + I_T \times \beta^{income}_{HT} + Remain_T$$

Where:

S_T - savings at time t

A_T - individual's age

NC_T - number of children

I_T - current income

$$Remain_T = \varepsilon_T + Remain_{T-1} \times rho_H$$

T corresponds to time and H – household type

ε_T is a random term normally and independently distributed with standard deviation listed below

Remain consist of all unexplained part of savings and rho says something about autocorrelation with previous periods. Positive rho says that remain in year t are negatively correlated with remains in year t-1

Income = wages + pensions + financial income + other transfers – taxes.
The regression results are given in Table 9.

Table 9. Regression results – saving equation

	Couples	Singles without children	Singles with children
Constant	-45493	-2794	-563
Age	367	0	0
Sex	0	0	0
Number of children	-5588	0	-618
Income	0.2306	0.1123	0.0384
Rho	-0.0210	0.1163	0.0744
Standard deviation	66927	32991	24847

Housing demand in MOSART model

Housing demand depends on income, wealth and a few other characteristic. The simulation model adjusts the probabilities up for already owners, and down for outsiders (reducing the number of transitions between ownership/renting). The probability of owning a house is estimated with a logit model with observed ownership as depended variable (See the regression below). Wanted housing if individual is already an owner is based on actually observed housing demand which is based on the information about houses recently sold or bought.

$$P_T = \alpha_H + I_T * \beta^{income}_{HT} + W_T \text{ x } \beta^{wealth}_{HT} + N_T \text{ x } \beta^{numofpersons}_{HT} + A_T \text{ x } \beta^{age}_{HT} + \varepsilon$$

Where:
P_T – observed ownership =1 if individual owns a property and 0 otherwise
I_T - current income
W_T – current wealth
N_T – number of persons in household
A_T - individuals age

ε - error term

Current wealth = financial wealth + housing wealth

Income = wages + pensions + financial income + other transfers – taxes.
The regression results are given in Table 10.

Table 10: Regression results – The probability of owning a house

	Do own?	How much?
Constant	-1.5317	226477
Income	8.898e-6	0.4085
Income**2	-7.2e-12	-4.207e-8
Wealth	3.987e-6	0.3279
Wealth**2	-5.6e-13	-9.101e-9
Number of persons	0.3634	61578
Age	0.008	0
Age**2	-0.0001	0

The saving relation is used with no adjustments beyond wage growth. Housing demand is adjusted beyond wage growth; ownership is adjusted down (perhaps due to an increasing number of immigrants less inclined to ownership). Housing value is increased by roughly 50% on top of wage growth (lower interest rates and self-reinforcing price growth may be the reason for this).

5.2.2 Inheritance modelling in MOSART model

Inheritance is transferred at death and according to market values and standard distribution between heirs. The death probability depends on many factors such as age, education, gender, incomes, etcetera. To whom the wealth will be transferred depends on donor's status and various interrelations between individuals. For example, if the donor was married the whole

amount is transferred to his/her partner. Gifts are not included, but postponed to time of death. "Public inheritance" in the tables is leftovers from people with no obvious heirs.
Using market values may overestimate the revenue from inheritance taxes, while excluding gifts places more wealth at old people, and less at young people. It should not however significantly affect the results.

5.2.3 Source of data and tax rules

In a microsimulation model the selection of the base dataset is crucial as the quality of the input data determines the quality and reliability of the simulation results. The MOSART model has recently been updated and today it includes the entire Norwegian population. Key characteristics are migration, mortality, fertility, household formation, educational activities, retirement, labor force participation, income, wealth, household status and pension entitlements. The base year is 2010 and it is used as simulated initial population when used for projections beyond year 2010. Since 2004 all information on household composition and status such as income and wealth has been collected from the various administrative registers. This is believed to provide more reliable data in comparison to previously used statistics from household surveys. The information about wealth and incomes are collected from the tax returns. In addition to large initial population and very reliable data, the current version of MOSART model includes all known family relations. This is particularly important in predicting future developments in inheritance and gifts where probability of receiving a wealth transfer depends on various family relations.
Under a baseline scenario, the tax rules from 2010 are applied. In any case, housing wealth is hardly taxed at all (at most wealth tax of 25% percent of the market value), while financial wealth is taxed heavily at nominal interest rates.

In the next subsection some results concerning the future of the wealth and inheritance are going to be provided. In dynamic microsimulation the underlying assumptions and projection alignments are very important and the accuracy of the simulation is limited to the underlying assumptions being reasonably correct. In the present simulation, three different scenarios have been assumed: In the baseline scenario all parameters are based on underlying assumption described above. In the alternative scenario the real interest rate has been increased to 5% and lower personal allowances for annual wealth taxes have been assumed. Finally in the second scenario both wealth and inheritance taxes have been set to zero,

otherwise everything else continues as under the baseline scenario. The time interval applied under this study is between 2010 and 2040. Any projections beyond it are thought to become less reliable. In addition, in some calculations basic principles of difference in difference method have been applied. Appendix 2 contains brief introduction to this method and simple example how the method can be applied.

It is also important to keep in mind that certain inputs such as income, wealth, taxes and savings are not a central part of the MOSART model. Therefore some of the results might in consequence come from model's weaknesses or oversimplified assumptions. In addition the model does not capture various behavioural responses that might be of crucial importance in this study. For example, the removal of wealth related taxes in the long run is likely to affect wealth allocation, investments, savings, housing demand and overall resource allocation, which can largely affect the results. Some of the outcomes however (for example these related to demographic projections and their impact on future wealth distribution between different age groups) are reasonably reliable and easy to predict.

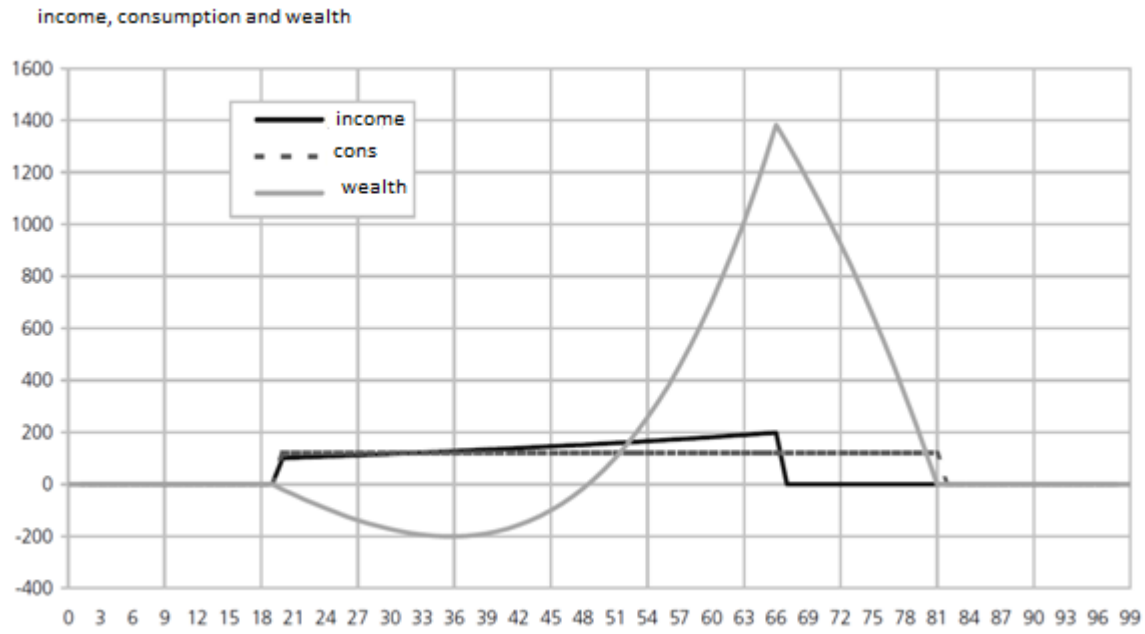
5.3 Simulation results and discussion

Before providing the main figures showing the future revenues and changes in wealth concentration, I will present some results concerning changes in wealth composition between different age groups, and shortly discuss their potential future consequences. This is to suggest that due to certain demographic changes stronger pressure on fiscal and distributional aspects may be expected in coming years. As a result higher taxes on high earners and wealthy individuals are likely to increase in importance.

5.3.1 Changing wealth and age composition

Figure 9 gives an example of lifecycle model. It depicts how consumption, incomes and wealth tend to change over the lifespan. The example shows that the wealth tends to increase rapidly as the individuals approach their retirement age and it starts to go down after it peaks (following reaching retirement age). This rather intuitive example implies that as higher proportion of total population approaches their retirement age, the average wealth in society is likely to increase.

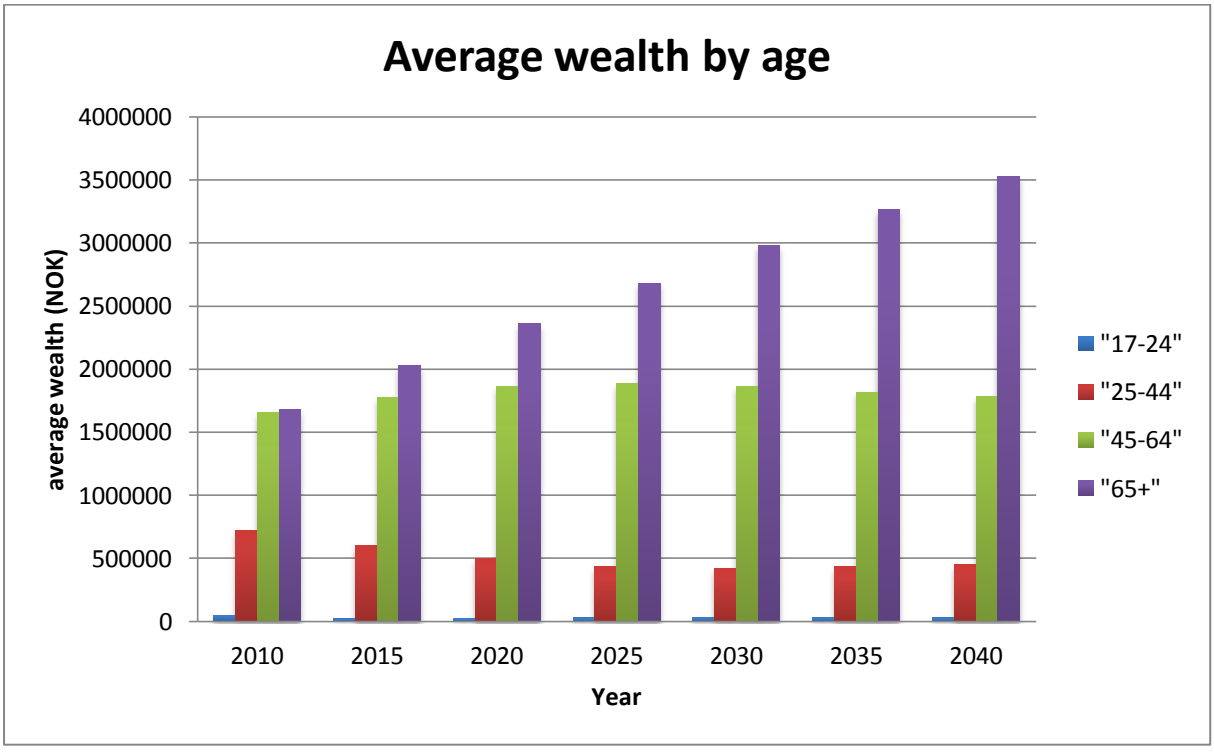
Figure 9. Example of wealth development over the lifecycle model



Source: Thoresen, et al. (2001)

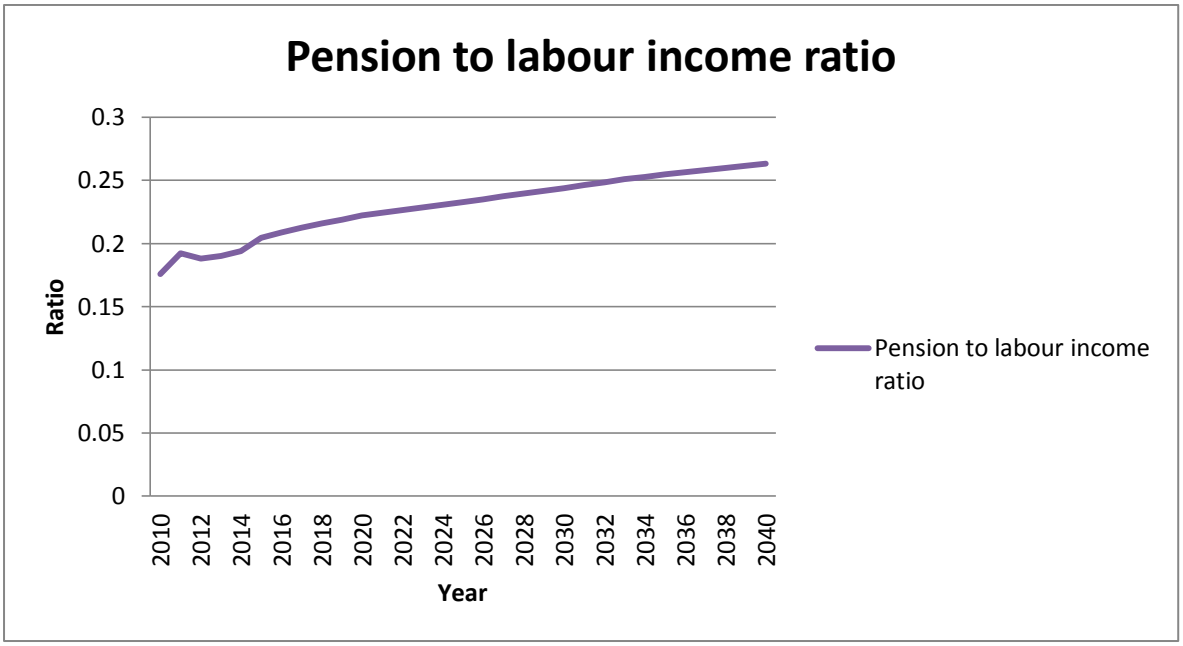
This is exactly what the model predicts: First, due to substantial increase of birth cohorts from baby boom period and increasing life expectancy, the model predicts that the number of individuals "65+" will rapidly increase and in 2040 this age group will constitute approximately 27% of total adult population (17+) in Norway (see table A9 in Appendix 2). Second, the model predicts that average wealth within the simulation period will increase substantially. Figure 10 shows the average wealth by four different age groups including only population over the age of 17. Under the baseline scenario over the next 30 years, an increase of approximately 38% in average wealth can be expected. Moreover, the model predicts substantial changes in wealth distribution between different age groups. Here, while the average wealth among the first three age groups is projected to decline in the long run, the average wealth within the fourth group "65+" is expected to increase significantly. Similar outcomes have been obtained when only Norwegian citizens who have always stayed in Norway (not including Norwegians who have been registered abroad for a year or more) have been included. In both cases an increase in average wealth and changes in wealth composition between different age groups are projected (refer to tables A1 and A2 in Appendix 2 for more detailed results).

Figure 10. Average wealth by age



Aging population is likely to result in increasing dependency ratio. As the Figure 11 illustrates the ratio between pension incomes and labor incomes is projected to increase. This in effect is likely to add an upward pressure on already high public spending on pensions and health care. As such spending will probably have to be financed from public funds, major increases in tax revenues might be required. Here, wealth related taxes may be use to provide additional capital required to cover extra expenses, and as the amount of taxable wealth increases the revenue from these taxes are likely to be higher.

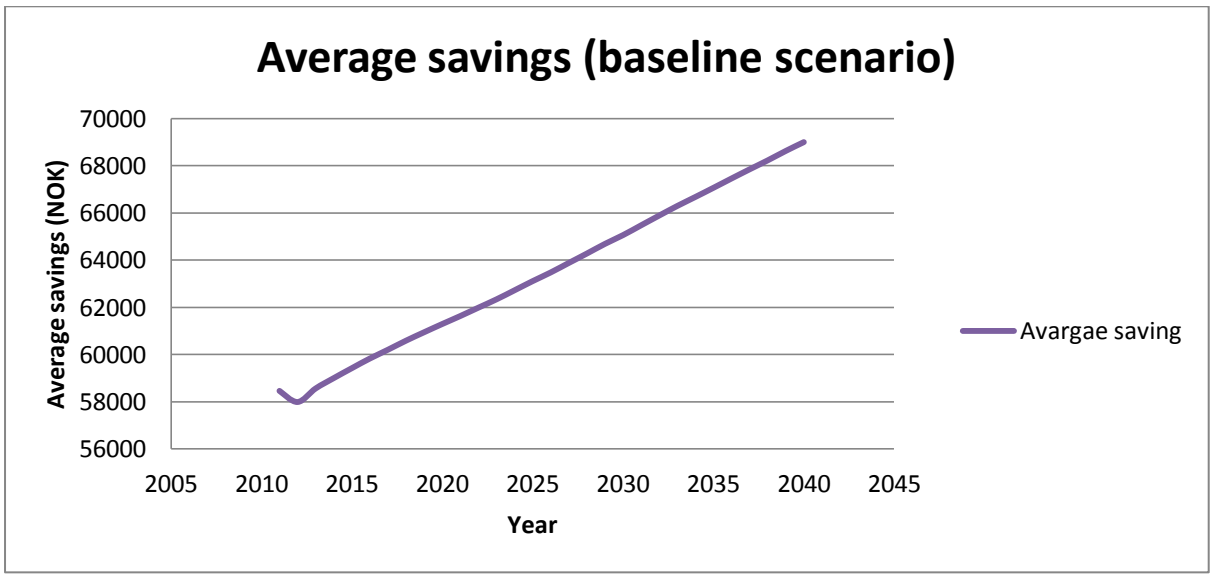
Figure 11. Pension to labor income ratio



5.3.2 Future revenues from annual wealth tax

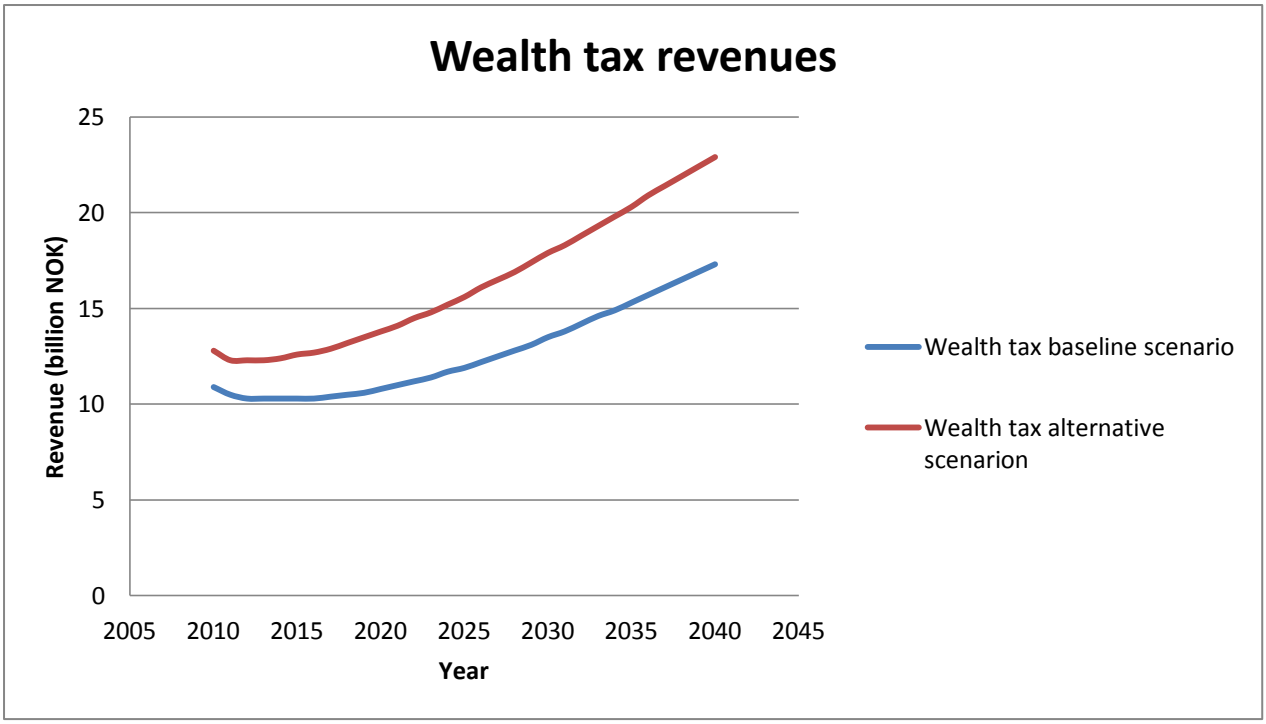
In the MOSART model, the total household's wealth is simply divided by net financial wealth and housing wealth. The net financial wealth includes all forms of investment types such as bank deposits, stocks, shares, bonds, etc. The model however does not distinguish between different asset types. Table A3 in Appendix 2 presents the composition of wealth across different assets. As the table indicates the vast amount of taxable wealth comes from housing wealth. The net financial wealth is relatively low and is expected to further decline in the first few years of the simulation, most probably due to combination of high property prices and high housing demand financed by debt. According to the projections however, in the long run both housing wealth and financial wealth are expected to increase significantly. As more households will repay their debt the net financial wealth as a proportion of total taxable wealth is thought to increase substantially. The major amount of taxable wealth will continue to come from housing wealth; however its share of total wealth is expected to be slightly lower. In effect, substantial increase in disposable income with high propensity to save (See Figure 12), high housing demand and substantial increases in property prices will result in increase in the total amount of taxable wealth.

Figure 12. Average savings under baseline scenario



The total amount of taxable wealth is projected to more than double during the simulation period under baseline scenario. This alone will lead to increase in wealth tax revenues as Figure 13 indicates.

Figure 13. Wealth tax revenues

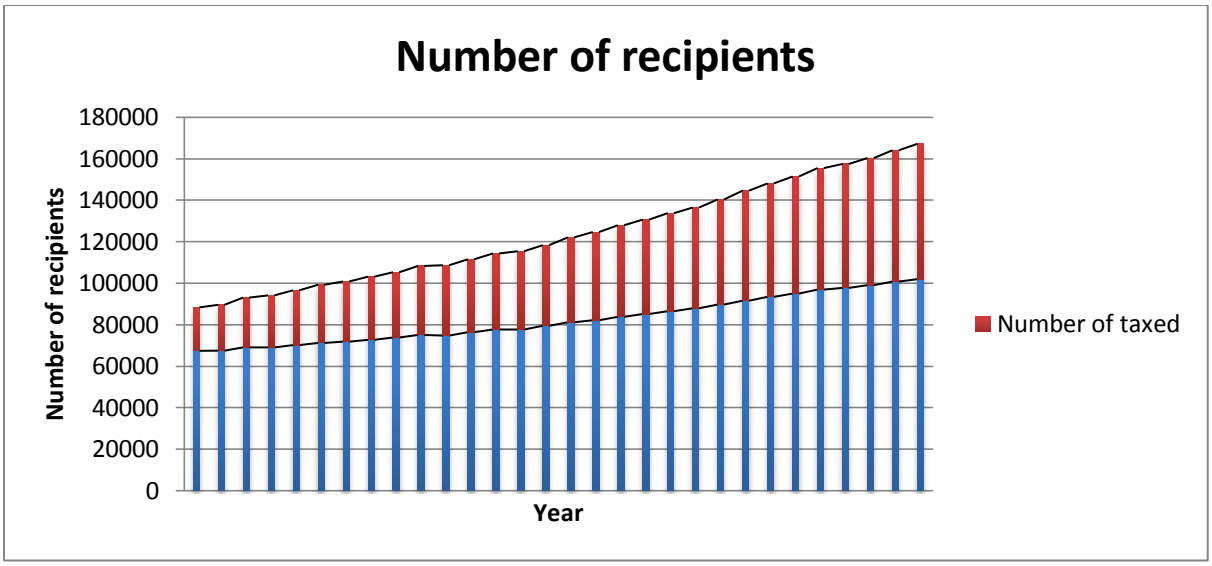


According to the model predictions, under the baseline scenario, substantial increase of around 63% in yearly revenue from annual wealth tax can be expected within the next 30 years. The revenues from annual wealth tax will provide around 17.3 billion NOK in 2040 which is significantly higher than in 2010. Moreover, the revenue from annual wealth tax is projected to increase much faster in proportion to other taxes used in this study. In such case, the fiscal importance of annual wealth tax is likely to increase. The tax contribution to annual budget however is still predicted to be modest as of 2040.

5.3.3 Future revenues from the inheritance tax

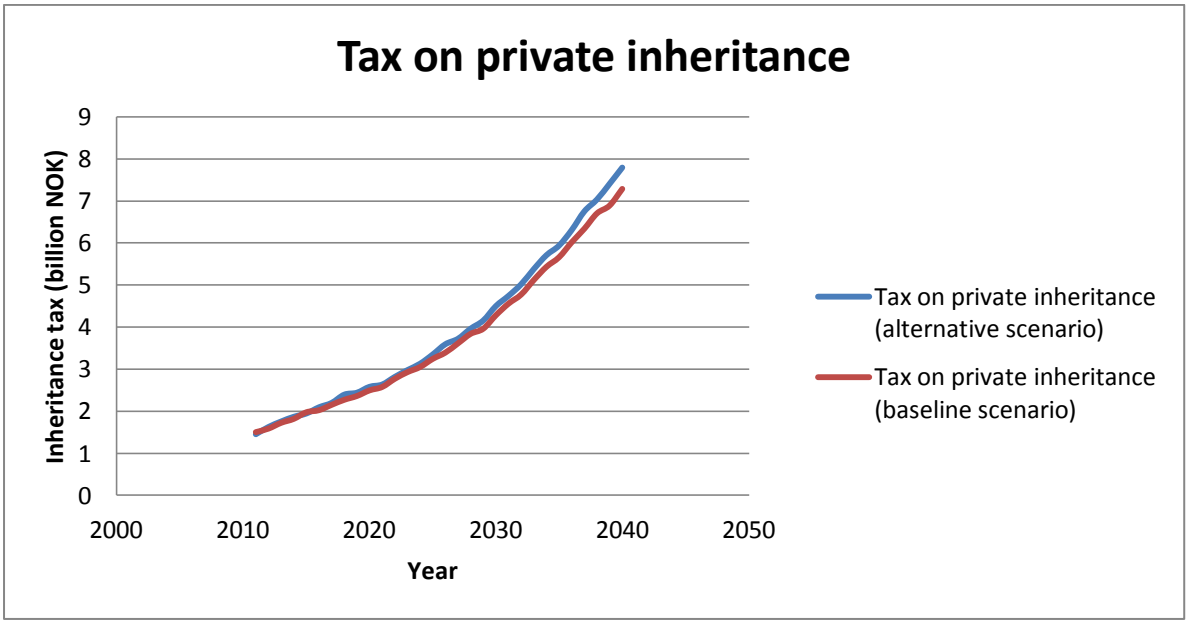
Increase in average wealth combined with aging population factor will result in higher amounts of bequests being inherited. As the proportion of elderly people increases it is predicted that there will be more people dying and thus more wealth being transferred between generations. As the average wealth among elderly (who are most likely to make transfers) increases, the amount of average inheritance is expected to be higher, meaning that the tax should affect larger proportion of recipients. As the Figure 14 demonstrates the number of recipients will be steadily growing in coming years. The figure also shows an increase of proportion of people being taxed.

Figure 14. Number of recipients



According to the projection, under both scenarios the total amount of net private inheritance will almost triple within the simulation period resulting in enormous hikes in tax revenues from private inheritance taxation (See Figure 15). Under the baseline scenario, annual revenue of approximately 7.29 billion NOK in 2040 has been predicted. This compared to current revenues from these form of taxation gives an enormous increase. Similarly as with annual wealth tax the tax contribution to annual total budget still remains relatively low. The revenues from both taxes are however expected to grow much higher in proportion to other taxes used in this study, such as taxes on labor income.

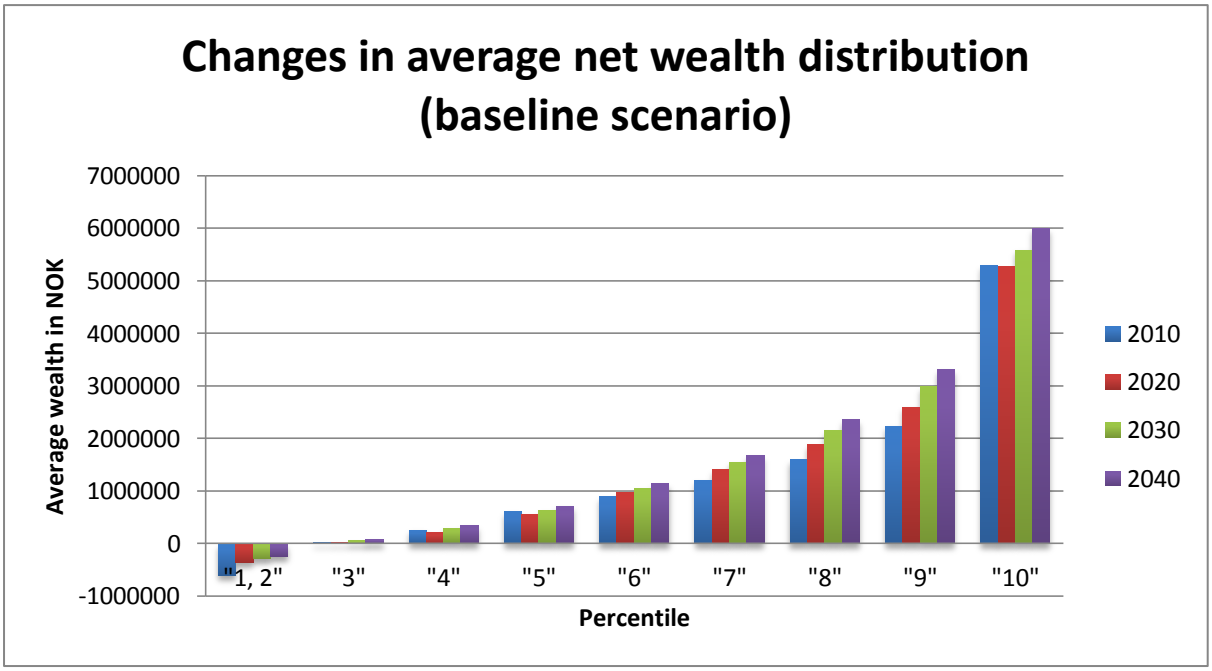
Figure 15. Tax on private inheritance



5.3.4 Wealth distribution analysis

Figure 16 illustrates changes in wealth concentration in Norway within the simulation period under baseline scenario. Total population has been divided into 10 equal percentiles according to amount of wealth owned and the Gini coefficient has been used as a measure of wealth inequality (see Table A5 in Appendix 2 for detail outcomes).

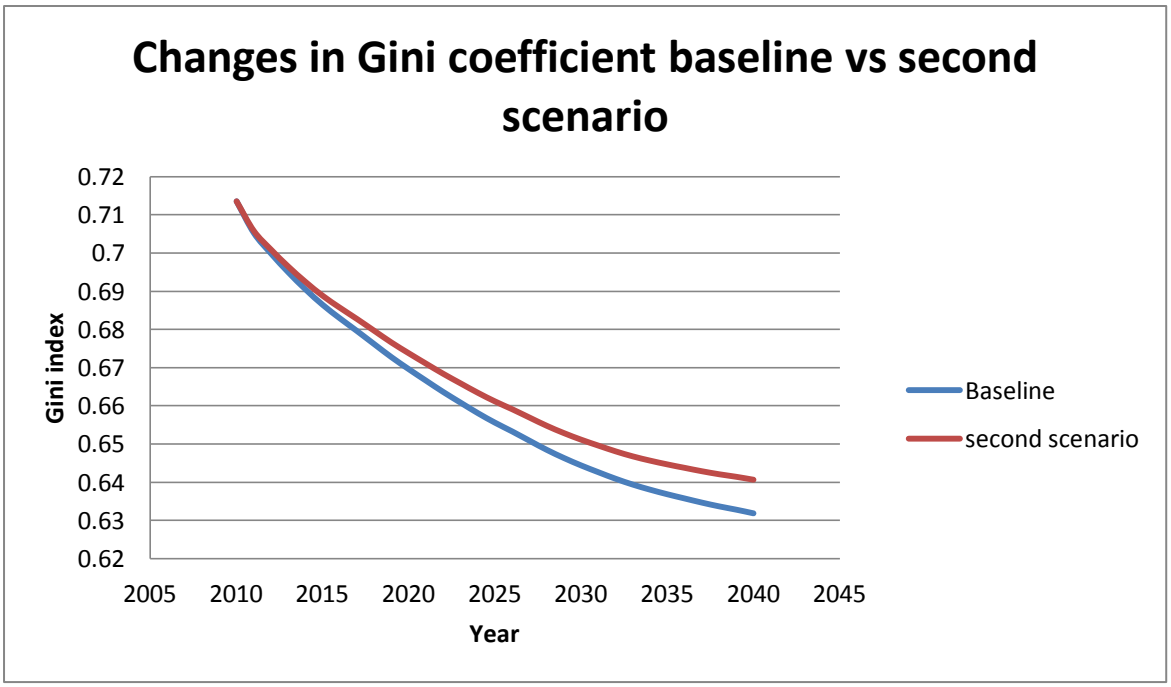
Figure 16. Changes in average wealth distribution (baseline scenario)



The figure shows that average wealth for each percentile will increase. Furthermore, according to the projections, substantial decrease in net wealth inequality measured in Gini coefficient will occur. The Gini coefficient under baseline scenario is thought to decrease by approximately 11% from 0.71356 in 2010 to 0.63178 in 2040. There are several reasons that could explain the decline in wealth concentration. Recent reforms aimed to improve progressivity of the capital part of taxation may be one of them. Increasing fiscal importance of annual wealth and inheritance taxes may have also contributed to substantial reduction in wealth inequality. The other explanation which is probably the most feasible in this case comes from the fact that average wealth of "65+" is much higher and more equally distributed (See Table A8 in Appendix 2). Therefore, as the proportion of individuals "65+" of total population increases, it is likely that the wealth distribution becomes more equal. The

main interest of this study is however to show how much of the decline was due to use of wealth and inheritance taxes. In order to evaluate it wealth and inheritance taxes have been removed under second scenario (otherwise everything continues as before). The removal of both taxes will give us some indication of how likely taxes on annual wealth and wealth transfers are able to mitigate high wealth inequality. The simulation results under second scenario are given in Table A6 in Appendix 2. The results show that under second scenario the Gini coefficient is expected to decrease from 0.71356 in 2010 to 0.64069 in 2040 which gives us similar results as under base line scenario. In 2040 the Gini coefficient under baseline scenario is only slightly lower (0.63178 compared to 0.64069 obtained under second scenario in 2040) but it gives some indication that some of the reduction in Gini index under baseline scenario was due to use of wealth related taxes. However, most of the reduction in inequality can be explained by other factors. Figure 17 has been used to plot differences in changing Gini coefficient across time between baseline and second scenario.

Figure 17. Changes in Gini coefficient baseline vs. second scenario



As the only difference between two scenarios are wealth and inheritance taxes, the difference between two Gini coefficients in 2040 can be used to calculate what proportion of the total reduction under baseline scenario was due to both taxes. The simple formula can be applied:

	Before: t=2010	After: t=2040
Gini coefficient: Baseline scenario	0.71356	0.63178
Gini coefficient: Second scenario	0.71356	0.64069

DID = $(Gini_{ss,t=2040}\text{-}Gini_{bs,t=,2040}) - (Gini_{ss,t=2010}\text{-}Gini_{bs,t=2010})$

Where:

DID - difference in difference

ss=second scenario

bs=baseline scenario

t=time period

DID = (0.64069 - 0.63178) - (0.71356 - 0.71356) = 0.00891

The difference can be then divided by total decline in Gini coefficient under baseline scenario to give us what part of decline was due to wealth related taxes. It appears that approximately 11% of the total reduction in Gini coefficient under baseline scenario between 2010 and 2040 was due to taxes on wealth and inheritance.

In addition, as the fiscal importance of both taxes increases each year, one may suppose that wealth and inheritance taxes should become stronger instruments that could be used in order to reduce high inequality of wealth. In order to evaluate what proportion of total reduction in Gini coefficient between each year was due to use of wealth and inheritance taxes the above calculation has been used and applied separately for each year:

DID = $(Gini_{ss,t+1}\text{-}Gini_{bs,t+1}) - (Gini_{ss,t}\text{-}Gini_{bs,t})$

Where:

Ss and bs = second scenario and baseline scenario respectively

t = time period

The results obtained for each year are given in Table 11.

Table 11. Change in Gini coefficient due to wealth and inheritance taxes

Year	Gini – (Baseline scenario)	Gini – (Second scenario)	DID	% change due to wealth and inheritance taxes
2010	0.71356	0.71356		
2011	0.70527	0.70581	0.00054	0.065138721
2012	0.69987	0.70091	0.0005	0.092592593
2013	0.69496	0.69648	0.00048	0.097759674
2014	0.69048	0.69246	0.00046	0.102678571
2015	0.68641	0.68882	0.00043	0.105651106
2016	0.68287	0.68569	0.00041	0.115819209
2017	0.67952	0.68272	0.00038	0.113432836
2018	0.67608	0.67964	0.00036	0.104651163
2019	0.67267	0.67657	0.00034	0.099706745
2020	0.66954	0.67377	0.00033	0.10543131
2021	0.66653	0.67106	0.0003	0.099667774
2022	0.66357	0.6684	0.0003	0.101351351
2023	0.66079	0.66591	0.00029	0.104316547
2024	0.65805	0.66345	0.00028	0.102189781
2025	0.65553	0.66118	0.00025	0.099206349
2026	0.65323	0.65913	0.00025	0.108695652
2027	0.65081	0.65696	0.00025	0.103305785
2028	0.64842	0.65481	0.00024	0.10041841
2029	0.64628	0.65289	0.00022	0.102803738
2030	0.64433	0.65117	0.00023	0.117948718
2031	0.64255	0.64962	0.00023	0.129213483
2032	0.64084	0.64812	0.00021	0.122807018
2033	0.63931	0.6468	0.00021	0.137254902
2034	0.63798	0.64569	0.00022	0.165413534
2035	0.63678	0.6447	0.00021	0.175
2036	0.63568	0.6438	0.0002	0.181818182
2037	0.6346	0.64292	0.0002	0.185185185
2038	0.63361	0.64213	0.0002	0.202020202
2039	0.63274	0.64146	0.0002	0.229885057
2040	0.63178	0.64069	0.00019	0.208333333

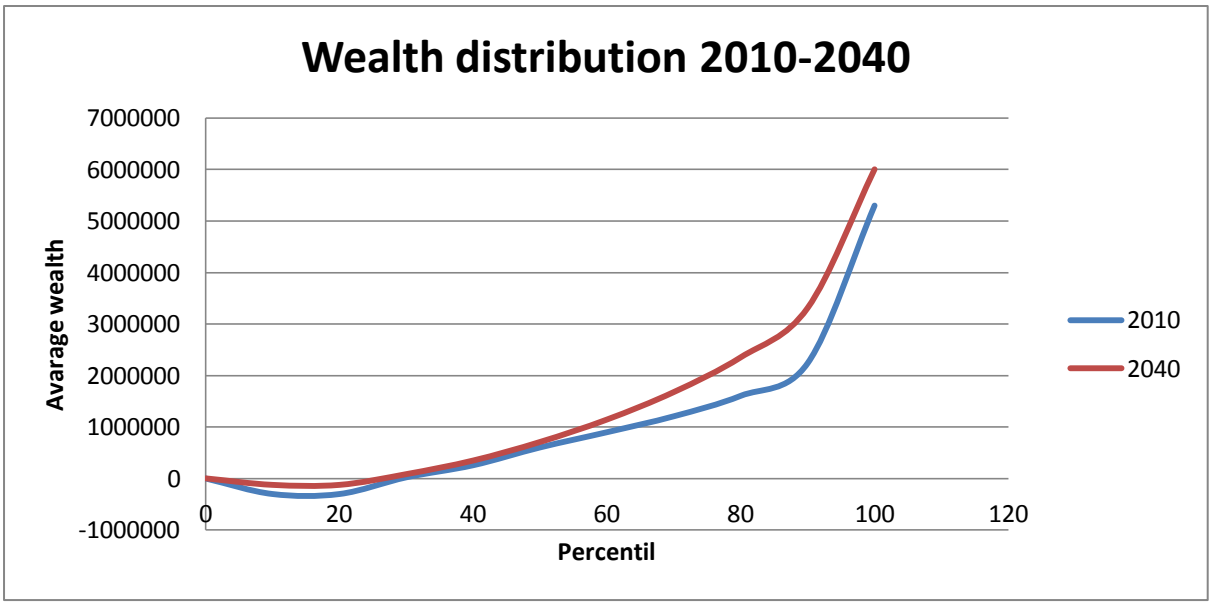
The table shows that within the time, higher proportion of total reduction in Gini coefficient under baseline scenario can be attributed to wealth and inheritance taxes. For example in 2010 approximately 6.5% of the total reduction was due to these taxes, while in 2040 their contribution was approximately 20%. The total reduction in Gini coefficient becomes smaller

each year. However one can say that wealth and inheritance tax's contribution to total reduction in Gini coefficient under baseline scenario is larger in 2040 than in 2010.

The change over time in the relationship between the mean and median might also provide some indication of changes in wealth distribution. Under the baseline scenario the average wealth goes up by approximately 33% while the median increases by 20% meaning that the gap between the two will widen. Thus, it appears that even though the wealth inequality measured in Gini coefficient declines the total discrepancy between poor and rich (in wealth relative terms) has in fact widen.

Figure 18 is used to evaluate how the average wealth was changing across different percentiles. It shows that most of the changes between 2010 and 2040 occurred in the middle and top of the scale. In such case most of the reduction in wealth discrepancy measured in Gini could have occurred mainly due to decreased wealth discrepancy between individuals on top of the wealth distribution.

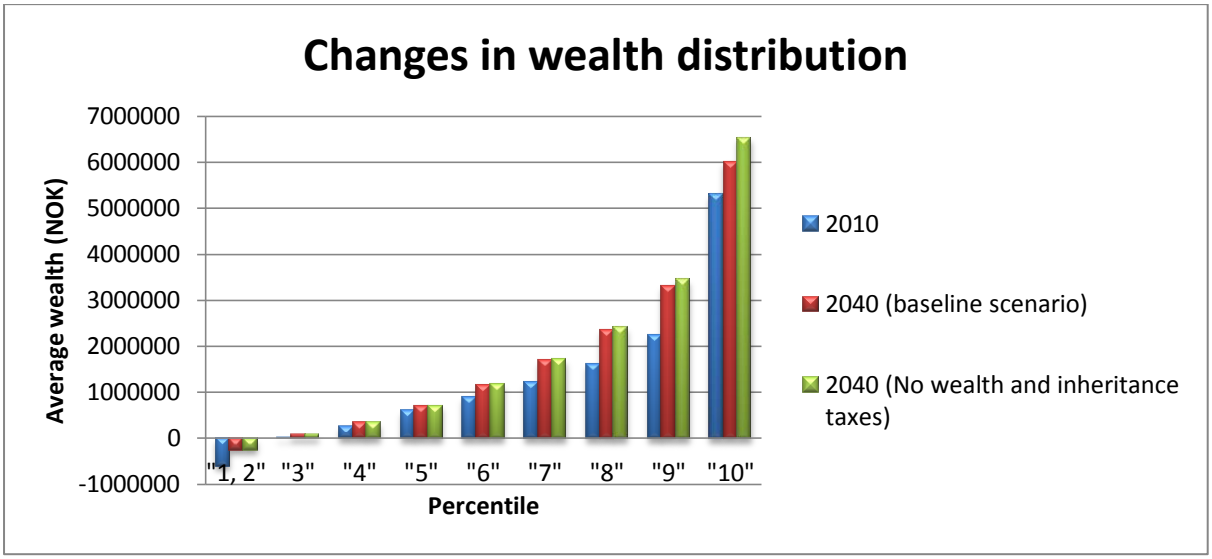
Figure 18. Wealth distribution 2010-2040



Further, Figure 19 has been used to compare the effect of tax removal on different percentiles. It shows the difference in net average wealth between 2010 and 2040 for each percentile under two different scenarios. It clearly shows that the removal of wealth related taxes would mostly benefit the wealthiest with almost no impact on lowest percentiles. Furthermore, the removal of both taxes results in increase in median wealth in 2040 from

912452 NOK under baseline scenario to 9198901 NOK under second scenario while the average wealth is projected to increase from 1538232 NOK to 1614703 NOK, see Tables A5 and A6 in Appendix 2.

Figure 19. Difference in changing wealth distribution under two assumptions



As previously anticipated, the removal of the annual wealth and inheritance taxes would mainly benefit the wealthiest. The results in the Table 12 show what impact the removal of both taxes would have on the top 10% individuals with the highest net wealth. For 1% of the wealthiest individuals the average wealth differentials in 2040 between baseline and second scenario are as high as 95 million NOK, which reveals how important taxes on capital stocks are for the wealthiest individuals in Norway. Moreover, since a substantial amount of the total tax payments paid by the wealthiest individuals in Norway comes from annual wealth tax, its removal could significantly reduce their tax payments.

Table 12. Top 10% wealth share divided into 10 equal sized groups according to rising wealth (million NOK)

Percentile	1	2	3	4	5	6	7	8	9	10
2010	2.87	3.04	3.23	3.46	3.74	4.11	4.63	5.48	7.42	250
2040 (baseline scenario)	4.18	4.39	4.62	4.9	5.23	5.65	6.19	6.97	8.38	210
2040 (second scenario)	4.4	4.63	4.89	5.2	5.57	6.04	6.64	6.97	9.17	305

Here, it is important to keep in mind that the above results are mainly the direct result of tax removal. In reality removal of wealth and inheritance taxes is likely to trigger various behavioral responses in the long run which could highly affect the above results. For example, according to common beliefs, both wealth and inheritance taxes are likely to affect labor supply of wealthy individuals as well as increase individuals savings and investment. In addition without wealth related taxes individuals could be more likely to reveal their actual wealth and less prone to seek tax avoidance. Such behavioral responses are however difficult to measure and are not included in the current version of the model. In addition current knowledge about indirect impacts of wealth related taxes might not be sufficient to quantify such behavioral effects. Therefore these results should be rather treated as rough estimations.

6. Conclusion

The main objective of this study was to discuss the future of annual wealth and inheritance taxation in Norway. A dynamic microsimuation model has been used to analyze future revenues from both taxes and their distributional effects. In addition current schedules, valuation methods, distortions and future challenges on national and international scale have been discussed.

Today annual wealth tax is thought to play an important supplementary role in the current dual income system of capital taxation by ensuring high progressivity on top of the distribution scale. Various distortion related to both taxes however remain. Discrimination between assets, for example, seems to affect the market value of properties and shapes the investment decisions among investors. Effective tax rates on savings vary widely across asset classes. Furthermore, current allowances and preferential rules related to inheritance and gifts have a number of undesirable characteristics that may undermine their redistributive role and lead to higher tax avoidance. The review of empirical studies do not provide a unified and clear picture on how these taxes work and what are their economic impacts. I have also argued that future developments on international scale will have important implication for annual wealth and inheritance taxation in Norway. High wealth concentration, aging population and upward pressure on already high public spending force many countries to rethink they strategy and it appears that wealth related taxes are often considered as one of the solutions. In fact simulation results show that potential revenues from this type of taxes, which could be used to partly cover increased future spending in Norway, are expected to increase substantially.

Furthermore, the simulation results have been used to measure future changes in net wealth concentration in Norway and to analyze to what extent taxes on wealth and inheritance can help with achieving more equal wealth distribution. A substantial decrease in net wealth inequality measured by Gini coefficient is projected during the simulation period. Most of the reduction will occur due to other factors than wealth and inheritance taxes. In the long run however both types of taxes have a significant contribution to overall reduction in wealth inequality. Moreover, within the time as the fiscal importance of these taxes increases, higher proportion of total reduction in Gini coefficient under baseline scenario can be attributed to wealth and inheritance taxes. The simulation results also imply that removal of both taxes would largely benefit the wealthiest individuals in Norway and since a substantial amount of their total tax obligation comes from annual wealth tax it would significantly reduce their tax

payments and could undermine the effective progressivity of the tax system. Thus before any attempt to remove wealth related taxes in Norway the impact on tax progressivity must be carefully analyzed.

References:

Andersson, K. and E. Norrman (1987): Capital taxation and neutrality. Lund: Lund economic studies. p32-40.

Atkinson, A.B. and J.E. Stiglitz (1980): Lectures on Public economics. McGraw-Hill Book Co.

BBC (2013): Mansion tax: Labour defeated in Commons after Lib Dems side with coalition partners. Available: http://www.bbc.co.uk/news/uk-politics-21745529. Last accessed 28th April 2013.

Bertocchi, G. (2007): The vanishing bequest Tax: The Comparative Evolution of Bequest Taxation in Historical Perspective. Institute for the Study of labor. Discussion Paper No. 2578

Bach, S., M. Beznoska, and V. Steiner (2011): A wealth tax on the rich to bring down public debt? Revenue and distributional effects of a capital levy. German Socio-Economic Panel Study. SOEP papers 397

Bonesmo Fredriksen, K. (2012): "Less Income Inequality and More Growth – Are they Compatible? Part 6. The Distribution of Wealth", OECD Economics Department

Working Papers, No. 929, OECD Publishing. http://dx.doi.org/10.1787/5k9h28t0bznr-en

Bo, E.E., P.L Lambert and T.O. Thoresen (2011): Horizontal inequity under a dual income tax system: principles and measurement. Discussion Papers No. 647, Statistics Norway research department

Cremer, H. and P. Pestieau (2009): Wealth and wealth transfer taxation. A survey. Toulouse School of Economics

Cabre, J,M. and A.E More (2001): An empirical analysis of wealth taxation. Equity vs. tax compliance. University of Barcelona

Denk, O. (2012): "Tax Reform in Norway: A Focus on Capital Taxation", OECD Economics Department Working Papers, No. 950, OECD Publishing.
http://dx.doi.org/10.1787/5k9bls0vpd5d-en

Deutsche Bank Research (2012): Income and wealth taxes in the euro area. Available: http://www.dbresearch.com/PROD/DBR_INTERNET_EN-PROD/PROD0000000000292966/Income+and+wealth+taxes+in+the+euro+area%3A+An+initial+overview.PDF. Last accessed 4th April 2013.

Dimensions of Tax Design: The Mirrlees Review, J. Mirrlees, S. Adam, T. Besley, R. Blundell, S. Bond, R. Chote, M. Gammie, P. Johnson, G. Myles and J. Poterba (eds), ISBN: 978-0-19-955375-4, Oxford University Press: April 2010

Edson, Ch. (2012): The capital constraining effects of the Norwegian wealth tax. Available: http://www.ssb.no/a/publikasjoner/pdf/DP/dp724.pdf. Last accessed 9th April 2013.

Epland, J. and M.I. Kirkeberg (2012): Wealth Distribution in Norway Evidence from a New Register-Based Data Source. Available: http://www.ssb.no/a/english/publikasjoner/pdf/rapp_201235_en/rapp_201235_en.pdf. Last accessed 9th April 2013.

Ernst & Young (2012): Personal Tax Services network. International Estate and Inheritance Taxguide.http://www.ey.com/Publication/vwLUAssets/International_Estate_and_Inheritance_Tax_Guide/$FILE/International_Estate_and_Inheritance_Tax_Guide.pdf. Last accessed 4th April 2013.

Fredriksen, D. (1998): Projections of Population, Education, Labour supply and Public Benefits, Social and Economic Studies 101, Oslo: Statistic Norway

Gale, W, G. Hines, J,R. and J. Slemrod (2001): Rethinking Estate and Gift Taxation. Brooking institution press. Washington, D.C. pp. 217-257

Glennerster, H. (2012): Why was a wealth tax for the UK abandoned?: lessons for the policy process and tackling wealth inequality. Journal of social policy, 41 (2), 233-249.

Hanson, A. (2002): The wealth tax and economic growth. Working papers, Department of economics, Lund University

Hanson, A. (2008): The wealth tax and entrepreneurial activity, Journal of entrepreneurship, Vol. 17, 139-156

Holtz-Eakin, D., Joulfaian, D. and Rosen, H (1993): The Carnegie conjecture. Some empirical evidence. Quarterly journal of Economics. Working paper 4118, 413-436

Jinjing, L. (2011) Dynamic microsimulation for public policy analysis. Available: http://arno.unimaas.nl/show.cgi?fid=23887. Last accessed 9th April 2013.

Johansson, A. (2012): Looking to 2060. Long term global growth prospects. OECD economic policy papers. OECD Publishing. http://www.oecd.org/eco/outlook/2060%20policy%20paper%20FINAL.pdf

Lambert, P., and Thoresen, T, O. (2011): The inequality effects of a dual income tax system. Discussion Papers No. 663. Statistics Norway research department

Ministry of Finance (2012): Main features of the tax programe for 2013. Available: http://www.regjeringen.no/pages/38074274/skatt_eng.pdf. Last accessed 9th April 2013.

Ministry of Finance (2000): "Arveavgift: Historisk oversikt" (In Norwegian. "Inheritance taxes: Historic overview"), http://www.regjeringen.no/nb/dep/fin/dok/nouer/2000/nou-2000-8/3/1.html?id=116824, accessed 16/4-2013.

Ministry of Finance (2006): "The Norwegian tax reform 2004-2006", http://www.regjeringen.no/en/dep/fin/Selected-topics/economic-policy/norsk_okonomi/The-Norwegian-tax-reform-2004-2006.html?id=418079, accessed 16/4-2013.

Ministry of Finance (2011): Evaluation of the 2006 tax reform. Report No. 11 to the Storting

Ministry of Finance (2012): "Forbedringer i formuesskatten" (In Norwegian. "Improvements in wealth taxation"), http://www.regjeringen.no/nb/dep/fin/pressesenter/pressemeldinger/2012/forbedringer-i-formuesskatten.html?id=704097, accessed 22/4-2013.

Ministry of finance (2013): "Skatter, avgifter og toll 2013" (In Norwegian. "taxes, expenses and duties in 2013"), http://www.regjeringen.no/nb/dep/fin/dok/regpubl/prop/2012-2013/prop-1-Is-20122013/2/3/3.html?id=702595, accessed 22/4-2013.

NHO (2013): "Formuesskaten deler Norge i to"(In Norwegian "The wealth tax divides Norway in two") ,http://www.nho.no/skatter-og-avgifter/formuesskatten-deler-norge-i-to-article25429-178.html, accessed 27/4-2013.

Piketty, T. and E. Seaz (2012): "A theory of optimal capital taxation", National Bureau of economic research, Working paper 17989

Piketty, T. and E. Seaz (2007): How progressive is the U.S. Federal Tax System? A historical and international perspective. Journal of Economic Perspectives, 21 (1), 3-24.

Rudnick, R.S. and R.K. Gordon (1996): Tax Law Design and Drafting (volume 1; International Monetary Fund: 1996; Victor Thuronyi, ed.) Chapter 10, Taxation of Wealth

Skatteetaten (2013): "Formuesskatten-tabeller og satser" (In Norwegian "wealth tax-tables and rates") http://www.skatteetaten.no/no/Tabeller-og-satser/Formuesskatt/ , accessed 27/4-2013.

Skatteetaten (2013): "arveavgift-tabeller og satser" (In Norwegian "inheritance tax-tables and rates") http://www.skatteetaten.no/no/Tabeller-og-satser/Arveavgift/ , accessed 27/4-2013.

Salanié, B. (2003): The Economics of Taxation, MIT Press: Ch 6, pp. 121-129

Sørensen, P. B. (1998): Tax policy in the Nordic countries. London: Macmillan press ltd. pp1-15.

Sørensen, P.B. (2005): Neutral taxation of shareholder income. A Norwegian tax reform proposal, International Tax and Public Finance, 12 (6), 777-801

Spadaro, A. (2007): Microsimulation as a tool for the evaluation of public policies. Methods and application. Bilbao: Fundacion BBVA. Pp.17-54.

Stiglitz, J.E. (2000): Economics of the Public sector. New York. Norton, 3rd ed.

Stranger, M. (2009): "Fordelingsvirgninger av endringer i formuesskatten" (In Norwegian "Distributional effects of changes in wealth taxation") https://www.duo.uio.no/bitstream/handle/10852/17564/MarenxStrangerxmasteroppgaven.pdf?sequence=3, accessed 27/4-2013.

Statistics Norway (2013): "Skatterekneskap" (In Norwegian "Tax accounts) http://ssb.no/a/aarbok/tab/tab-476.html, accessed 10/5-2013

Statistics Norway (2013): "Arv" (In Norwegian "Inheritance" http://www.ssb.no/arv/, accessed 10/5-2013

Thoresen, T., D. Fredriksen and S. Pedersen (2001): “Skatt pa overforing mellom generasjoner. En diskusjon av arveavgiften”(In Norwegian “The discussion about inheritance taxation”) http://www.ssb.no/a/publikasjoner/pdf/rapp_200132/rapp_200132.pdf, accessed 27/4-2013.

Zaidi, A and K. Rake (2011): Dynamic microsimulation models: Review of some lessons for SAGE. SAGE research group. The London school of economics

APPENDIX 1

From a Norwegian perspective, a gift is given when a living person (donor) transfers property or economic benefit of any kind to another person without full consideration. Gifts are taxable only in the following cases:

1. Gifts to persons who at the time of the gifts are the nearest heirs or foster children of the donor or his or her spouse or cohabitant.
2. Gifts to any persons provided for in the donor's will at the time of the gift.
3. Gifts to linear descendants of persons mentioned above.
4. Gifts to spouses or cohabitants of persons mentioned above.
5. Gifts to entities, foundations, etc., in which any person mentioned above has an interest comparable to that of an owner or participant and where distributions by these bodies mainly benefit members of certain families.
6. Gifts to any persons made within six months prior to the donor's death.
7. Gifts to any persons provided for in the donor's will at the time of death or to a spouse of such person, if such gifts are made within five years prior to the donor's death.

Exemptions and reliefs

Any inheritance or gift received from one's spouse or cohabitant will be exempt from IHT.
Other exemptions also exist, such as the following:

• Each year the National Assembly determines a National Insurance Amount (G), now NOK79.216. Gifts with a total value below ½ G each year are exempt from IHT. The exemption does not apply when the gift consists of unlisted shares, participation in partnerships, other types of unlisted securities, real estate and insurance policy or payment of premium to such insurance policies.

• Periodical gifts for support or educational purposes as long as the gifts have been used before the donor's death.

• Testamentary donations in favour of institutions and foundations, whose purpose is considered to be charitable or of public interest, are exempt, provided certain criteria are met. For other donations, the Ministry of Finance may grant an exemption, provided it may be proved that the assets are "used for charitable purposes." If the criteria to grant an exemption are not available for all of the assets, the department may grant a partial relief.

APPENDIX 2

Table A1. Average wealth by age (baseline scenario)

"Year"	"All"	"17-24"	"25-44"	"45-64"	"65+"
2010	1152510	45832	717265.25	1655415.3	1676545
2015	1206237	20383	600567.5	1774282.8	2024559
2020	1275688	24139	497271.5	1862107.5	2359570
2025	1354857	26734.5	434146	1885818	2681292
2030	1438021	28464	422394.75	1858290.3	2981953
2035	1518412	27741	434216.25	1817639.3	3267391
2040	1594053	26734.5	449905	1782215.3	3528642

Table A2. Average wealth by age always residents (baseline scenario)

"Year"	"All"	"17-24"	"25-44"	"45-64"	"65+"
2010	978700	43383	596303.8	1394538	1500314
2015	1015066	17897.5	489238.5	1479440	1790804
2020	1060723	20821.5	390299.8	1524792	2063476
2025	1111250	22810	331517	1503634	2319403
2030	1162972	24861	321008.5	1453794	2521915
2035	1210844	24423	331165.5	1373393	2733133
2040	1253451	23875.5	343333.3	1306867	2931100

Table A3. Wealth tax - baseline scenario (billion NOK)

Year	"Incm Tax"	"Labour income"	"Pensions"	"Savings"	"Finan. wealth"	"Housi." wealth"	"Taxab. wealth"	"Tax.W. income"	"Wealth tax"
2010	362,2	1113,8	196,2	0,0	42,2	4417,3	1146,6	-35,2	10,9
2011	350,3	1101,3	212,2	291,5	6,8	4551,3	1156,8	-33,4	10,5
2012	371,4	1159,2	218,3	293,0	-6,3	4666,9	1159,4	-33,9	10,3
2013	377,3	1177,7	224,2	299,8	-6,3	4772,3	1177,0	-34,6	10,3
2014	383,6	1192,9	231,7	306,0	-4,8	4878,1	1204,2	-34,8	10,3
2015	398,2	1206,8	247,2	312,2	-1,5	4984,2	1233,2	-35,0	10,3
2016	403,7	1219,4	255,0	318,4	3,9	5090,2	1264,1	-35,1	10,3
2017	409,2	1231,5	262,1	324,4	10,5	5196,9	1296,8	-35,3	10,4
2018	414,5	1243,1	268,9	330,4	17,4	5304,5	1330,3	-35,4	10,5
2019	419,5	1254,1	275,2	336,2	26,1	5412,5	1365,3	-35,6	10,6
2020	424,2	1264,5	281,4	341,9	34,7	5521,5	1401,2	-35,8	10,8
2021	428,7	1274,8	286,7	347,5	43,2	5631,1	1437,5	-36,0	11,0
2022	433,0	1284,8	291,7	353,1	53,8	5739,9	1474,2	-36,2	11,2
2023	437,1	1294,4	296,6	358,6	64,8	5849,0	1512,5	-36,4	11,4
2024	441,1	1303,4	301,4	364,2	77,1	5957,2	1551,2	-36,5	11,7

2025	445,0	1312,0	306,2	369,7	90,1	6065,3	1590,9	-36,7	11,9
2026	448,8	1320,0	311,0	375,0	104,2	6172,3	1631,6	-36,8	12,2
2027	452,5	1327,7	315,8	380,4	120,5	6277,5	1673,3	-36,8	12,5
2028	456,1	1335,1	320,5	385,7	138,1	6381,5	1716,3	-36,8	12,8
2029	459,7	1342,4	325,2	391,0	156,3	6484,9	1759,9	-36,8	13,1
2030	463,2	1349,3	329,9	396,0	175,7	6587,0	1804,7	-36,7	13,5
2031	466,7	1355,8	334,8	401,2	196,1	6687,6	1850,4	-36,6	13,8
2032	470,2	1362,5	339,5	406,3	217,8	6786,8	1895,9	-36,4	14,2
2033	473,7	1369,3	344,0	411,3	241,4	6883,8	1943,5	-36,2	14,6
2034	477,2	1376,1	348,4	416,1	266,7	6978,2	1991,8	-35,9	14,9
2035	480,9	1383,0	352,8	420,9	292,2	7071,8	2041,0	-35,6	15,3
2036	484,6	1389,8	357,1	425,7	319,0	7163,6	2090,9	-35,2	15,7
2037	488,3	1396,7	361,4	430,4	346,5	7253,8	2140,3	-34,8	16,1
2038	492,1	1403,8	365,5	435,0	375,2	7342,9	2191,9	-34,3	16,5
2039	495,8	1410,9	369,6	439,7	404,6	7430,0	2242,6	-33,9	16,9
2040	499,5	1417,9	373,5	444,2	434,4	7517,0	2294,9	-33,3	17,3

Table A4. Second scenario – wealth and inheritance taxes set to zero (billion NOK)

Year	"Incm Tax"	"Labour income"	"Pens-ions"	"Sav-ings"	"Finan. wealth"	"Housi. wealth"	"Taxab. wealth"
2010	351,3	1113,8	196,2	0,0	42,2	4417,3	1146,6
2011	339,9	1101,3	212,2	83,8	18,8	4551,3	1158,3
2012	361,2	1159,2	218,3	90,3	17,4	4666,9	1172,4
2013	367,2	1177,7	224,2	98,1	28,9	4772,3	1201,4
2014	373,5	1192,9	231,7	105,3	41,8	4878,1	1239,7
2015	388,2	1206,8	247,2	112,1	56,4	4984,2	1279,8
2016	393,8	1219,4	255,0	119,0	73,1	5090,2	1321,6
2017	399,3	1231,5	262,1	125,5	91,0	5196,9	1365,2
2018	404,5	1243,1	268,9	132,1	109,0	5304,5	1409,6
2019	409,4	1254,1	275,2	138,4	129,0	5412,5	1455,4
2020	414,0	1264,5	281,4	144,6	148,9	5521,5	1502,3
2021	418,5	1274,8	286,7	150,7	168,9	5631,1	1549,4
2022	422,6	1284,8	291,7	156,9	191,1	5739,9	1597,3
2023	426,5	1294,4	296,6	162,8	213,9	5849,0	1646,9
2024	430,4	1303,4	301,4	168,7	238,1	5957,2	1697,0
2025	434,1	1312,0	306,2	174,6	263,3	6065,3	1748,4
2026	437,6	1320,0	311,0	180,5	289,8	6172,3	1800,9
2027	441,1	1327,7	315,8	186,2	318,8	6277,5	1854,7
2028	444,4	1335,1	320,5	192,1	349,5	6381,5	1910,1
2029	447,8	1342,4	325,2	197,8	380,8	6484,9	1966,3
2030	451,1	1349,3	329,9	203,6	413,8	6587,0	2024,1
2031	454,3	1355,8	334,8	209,3	448,2	6687,6	2083,2

2032	457,5	1362,5	339,5	214,8	484,1	6786,8	2142,2
2033	460,8	1369,3	344,0	220,3	522,5	6883,8	2203,9
2034	464,0	1376,1	348,4	225,9	563,0	6978,2	2266,6
2035	467,4	1383,0	352,8	231,3	604,0	7071,8	2330,5
2036	470,8	1389,8	357,1	236,6	646,7	7163,6	2395,6
2037	474,2	1396,7	361,4	241,8	690,4	7253,8	2460,5
2038	477,7	1403,8	365,5	246,9	735,9	7342,9	2528,1
2039	481,1	1410,9	369,5	252,0	782,3	7430,0	2595,1
2040	484,5	1417,9	373,4	257,0	829,7	7517,0	2664,2

Table A5. Wealth distribution changes (baseline scenario)

	"No of	"Median"	"Average"	"Gini"	"Deciles averages	
"Year"	"persons"	"value"	"value"	"coeff."	"1" "2"	"3"
2010	3869757	754827	1152402	0,71356	-603051	22103
2020	4421147	757748	1256105	0,66954	-360879	25239
2030	4827011	820848	1400446	0,64433	-285782	58548
2040	5167460	912452	1538232	0,63178	-252724	82276
"4"	"5"	"6"	"7"	"8"	"9"	"10"
257499	603008	898241	1207652	1604308	2238191	5296076
213073	549896	974108	1405374	1889587	2598213	5266451
289463	623168	1047526	1553564	2150929	2982022	5585029
347361	707913	1144215	1678605	2353726	3313705	6007242

Table A6. Wealth distribution changes (second scenario)

	"No of"	"Median"	"Average"	"Gini	"Deciles averages	
"Year"	"persons"	"value"	"value"	"coeff."	"1" "2"	"3"
2010	3869757	754827	1152402	0,71356	-603051	22103
2020	4421147	759600	1281926	0,67377	-360696	25306
2030	4827011	825000	1449752	0,65117	-285491	58772
2040	5167460	919801	1614703	0,64069	-252338	82703
"4"	"5"	"6"	"7"	"8"	"9"	"10"
257499	603008	898241	1207652	1604308	2238191	5296076
213347	550890	977203	1411191	1901030	2626930	5474069
290210	625570	1054732	1569196	2183238	3054368	5946930

348775	712347	1156155	1706118	2415840	3450905	6526528

Table A7. Tax on private inheritance (baseline scenario – billion NOK)

"Year"	"Public ieritance"	"Number of recipien."	"Net private inheritance"	"Number of taxed"	"Tax on pri. inheritance"
2010	0,000	0	0,000	0	0,000
2011	9,774	67553	52,439	20651	1,499
2012	9,206	67825	54,434	22481	1,582
2013	9,653	68355	57,262	23991	1,720
2014	9,575	69338	59,309	25087	1,814
2015	9,262	70391	62,038	26395	1,972
2016	9,574	71167	63,856	27458	2,021
2017	9,336	71571	66,274	28461	2,149
2018	9,698	72725	69,223	30087	2,269
2019	8,968	73215	71,474	31110	2,359
2020	9,251	74192	73,919	32189	2,493
2021	9,377	75099	76,009	33902	2,574
2022	9,160	76012	79,982	34915	2,769
2023	9,106	77097	82,177	36368	2,927
2024	9,251	78469	85,154	37486	3,049
2025	9,360	80033	88,660	38801	3,243
2026	9,454	80723	91,370	40051	3,392
2027	9,837	82332	94,820	41701	3,613
2028	10,351	83755	98,854	43106	3,839
2029	10,463	85430	102,121	45219	3,961
2030	10,768	86506	107,364	46489	4,282
2031	11,281	88148	111,011	48121	4,559
2032	11,625	90047	115,416	50079	4,776
2033	12,017	91692	120,067	52056	5,121
2034	12,750	93142	125,118	53473	5,435
2035	13,567	94893	128,766	55481	5,664
2036	13,832	96719	133,941	57466	6,020
2037	14,569	98261	138,162	59004	6,343
2038	14,924	99125	143,112	60766	6,708
2039	15,771	100574	146,793	62491	6,895
2040	15,270	102516	150,963	64268	7,291

Table A8. Wealth distribution changes (baseline scenario, only including individual "65+" of age)

	"No of"	"Median"	"Average"	"Gini	"Decile averages	
"Year"	"persons"	"value"	"value"	"coeff."	"1" "2"	"3"
2010	351610	1356238	1743462	0,48814	6903 257553	589919
2020	420417	1895839	2363193	0,42820	107166 710153	1106611
2030	597886	2400991	2909357	0,39644	235898 1026125	1483255
2040	743262	2903497	3403208	0,37357	361623 1271397	1816929
"4"	"5"	"6"	"7"	"8"	"9"	"10"
924615	1214414	1506440	1846252	2280259	2966044	5842216
1427767	1735065	2067516	2459328	2978967	3809833	7229618
1854568	2213780	2605977	3073932	3695665	4674363	8230072
2257689	2683512	3141396	3678261	4376942	5464637	8979734

Table A9. Population by age (baseline scenario)

		Population by age			
"Year"	"All"	"17-24"	"25-44"	"45-64"	"65+"
2010	3869105	514142	1358962	1254528	741473
2015	4163314	547481	1432084	1331586	852163
2020	4419970	544309	1512356	1406191	957114
2025	4637184	546508	1578103	1440362	1072211
2030	4825664	569556	1596302	1467236	1192570
2035	5001283	592834	1594621	1494287	1319541
2040	5165744	624815	1585356	1536247	1419326

APPENDIX 3

The Difference in Difference Estimator

The difference in difference (or "double difference") estimator is defined as the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome in the control group before and after treatment: it is literally a "difference of differences."

$$\hat{\delta}_{DD} = \bar{Y}_1^T - \bar{Y}_0^T - (\bar{Y}_1^C - \bar{Y}_0^C)$$

Taking the expectation of this estimator we will see that it is unbiased:

$$\begin{aligned}\hat{\delta}_{DD} &= E[\bar{Y}_1^T] - E[\bar{Y}_0^T] - (E[\bar{Y}_1^C] - E[\bar{Y}_0^C]) \\ &= \alpha + \beta + \gamma + \delta - (\alpha + \beta) - (\alpha + \gamma - \gamma) \\ &= (\gamma + \delta) - \gamma \\ &= \delta\end{aligned}$$

This estimator can be seen as taking the difference between two pre-versus-post estimators subtracting the control group's estimator, which captures the time trend γ, from the treatment group's estimator to get δ. We can also rearrange terms in equation to get: $\hat{\delta}_{DD} = \bar{Y}_1^T - \bar{Y}_1^C - (\bar{Y}_0^T - \bar{Y}_0^C)$

in which can be interpreted as taking the difference of two estimators of the simple treatment versus control type. The difference estimator for the pre-period is used to estimate the permanent difference β, which is then subtracted away from the post-period estimator to get δ.

It is common to find difference in difference estimators presented in a table of the following form.

	Pre	Post	Post-Pre Difference
Treatment	$\bar{Y}_0^T$	$\bar{Y}_1^T$	$\bar{Y}_1^T - \bar{Y}_0^T$
Control	$\bar{Y}_0^C$	$\bar{Y}_1^C$	$\bar{Y}_1^C - \bar{Y}_0^C$
T-C Difference	$\bar{Y}_0^T - \bar{Y}_0^C$	$\bar{Y}_1^T - \bar{Y}_1^C$	$\bar{Y}_1^T - \bar{Y}_1^C - (\bar{Y}_0^T - \bar{Y}_0^C)$

Notice that the first row ends with the estimate ˆδ1, the second column ends with estimate ˆδ2, and the lower right hand corner entry gives the estimate δ_{DD}

Example: According to the model, by Card and Krueger (1994) comparisons of employment growth at stores in New Jersey and Pennsylvania (where the minimum wage was constant), provide simple estimates of the effect of the higher minimum wage. Some of the results from Table 3 are shown below with the average employment in the fast-food restaurants, with standard errors in parentheses

	Before Increase	*After Increase*	*Difference*
New Jersey	20.44	21.03	0.59
(Treatment)	(0.51)	(0.52)	(0.54)
Pennsylvania	23.33	21.17	−2.16
(Control)	(1.35)	(0.94)	(1.25)
Difference	−2.89	−0.14	2.76
	(1.44)	(1.07)	(1.36)

The difference in difference estimator shows a small increase in employment in New Jersey where the minimum wage increased. This came as quite a shock to most economists who thought employment would fall.

Notice that we can see that prior to the increase in the minimum wage Pennsylvania had higher employment than New Jersey and that it was bound to fall to a lower level. This may be a failure in the parallel trend assumption. However the small, albeit insignificant increase in employment in New Jersey makes it hard to accept the hypothesis that employment actually decreased in New Jersey over this time. Although still somewhat controversial, this study helped change the common presupposition that a small change in the minimum wage from a low level was bound to cause a significant decrease in employment.

Problems with Difference in Difference Estimators

If any of the assumptions listed above do not hold then we have no guarantee that the estimator δ_{DD} is unbiased. Unfortunately, it is often difficult and sometimes impossible to check the assumptions in the model as they are made about unobservable quantities. Keep in mind that small deviations from the assumptions may not matter much as the biases they introduce may be rather small, biases are a matter of degree. It is also possible, however, that

the biases may be so huge that the estimates we get may be completely wrong, even of the opposite sign of the true treatment effect.

One of the most common problems with difference in difference estimates is the failure of the parallel trend assumption. Suppose that cov (εi, Ti · ti) = E (εi (Ti · ti)) = Δ so that Y follows a different trend for the treatment and control group. The control group has a time trend of $\gamma^C = \gamma$, while the treatment group has a trend of $\gamma^T = \gamma + \Delta$. In this case the difference in difference estimator will be biased as

$$E\left[\hat{\delta}_{DD}\right] = (\gamma^T + \delta) - \gamma^C = \gamma + \Delta + \delta - \gamma = \delta + \Delta$$

The failure of the parallel trend assumption may in fact be a relatively common problem in many program evaluation studies, causing many difference in difference estimators to be biased.

One way to help avoid these problems is to get more data on other time periods before and after treatment to see if there are any other pre-existing differences in trends. It may also be possible to find other control groups which can provide additional underlying trends. There is a huge literature on this subject, although a good place to start is Meyer (1995).