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Measuring long-run wealth inequality: Empirical results for Norway 1912-2019

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Abstract

This paper introduces a framework for estimating long-run series of measures of overall inequality and top wealth shares when data consist of a combination of historical tabulations and modern administrative registers of taxable wealth. The proposed framework is applicable when historical wealth tabulations as a minimum provide information on bracket boundaries and the proportion of tax units for each of the wealth brackets.

The framework has been used to produce evidence on wealth inequality in Norway from 1912 to 2019. The empirical results show that wealth inequality as measured by the Gini coefficient was very high at the beginning of the twentieth century, fell during the post-war period and has increased substantially since the 1980s. The rise in wealth inequality over the recent four decades is driven by a rise in the wealth share of the top 1 per cent, while equalization among the bottom 99 per cent accounted for 70 percent of the reduction in wealth inequality from the early 1950s to the late 1960s.

Keywords: Distribution of wealth, long-run inequality, the Gini coefficient, wealth taxation, Norway

JEL classification: D31, D63, H29, N34.

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Samandrag

Måling av langsiktig ulikskap i formue: Empiriske resultat frå Noreg, 1912-2019

Denne artikkelen presenterer eit metodisk rammeverk for å talfeste ulikskap i fordelinga av formue over ein lang tidshorisont, når data er basert på skattbar formue frå historiske tabellar og moderne administrative register. Vi definerer populasjonen på same måte i alle år, innfører fleksible føresetnader om forma på fordelinga innanfor formuesgruppene og korrigerer for variasjonar i den skattbare formuesgrensa frå år til år. Rammeverket vi presenterer kan òg nyttast for andre land der det er tilgang på liknande data.

Som mål på ulikskap bruker vi Gini-koeffisienten. Tidlegare forsking på ulikskap over lange tidshorisontar, har fokusert på formuesdelar blant den rikaste prosenten. Ved å bruke Gini-koeffisienten som mål på ulikskap får vi med endringar i skilnader mellom folk i heile fordelinga. Vi dekomponerer og Gini-koeffisienten. Dekomponeringa gjer at vi kan skildre kor i fordelinga endringar i ulikskap stammar frå, samt at vi kan samanlikne resultata våre med tidlegare forsking som berre har sett på topp-formuesdelar.

Basert på norske data for skattbar formue for perioden 1912 – 2019 finn vi at ulikskapen i fordelinga av formue blant norske hushald var svært høg på starten av 1900-talet, gjekk ned på 1950- og 1960-talet og har auka vesentleg frå 1980-talet og fram til i dag. Veksten i ulikskap dei siste fire tiåra skuldast hovudsakeleg stigande formue for den rikaste prosenten, medan utjamninga mellom hushalda tilhøyrande den resterande 99 prosenten er den viktigaste grunnen til reduksjonen i ulikskap frå tidleg på 1950-talet til seint på 1960-talet.

Artikkelen presenterer òg resultat for ulikskap i formue for perioden 1969 - 2019 når marknadsverdien av eigen bustad reknast inn i grunnlaget for formue, og for eit utvida formuesomgrep basert på data frå nasjonalrekneskapen. Dei ulike føresetnadene brukt til å fordela aggregerte tal frå nasjonalrekneskapen gir ulike resultat når det gjeld nivået på ulikskapen i formue, men utviklinga over tid viser den same U-forma som for skattbar formue.

1 Introduction

Inequality and concentration in the distribution of wealth is at the heart of the political debate in most democratic societies, although tax-based empirical evidence for recent decades is only available for a few countries. Wealth taxation was however more common during the 20th century, which also formed the basis for historical data series of the wealth distribution. Yet, the literature on economic inequality offers surprisingly few results on the long-run evolution of overall wealth inequality. Attention has instead been directed towards the evolution of wealth concentration as measured by top wealth shares (see reviews by Davies and Shorrocks, 2000; Roine and Waldenström, 2015; Zucman, 2019; Waldenström, 2024).[1] Even though available evidence on the concentration of wealth suggests large overall wealth inequality, omitted information of wealth differences across the rest of the population is crucial for getting a more complete picture of the long-run evolution of overall wealth inequality. To this end, it will be convenient to use measures of inequality that summarize the informational content of the relative distributions of wealth.

The main objective of this paper is to propose a recipe for how historical data, usually made available in terms of tabulations, can be exploited to produce reliable and comparable long-run series of overall wealth inequality. The purpose of the recipe is to deal with additional methodological challenges that arise when estimating long-run series of overall inequality rather than of wealth concentration. Although the methodological discussion of the paper will focus on the Gini coefficient it should be noted that the proposed recipe can be used for any measure of inequality.

Historical wealth tabulations group taxpayers into wealth brackets. The informational content of the tax-based wealth data might vary significantly across time due to changes both in the wealth tax and the publishing practice of statistical agencies. A major reason is the standard practice of excluding non-taxpayers both in register data and tabular data. Since the design of the wealth tax changes over time, the coverage of the data may vary significantly and create a challenging comparability problem. Owing to high taxable wealth thresholds the data may in some periods only include a minority of the population. This means that historical tax reported wealth data provide proper information for the top of the wealth distribution, but are in some periods silent about the rest of the distribution. The periodically limited coverage of wealth tax data can explain why the literature on the long-run evolution of the wealth distribution has mainly been limited to describing the evolution of top wealth shares. As shown in this paper, using data from taxable wealth without taking into account variation in coverage can lead to misleading results with significant annual changes in estimates of the overall measure of inequality. To deal with this challenge and strengthen the comparability across time we have replaced the observed tax thresholds by a common lower wealth threshold. For years where

[1] OECD (see Balestra and Tonkin (2018)) and some national statistical agencies provide estimates of top wealth shares on a regular basis, whereas estimates of overall wealth inequality are rarely available.

the chosen common threshold is lower than the observed wealth tax threshold, the unobserved segments are represented by imputed data from neighboring years.

A second methodological challenge arises because the distribution of wealth within brackets is normally skewed to the right, which is not reflected by the standard estimation methods used for tabular data. This problem is exacerbated by the varying number of brackets and bracket widths across time. For some years, brackets can be rather broad even at the top of the wealth distribution. Broad upper brackets make it preferable to replace the standard estimation assumption of equal wealth within each wealth bracket with parametric distributions to capture the strict convex curvature of the Lorenz curve in the upper segment. To this end, we introduce bracket-specific parametric distributions, which add significant flexibility to the overall semi-parametric description of the tabulated data as compared to relying on one specific common parametric distribution with fewer parameters.

Note that the proposed framework can be used as a recipe for any country where historical tabulations of taxable wealth as a minimum provide information on bracket boundaries and the proportion of tax units for each of the wealth brackets.

As housing is the key asset for most households and known to be systematically underestimated in tax records, we have also produced an alternative series of wealth inequality for the recent five decades, where tax assessed housing wealth have been replaced by assessed market values. Furthermore, this paper also includes an exercise where the excess wealth from the System of National Accounts (SNA) is accounted for. A major aim of this exercise is to evaluate the sensitivity of the inequality estimates to the chosen allocation assumptions of the (aggregated) SNA excess wealth.

Long-run evolution of wealth concentration and inequality in Norway. The second objective of this paper is to apply the proposed recipe for estimating long-run series of the Gini coefficient and the wealth share of the top 1 per cent based on taxable wealth data for Norway from 1912 til 2019.[2]

The tax unit in Norway, which is either a married couple or a single adult, defines the unit of analysis since wealth has been subject to joint taxation throughout the period where only tabular data were published. Access to register data of taxable wealth from 1967 onwards have made it possible to use the same definitions and methods dictated by the tabular data from the early period.

Our benchmark series for inequality and concentration in the distribution of wealth over this period, which is displayed in the left panel of Figure 1, show that wealth inequality in Norway was extremely high at the beginning of the twentieth century. The wealth Gini coefficient was 0.90 in 1912 and 0.91 as late as in 1948. Wealth inequality in Norway declined during the 1950s, nearly a decade later than the decline in income inequality (Aaberge et al., 2020),

[2]The modern system of individual tax returns was implemented in Norway in 1911. Thus, for comparability reasons it has been attractive to study the evolution of wealth inequality and wealth concentration over the period 1912-2019.

suggesting the strict post-war economic policy regime with very high marginal tax rates as more likely explanations than wartime losses and/or regulations. The lowest wealth inequality emerged in 1968, with a Gini of 0.78, after which wealth inequality started to rise and reached a level of 0.86 in 2019.

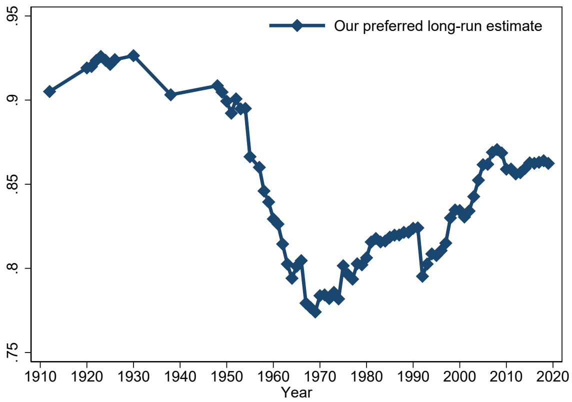
The strong focus in the literature on the evolution of top wealth shares makes it relevant and interesting to examine to what extent the evolution of top wealth shares reflects the evolution of overall wealth inequality. To this end, we employ a decomposition method, where the overall Gini coefficient is determined by the share of the top 1 per cent and the Gini coefficient of the other 99 per cent. The decomposition results show that the share of the top 1 per cent does not fully explain the evolution of the overall Gini coefficient, which means that exclusively focusing on the share of the top 1 per cent would have led to a misleading description of the evolution of overall wealth inequality.

The comparison of the estimates of the wealth share of the top 1 per cent attained in this study with the series of Norwegian top 1 per cent wealth shares provided by Roine and Waldenström (2015) shows the importance of the methodological approach used in this paper. Roine and Waldenström (2015) provided the first study on the evolution of top wealth shares based on data from Norwegian official statistics, but they did not claim to have produced a consistent series of estimates over the entire time period.[3] The right panel in Figure 1 shows the series of top 1 per cent wealth shares provided by Roine and Waldenström as well as our corresponding benchmark series. As is evident from the figure, there are significant differences between these two alternative series of top 1 per cent wealth shares. The largest differences occur before 1960 and after 1990, where the estimates of Roine and Waldenström (2015) show to be substantially lower than the estimates obtained in this paper. Moreover, from 1990 onwards, we find that the wealth share of the top 1 per cent increased dramatically, whereas the Roine and Waldenström (2015) series only suggests a modest rise. The differences between these two series are both due to the difference in the applied data sources and the chosen methodological approach. However, for the later period we would like to draw attention to the fact that Roine and Waldenström were unable to harmonize the population and wealth definition as they did not have access to Norwegian micro data.

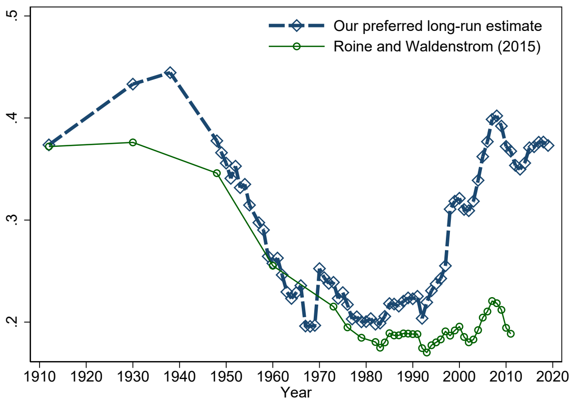
For the period 1969 - 2019, we have exploited additional data sources to evaluate the effects of replacing the tax assessed measure of housing by a market assessed measure of housing. Integrating the market value of housing reduced the level of measured inequality, but, reassuringly, the trend does not deviate much from our benchmark series. The series that account for the market value of housing can be considered as a lower bound of wealth inequality because housing is the key asset for most households. By contrast, unlisted companies, mostly owned by the top 1 per cent, are valued at book values, which in most cases are significantly lower

[3] Roine and Waldenström (2015) refer to the estimates based on the Norwegian data in the following manner: "Overall, these data are perhaps the most uncertain presented in the entire chapter and the estimates of top wealth shares presented in this chapter must therefore be interpreted cautiously".

Figure 1: Wealth inequality (Gini coefficient) and concentration (top 1 per cent wealth shares) in Norway, 1912 - 2019



(a) Gini coefficient



(b) Top 1 per cent wealth share

Notes: The left panel of Figure 1 shows our the Gini coefficient based on our preferred measure for assessed wealth as described in Section 3. The right panel compares the series for the wealth share of the top 1 percent provided by Roine and Waldenström (2015) for the period 1912-2011 with the series based on our preferred measure.

than than the expected market values. Thus, the lower inequality bound associated with the series that include market values of housing might be significantly lower than a series that also included the market values of unlisted companies.

Moreover, we also conduct an exercise where we assign excess wealth from the System of National Account (SNA) to potential owners for the period 1912 - 2019. As might not come as a surprise, the SNA-based inequality estimates depend heavily on the chosen allocation assumptions. It is however reassuring that the trend in the long-run evolution shows to be less sensitive to the allocation assumptions and roughly parallels the tax-based series.

Previous research. While the literature on historical wealth inequality is rather limited, there are a few studies examining the long-run evolution of wealth concentration. Using wealth tax data combined with survey data and national accounts, Albers et al. (2022) have estimated the top 1 per cent wealth share in Germany from 1895 to 2018 and found a strong decline in top wealth concentration from 1905 to 1955, and a weak increase for the period 1955-2016. Their study is supplemented with an estimate of overall wealth inequality from 1978 onwards, showing a moderate increase in the wealth Gini coefficient over this period.

Roine and Waldenström (2015) studies of wealth concentration (top wealth shares) based on tax data for Denmark, Finland, the Netherlands, Norway, Sweden and Switzerland. Roine and Waldenström found conflicting evidence for the period before the First World War, but suggest that there was a near-universal trend of declining wealth inequality from around 1920 to 2000.[4] Zucman (2019) has provided an updated review that shows a rise in top wealth shares in the United States and a few other countries after 2000. Other studies covering the time

[4]Their review also includes series (using other estimation methods) for Australia, France, the United Kingdom and the United States.

period from 1980 onwards provide mixed evidence. Jakobsen et al. (2020) found increasing wealth concentration for Denmark, while Alvaredo and Saez (2009) found stable top wealth shares for Spain. The estimated series of the wealth share of the top 10 per cent for Sweden from 1908 onwards provided by Roine and Waldenström shows decline in wealth concentration from approximately 1920 to 1975 and increase from 1985 onwards.

As an alternative to using tax assessed wealth data (described by Zucman (2019, p. 114) as the "ideal data source" for measuring wealth inequality), the predominant approach for estimating wealth concentration relies on estate records (probates). These data often record comprehensive details of the wealth of deceased people, though normally only for a selected sample. Hence, estimating wealth concentration from estate records requires assumptions on how representative those dying and leaving estate records are with respect to the general population.[5] It is in some cases also possible to obtain wealth concentration estimates from survey data, even though large sampling errors will lead to large confidence intervals for estimates of top wealth shares. Unfortunately, wealth surveys have rarely been performed in a consistent way over long time periods, but Kuhn et al. (2017) is an exception by providing a series of U.S. wealth concentration estimates from 1949 onwards using the Survey of Consumer Finances.[6]

Finally, one can attempt to assess wealth inequality from income data by using a capitalization method. Fundamentally, one uses data on capital income and combines this with data/assumptions on typical rates of return, “backing out” the wealth holdings. Long-run wealth concentration series based on this method have been estimated by Saez and Zucman (2016) and Smith et al. (2023) for the United States, and by Garbinti et al. (2020) for France. Capitalizing tax reported incomes are often used in conjunction with exploiting aggregate wealth data from the National Accounts. However, as indicated by Smith et al. (2023) estimates of top wealth shares show to be rather sensitive to assumptions on return rates simply because there is large heterogeneity in the return rate within and across assets.

The present paper also supplements previous studies on the evolution of wealth inequality in Norway during the recent three decades (Fagereng et al., 2016; Aaberge and Stubhaug, 2018; Aaberge et al., 2021; Hansen and Toft, 2021). According to these studies, inequality and concentration of wealth rose over this period.

Paper outline. The paper proceeds as follows. In Section 2, we present the data sources and key definitions that form the basis of our analysis. Large variation in the information content of the available historical tax assessed data has required use of methods for strengthening the

[5]Prominent examples of estate-based studies of long-run wealth development are Roine and Waldenström (2009) and Bengtsson et al. (2018) for Sweden; Alvaredo et al. (2018) for the United Kingdom; Bengtsson et al. (2019) for Finland; Piketty et al. (2006) for France, Gabbuti and Morelli (2023) and Acciari et al. (2024) for Italy, Davies and Di Matteo (2021) for Canada and Alvaredo et al. (2025) for Belgium, Japan and South Africa.

[6]Some studies rely on a combination of different approaches, e.g. Wolff and Marley (1989) who combine estate, survey and wealth stock data to study changes in wealth concentration in the United States between 1922 and 1983. A few studies also use “rich lists” provided by newspapers, magazines or organizations (e.g. the 100 richest in a given year) to refine and supplement estimates, but such lists are rarely used as the only source of a wealth inequality estimate.

comparability across time of the estimated long-run series of wealth concentration and wealth inequality. The methods in question are discussed in Section 3, while Section 4 presents our preferred estimated series of the long-run evolution of wealth inequality in Norway. The series of wealth inequality are also supplemented with a description of top wealth shares and a comparison of the long-run evolution of income and wealth inequality. Section 5 presents two alternative series of wealth inequality for the period 1969 (1995) - 2016, where the tax assessed value of housing is replaced by a market assessed measure of housing. Section 6 concerns the application of National Accounts data and methods for combining National Accounts aggregates with distributional information from tax data. Section 7 concludes.

2 Data

This paper aims at estimating the entire wealth distribution on the basis of tax data after 1911, when the individual tax return was introduced in Norway. The tax unit, a married couple or a single individual, defines the unit of analysis and assessed household wealth ("antatt formue") the measure of wealth for the entire period of study. This section presents the main data sources, from 1912 until the twenty-first century.

2.1 Taxable wealth

Our primary source for the Norwegian wealth distribution is data on wealth collected for the purpose of wealth taxation. Historically, before the twentieth century, property was the main basis for individual-level taxation in Norway. Throughout the last century, income has replaced wealth as the main source of (direct) tax, but wealth taxes have been in place throughout the period we study.

Before 1911, individual wealth was assessed by the tax authorities. After the introduction of individual tax declarations in 1911, wealth was reported by the taxpayers themselves but also subject to government control. This system remains in place today. The data sources covering the time period from 1912 onwards differ along three dimensions: reporting format, unit of observation, and coverage of wealth recorded.

Reporting format. For a number of years until 1967, Statistics Norway published tabulations of the distribution of tax payers by wealth range, which in most years turn out to be very detailed at the top of the distribution. There is typically around 10 brackets reported, where each bracket gives a lower and upper wealth boundary as well as the number of tax units within the bracket. For some years, the total wealth held by tax units in each bracket is also reported. Wealth tabulations are available for 1912, 1920-26, 1929, 1938, and 1948-66. Details on the sources are given in the Appendix, Table B.1.

Individual-level data on taxable wealth including individual-level identifiers have been made available on computer files by Statistics Norway since 1967, where the unit of observation has been the individual rather than the household.[7],[8] From 1995 and onwards, the files are more comprehensive. There are details on some non-taxable wealth, as well as on asset types.

Unit of analysis. The statistical unit in the historical wealth tabulations is the tax unit of wealth, which is defined to be either a married couple or a single (unmarried) individual. The choice of using household (couple or single) as unit of analysis in this paper is dictated by the statistical unit used in historical wealth tabulations.[9] As indicated above, the unit of observation in the register data is the individual, even when the tax rules allow for joint taxation of couples. We adjust this data (at the individual and couple level) to maintain the historical definition of tax units (individuals or married couples), as detailed in Section 2.2.

Definition and measurement of wealth. Unlike income, wealth is a stock variable. The definition of household wealth is the value of all the assets owned by the household subtracted the value of all liabilities. Since wealth might change over time it is for tax purposes normal to use the end of the year as reference date for measurement of wealth. According to the tax laws (Zimmer, 2022), the assessment value of an asset should as a principle be equal to the market value or assumed market value of the asset. In practice, the valuation of real assets, especially real estate, has been lower than the (hypothetical) market values. The level of wealth might also be influenced by under-reporting due to tax evasion.[10]

Although the definition of wealth is kept fixed across the entire period, the tax threshold as well as the types of reported wealth vary across time. Until 1995, only taxable wealth was recorded. Hence both total taxable wealth and the proportion of households included in the tax tabulations might vary across time due to changes in the tax threshold. Accordingly, a description of wealth inequality and wealth concentration based exclusively on data from the tax tabulations will clearly suffer from lack of comparability across time. In Section 3, the challenge associated with the comparability problem is discussed in more detail. From 1995 onwards, the tax data also include assessed wealth below the tax threshold. Moreover, for the sources from 1995 onwards we have access to all components of wealth from individual tax returns, which have made it possible to construct more comprehensive wealth measures.

Tax assessed wealth suffers from two shortcomings. First, the wealth of households that is lower than the threshold for taxation is normally not observed, and the proportion of unobserved households varies significantly across time. Second, the tax assessments of housing and some other assets differ significantly from the market values. In the next section we explain how

[7]Note however that wealth is still jointly taxed in Norway when it is favorable for the couple (Zimmer, 2022).

[8]The individual-level data includes some wealth below the threshold for taxation even though only wealth subject to taxation is supposed to be recorded in the files. It is unclear why this wealth is recorded and how representative it is. We have therefore chosen to exclude reported wealth below the tax threshold from our analyses.

[9]Since 1960 married couples could choose to be taxed separately. This means that in principle potentially married couples may emerge as two observations in the wealth tabulations from 1960 to 1967. However, it turns out that relatively few couples benefited from the tax change, which means that most couples were treated as one tax unit.

[10]For more details on the assessment of the values of assets, see Appendix B.1

we account for these limitations when estimating wealth inequality using tax assessed data. Sections 5 and 6 provide alternative estimates of wealth inequality by including data from other sources.

Summary. After harmonizing the unit of analysis, we are left with three different types of data, corresponding to three different time periods: Tabulations of the distribution of wealth tax payers by wealth range (1912-1966), micro data on taxable wealth (1967-1994), and modern micro data on all assessed wealth (1995-2019).

2.2 Population

We need to complement our wealth data with population data for two reasons. First, tax units (individuals and couples) with wealth below the tax threshold are normally not included in the tax tabulations. Second, after 1966, to maintain the same unit of analysis as before 1967 we use population registry data to set an age restriction and merge married couples. Data on aggregate population and household composition (number of married couples) is obtained from the decennial census 1900-1950 (interpolating between censuses) and from official population statistics / the population registry after 1951.

Our starting point for the population of analysis is individuals aged 20 or older. This means that we assume that the wealth reported in official sources before 1967 is only to a minor extent owned by people/families below this age.[11] After 1966, we use individual identifiers to restrict the sample to those 20 years and older. We also use the population registry data to merge married individuals into couple units, where the sum of the wealth of husband and wife defines the wealth of the married couple, to maintain comparability over time.[12]

Accordingly, our "total population" throughout the period is defined by the population of tax units; i.e. all individuals aged 20 and above minus the number of married women. Appendix Figure A.5 shows the development of the population over time, growing from 944,157 in 1910 to 3,233,016 in 2019. In the following we will refer to the tax units that make up our preferred population as households.

[11] In 1967, the earliest year in which this assumption can be checked, only 0.39 per cent of the individuals that hold wealth were below the age of 20 years and they only held 0.33 per cent of the wealth.

[12] In the early years with register data some observations are missing marital status, gender, and/or age, and some observations are registered as married but the spouse identifier is missing. We have matched men and women in the population that are registered as married, but are missing the spouse identifier, in three ways: according to perfectly positively correlated wealth, according to perfectly negatively correlated wealth, and randomly. Whether we match the men and women according to positively or negatively correlated wealth only makes a difference in the third decimal point of the Gini coefficient in the first three years with register data. We use the sample where men and women are randomly matched in the analyses. After having randomly matched the population with missing spouse identifiers, the difference between the population in the register data and the official statistics is 2 percent in the first year with register data and falling to 0.01 percent within ten years.

3 Estimating measures of concentration and inequality

This section explains how the data described in Section 2 are used to produce consistent estimates of both wealth inequality and wealth concentration as measured by the Gini coefficient and wealth shares of the top 1 per cent over 108 years. To this end, the Lorenz curve plays a crucial role. The Lorenz curve relates the cumulative proportion of households to the cumulative proportion of wealth owned when households are arranged in ascending order of their wealth, and it takes the form of a straight line if and only if all households own the same wealth. Measures of wealth inequality are designed to summarize the information content of the Lorenz curve. The Gini coefficient, which adds up weighted differences between the Lorenz curve and its egalitarian line, is the most commonly used summary measure of inequality and will form the basis of the description of inequality in this paper.[13]

3.1 Comparability issues

The starting point for estimating top wealth shares and measures of wealth inequality is the available tax-based historical tabulations. The most informative tabulations provide information on values of bracket boundaries as well as number of persons and total wealth for each bracket in a given year. As tabulations often only cover the upper part of the wealth distributions, the standard practice for strengthening the comparability of top wealth shares across time has been to use other statistical sources for totals of population and wealth. Moreover, it has been common to use interpolation and extrapolation methods to assess values for shares of total wealth for specific top wealth groups, such as the top 10, 1 and 0.1 per cent.[14]

In line with most previous studies we will for the long-run series starting in 1912 combine control totals for population with distributional data from the wealth tax. However, we use an alternative approach for assessing total wealth which will be explained in Sections 3.2 and 3.3. Since this study is concerned with the entire distribution of wealth and not only top wealth shares, it is required to account for varying and in some periods rather limited information on the central and lower part of the distribution. For this reason, access to reliable control totals for population and total wealth is a necessary but not a sufficient condition for obtaining consistent estimates of overall inequality. To obtain reliable estimates of the Gini coefficient it is also required to provide estimates for the lower and central part of the wealth distributions

[13] The Gini coefficient can be interpreted as the ratio between the average pairwise wealth differences in the population and twice the mean wealth, which means that the Gini coefficient becomes equal to 0 if and only if all population units have equal wealth. The other extreme is attained if and only if one unit receives the total wealth. In this case the Gini coefficient takes the value 1. When the Gini coefficient is equal to 0.5 then the average wealth difference is equal to the mean wealth. Note that the Gini coefficient is more sensitive to changes that take place in the central part than at the tails of typical unimodal distributions of wealth.

[14] We refer to Cowell and Mehta (1982), Jenkins (2016), Atkinson (2017), Blanchet et al. (2021), Jorda et al. (2021) and Charpentier and Flachaire (2022) for discussions of interpolation and extrapolation methods when tabulations provide information on the boundary values as well as the number of units and the total wealth for each bracket.

and the corresponding Lorenz curves. The periodically limited data coverage might explain why the literature on the long-run evolution of the wealth distribution has mainly been limited to describing the evolution of top wealth shares.[15]

To provide a preliminary description of the evolution of wealth inequality, Figure 2 displays non-parametric estimates of the Gini coefficient for the population with tax reported positive wealth and for the total population defined in Section 2.2. The applied non-parametric estimators of the numerator and denominator of the Gini coefficient (the absolute Gini coefficient and the mean) for tabular data are defined by the average of the right- and left-continuous empirical distribution functions, as the standard right-continuous empirical distribution function might produce biased estimates when tabulations have broad brackets.[16]

Figure 2 demonstrates that the level of the estimated Gini coefficient solely based on tax reported data varies significantly over time and is negatively correlated with the observed proportion of households, as displayed in panel (b). The series which accounts for the control total of population is also heavily affected by the proportion of the population with tax reported wealth. To strengthen the comparability of the Gini coefficient estimates and produce a more reliable description of the evolution of wealth inequality than the series displayed in Figure 2, we will make two adjustments:

(i) The bracket-specific step-wise jumps underlying the non-parametric method will be replaced by bracket-specific continuous parametric distributions. This choice is motivated by the fact that the distribution of wealth within brackets is normally not symmetric but skewed to the right, which will be reflected by the chosen parametric specifications discussed in Section 3.2.

(ii) Rather than applying yearly wealth tax thresholds as the lowest wealth limit, we will introduce a common lower threshold across time and utilize information about lower segments of the wealth distribution from neighboring years for years with missing data owing to high tax thresholds. The introduction of a common lower threshold can also be considered as an alternative approach for determining a control total for wealth. We refer to Section 3.3 for a further discussion of assessment and implementation of the common threshold and of the derived control total for wealth.

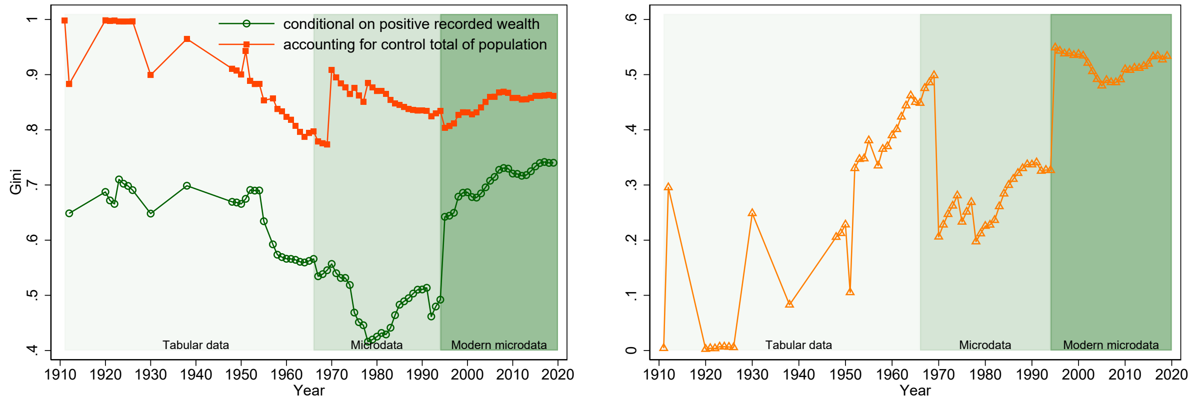
3.2 A semi-parametric approach for estimating the Lorenz curve and the Gini coefficient

Distributions within brackets. The available tabular wealth data provide non-parametric estimates for equally many points on the cumulative distribution function of wealth as the available

[15]Several studies has used total income from the System of National Accounts (SNA) as a basis for assessing a control total for income in studies of income distributions. We have however chosen to omit using total wealth assessed in SNA as part of our data basis for estimating the long-run series of wealth concentration and overall inequality both due to the large discrepancy between the total wealth in SNA and total tax assessed wealth and the fact that SNA does not provide sufficient reliable distributional information for allocating the SNA excess wealth. However, we refer to Section 6 for an exercise based on SNA assessed wealth.

[16]We refer to Appendix C1 for a formal definition of the non-parametric estimators.

Figure 2: Non-parametric estimates of the Gini coefficient based on non-adjusted tax reported data with/without accounting for control total of population



(a) Gini coefficient(non-parametric)

(b) The proportion of the population with tax reported positive wealth

Notes: The left panel displays the non-parametric estimates of the Gini coefficient for the population with tax reported positive wealth with and without accounting for control total of the population as described in Section 2.2. When the control total of the population is taken into account, the households that are not recorded with positive wealth are included with zero wealth. Negative wealth is set equal to zero in years with modern microdata (after 1994). In both series individually taxed spouses are treated as one unit.
The right panel displays the proportion of the population with tax reported positive wealth.

number of brackets of the wealth tabulation. This means that the non-parametric method in this case implicitly assumes that wealth is equally distributed within each bracket, which corresponds to represent the Lorenz curve by bracket-specific straight lines. However, this approach ignores the strict convex shape of the Lorenz curve and leads to downward biased estimates of the Gini coefficient. Since the width of brackets varies and in some cases are rather broad the pure non-parametric estimates might become significantly downward biased. To obtain more reliable estimates of the Gini coefficient it will be helpful to exploit a basic feature of the Lorenz curve. The Lorenz curve, which defines the relative distribution of wealth, is an increasing convex function taking values between 0 and 1. As wealth distributions normally are skewed to the right (heavy right tail), the associated Lorenz curves will exhibit a strict convex curvature in their upper part and an approximately linear curvature in their lower part. Thus, it is reassuring that most historical wealth tabulations provide detailed information for the upper part of the Lorenz curve, whilst estimation of the lower part only requires knowledge of a few points on the Lorenz curve.

To account for the strictly convex shape of the Lorenz curve, it appears attractive to represent each wealth bracket by an appropriate parametric cumulative distribution function. This could be achieved by representing the entire wealth distribution by a specific parametric distribution characterized by three or four parameters such as the Generalized Pareto, the Singh-Maddala or the Generalized Beta distributions. An alternative and more flexible approach is to use separate distributions for the brackets and to piece them together to an entire wealth distribution. As will be explained below this paper relies on bracket-specific distributions characterized by two parameters, which means that the description of the tabulations relies on a parametric distribution with twice as many parameters as the number of tabulation brackets.

Bounded Pareto distributions within groups. The open top bracket is normally well described by the Pareto distribution (see Atkinson et al. (2011)) and has been much used in studies of income and wealth distributions. The Pareto distribution is defined by

$$F^*(y) = 1-(a/y)^{\alpha}, \quad y \geq a \tag{1}$$

where a is a lower bound and α determines the shape of the cumulative wealth distribution F^*. The basic property of the Pareto distribution becomes clear by considering a log-log plot of the survival function $1-F^*(y)$, as is demonstrated by Figure 3 below.

Since the Pareto distribution is only considered to be appropriate for describing the very top of a wealth distribution (the top bracket of the tabulations), we will apply bounded versions of the Pareto distribution as a basis for describing each of the remaining brackets. This is attractive as it gives a closed form expression for the Lorenz curve, avoids distributional discontinuities at bracket boundaries and, as will be demonstrated below, can be estimated on the basis of data for bracket boundaries and the proportion of households located in the bracket.

To this end, let b_i and b_{i+1} denote the boundaries of bracket i, where $b_i < b_{i+1}$. Thus, the segment of the tabulated wealth distribution F associated with bracket i is given by

$$F(y) = 1-(a_i/y)^{\alpha_i}, \quad b_i \leq y \leq b_{i+1}, \quad a_i \leq b_i, \quad i = 1,2,...,s-1 \tag{2}$$

where s is the number of brackets and the parameters a_i and α_i are defined by

$$\alpha_i = \frac{\log(1-F(b_i)) - \log(1-F(b_{i+1}))}{\log(b_{i+1}) - \log(b_i)} \tag{3}$$

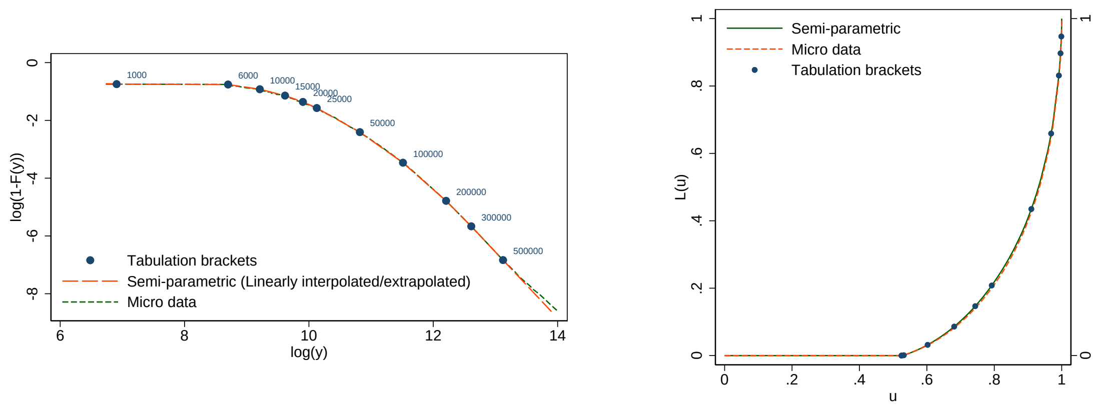
$$a_i = (1-F(b_i))^{\frac{1}{\alpha_i}} b_i \tag{4}$$

It follows from the definitions of a_i and α_i that the bracket-specific segments of the distribution F coincide at the boundaries between wealth brackets, i.e. $1-(a_i/b_{i+1})^{\alpha_i} = 1-(a_{i+1}/b_{i+1})^{\alpha_{i+1}} = F(b_{i+1})$, $i = 1,2,...,s-1$. As demonstrated by equation (3), data for bracket boundaries (b_i) and bracket-specific population proportions ($F(b_{i+1}) - F(b_i)$) provide sufficient information for estimating the shape parameters α_i of the bounded Pareto distributions.

We assume that the shape parameter α_s of the Pareto distribution for the highest open bracket (the richest group) is equal to the shape parameter of the bounded Pareto distribution for the second richest group, i.e $\alpha_s = \alpha_{s-1}$. This estimation method means that the estimated parametric distribution F coincides with the non-parametric point estimates of the wealth distribution for the boundary values of the observed wealth groups $(b_i, F(b_i))$, $i = 1,2,...,s$, which explains why we have called this method semi-parametric.

Figure 3 illustrates the performance of the method defined by equations (1) - (4). Based on data from 1967, the figure illustrates a comparison of the semi-parametric estimation method based on tabular data and the non-parametric estimation method based on micro-data. Panel (a) plots the tabulation bracket boundaries, the empirical logarithmic survival function based on micro-data and the logarithmic survival function based on the semi-parametric method. When using the semi-parametric method it follows from equation (3) that the shape parameter α_i is equal to the slope of the log of the survival function between $log(b_i)$ and $log(b_{i+1})$. The survival function is extrapolated for the richest group using the shape parameter from the second richest group, α_{s-1}. As is evident from the figure, the estimated shape parameters α_i almost coincide with the non-parametric slopes in every interval, and only leads to a slight downward biased estimate of the slope for the group at the very top. The estimate of the associated Gini coefficient based on the semi-parametric method shows to be 0.6 percentage points lower than the non-parametric Gini estimate based on micro data (0.778 vs. 0.784), while the wealth share of the richest 1 per cent based on the semi-parametric method shows to be 0.9 percentage point lower than the non-parametric estimate based on micro data (0.189 vs 0.198).

Figure 3: Illustration of the semi-parametric method



(a) The log of the survival function

(b) The Lorenz curve

Notes: The figure displays the log of the survival function and the Lorenz curve for 1967 based on micro data and the semi-parametric method using tabular data. The tabulation for the 1967 data is based on the 12 tabulation brackets from 1966.

The semi-parametric wealth distribution and the associated Gini coefficient.

As is clear from the above discussion, by relying on the following parametric distribution

$$F(y) = \begin{cases} 1-p & \text{if } 0 \le y \le b_1 \\ 1-(a_i/y)^{\alpha_i} & \text{if } b_i \le y \le b_{i+1}, \quad a_i < b_i, \quad i = 1,2....,s-1 \\ 1-(a_s/y)^{\alpha_s} & \text{if } b_s \le y \end{cases} \tag{5}$$

where p denotes the proportion of households with larger wealth than the tax threshold (or the common threshold), we obtain a continuous distribution of wealth F where α_i is determined by equation (3) and a_i by equation (4), $i = 1, 2, ..., s-1$.

Next, let $\tilde{F}$ denote the conditional distribution of wealth given that the wealth is larger than the tax threshold b_1 and let $\tilde{\mu}$ and $\tilde{G}$ denote the mean and the Gini coefficient of $\tilde{F}$. Since $F(y) = 1-p$ for $y \in [0, b_1]$, we get the following relationships: between $\tilde{F}$ and F, $F(y) = p\tilde{F}(y) + (1-p)$; and between $\tilde{\mu}$ and the mean μ, $\mu = p\tilde{\mu}$. Inserting for these relationships and for the parametric specification given by equation (5) for F in $G = [\int F(y)(1-F(y))\,dy]/\mu$ we get

$$\begin{aligned} G =& \frac{1}{\mu}\int_0^{\infty} F(y)(1-F(y))dy = (1-p) + p\tilde{G} \\ =&(1-p) + \frac{p}{\mu}\sum_{i=1}^{s-1}\left[\frac{a_i^{\alpha_i}}{\alpha_i - 1}\left(b_i^{1-\alpha_i} - b_{i+1}^{1-\alpha_i}\right) - \frac{a_i^{2\alpha_i}}{(2\alpha_i - 1)p}\left(b_i^{1-2\alpha_i} - b_{i+1}^{1-2\alpha_i}\right)\right] \\ &+ \frac{p}{\mu}\left(\frac{a_s^{\alpha_s}}{\alpha_s - 1}b_s^{1-\alpha_s} - \frac{a_s^{2\alpha_s}}{(2\alpha_s - 1)p}b_s^{1-2\alpha_s}\right) \end{aligned} \tag{6}$$

where

$$\mu = \sum_{j=1}^{s-1}\frac{\alpha_j}{\alpha_j - 1}a_j^{\alpha_j}\left(b_j^{1-\alpha_j} - b_{j+1}^{1-\alpha_j}\right) + \frac{\alpha_s}{\alpha_s - 1}a_s^{\alpha_s}b_s^{1-\alpha_s}. \tag{7}$$

Thus, the estimation of the Gini coefficient can easily be achieved on the basis of the estimated parameters a_j and α_j and the observed boundary values b_j of the wealth tabulations.

It follows by straightforward derivation that the the Lorenz curve is given by

$$L(u) = \frac{1}{\mu}\int_0^u F^{-1}(t)dt \tag{8}$$

$$= \frac{1}{\mu}\begin{cases} 0, u < 1-p \\ \sum_{j=1}^{i-1}\frac{\alpha_j}{\alpha_j-1}a_j^{\alpha_j}\left(b_j^{1-\alpha_j} - b_{j+1}^{1-\alpha_j}\right) + \frac{\alpha_i}{\alpha_i-1}a_i\left[\left(\frac{a_i}{b_i}\right)^{\alpha_i-1} - (1-u)^{1-\frac{1}{\alpha_i}}\right], 1-\left(\frac{a_i}{b_i}\right)^{\alpha_i} \le u \le 1-\left(\frac{a_i}{b_{i+1}}\right)^{\alpha_i} \\ i = 1, 2, ..., s-1, \\ \sum_{j=1}^{s-1}\frac{\alpha_j}{\alpha_j-1}a_j^{\alpha_j}\left(b_j^{1-\alpha_j} - b_{j+1}^{1-\alpha_j}\right) + \frac{\alpha_s}{\alpha_s-1}a_s\left[\left(\frac{a_s}{b_s}\right)^{\alpha_s-1} - (1-u)^{1-\frac{1}{\alpha_s}}\right], 1-\left(\frac{a_s}{b_s}\right)^{\alpha_s} \le u \le 1. \end{cases}$$

Note that the estimation of the wealth share of the top 1 per cent for tabular data relies on $1 - L(0.99)$, where $L(0.99)$ is assessed by equation (8). It follows from Appendix C.2. that the Lorenz curve for F exhibits an approximately linear shape for smaller u and and a strict convex curvature for larger u.

Panel (b) of Figure 3 plots the Lorenz curves both based on the semi-parametric method and on micro data (non-parametric method) for 1967. It is evident from Figure 3 that the the semi-parametric Lorenz curve based on tabular data reproduces the Lorenz curve based on micro data quite well. Moreover, the associated estimated Gini coefficients differ by less than one percentage point.

The available data on group boundaries and the population proportion of each bracket have formed the basis for estimating the Pareto distribution for the upper bracket and the segment-specific bounded Pareto distributions for the remaining brackets. The annual estimated parameters are displayed in Table A.3 in Appendix A.2.

The tabulations for the periods 1920-1926 and 1938-1966 do also include data for total wealth for each bracket. This information has been omitted in the estimation of the Gini coefficient in order to stick to a coherent approach for the entire period. However, we have used the observed means for these years as a basis for evaluating the prediction performance of the applied semi-parametric method. The results displayed in Table C.1 of Appendix C.3.2 show that the semi-parametric method reproduces the observed means quite well for most brackets over the years in question. These results suggest that the semi-parametric estimation method proposed in this paper can be used as a recipe for estimating the Gini coefficient both when historical tabulations contain or do not contain bracket-specific data on total wealth and can thus be used for any country where the minimum information for wealth tabulations is available.[17]

3.3 Accounting for variation in the tax threshold over time

Data on taxable wealth is subject to varying degree of left censoring, since data for non-taxpayers normally is omitted from the available sources and the tax threshold moreover changes significantly over time. As can be observed from Figure 2, the changes in the tax threshold across time have resulted in large variation in the proportion of households that are observed in the tax data, which creates comparability problems. To strengthen the comparability of long-run wealth distributions we introduce a fixed common lower threshold, which will be adjusted for changes in consumer prices.

The application of the common lower threshold, which we denote b_1, works as follows: For any year, say t, where the lowest observed positive wealth (b_{1t}) is lower than the common threshold b_1, we set wealth for individuals holding less than b_1 equal to zero. For years, say s, where the lowest observed wealth is higher than the common threshold $(b_{1s} > b_1)$, we impute

[17]The bracket with highest wealth accounts for significant larger proportions of the population in 1912 and 1929 than for later years, which means that the assumption $\alpha_s = \alpha_{s-1}$ might be questionable and produce total wealth that differ significantly from the observed total for these two years. Indeed, for these two years the total wealth estimated on the basis of (5) shows to be significantly larger than the the observed totals. Thus, for 1912 and 1929 we use an alternative method by assessing the mean of the top bracket (μ_s) on the basis of the difference between the observed total wealth and the total estimated wealth for the s-1 lowest brackets using equation C6 in Appendix C.3.2. Next, we determine α_s from the mean of the Pareto distribution $\mu_s = \alpha_s/(\alpha_s - 1) \cdot b_s$. This method reduces the Gini coefficient when measured in per cent by 2-3 percentage points, but has a larger effect (up to 17 percentage points) on the estimates of top wealth shares. By contrast, application of this approach for the 1938-1950 tabulations (where the top brackets account for smaller proportions of the population) gives virtually identical results to those obtained by the semi-parametric method.

the missing segment $(b_{1s} - b_1)$ from the closest neighboring years.

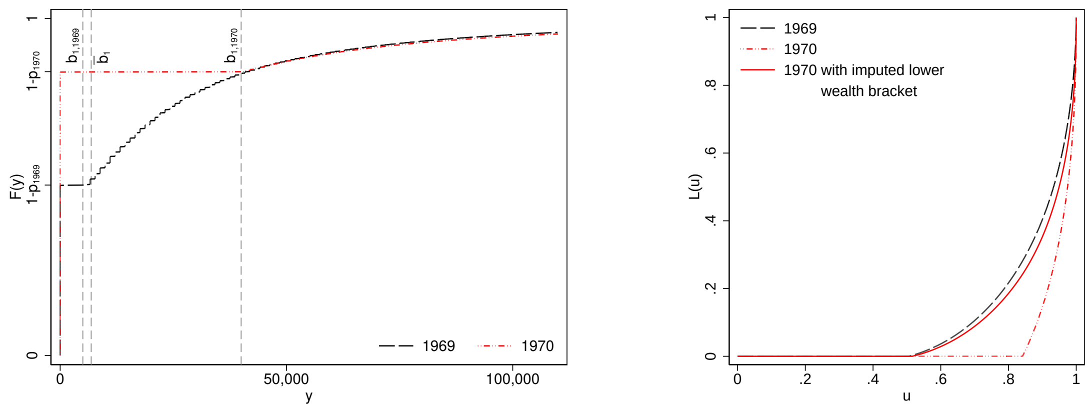
The choice of common threshold involves a trade-off between the extent of omission of data in some years and the extent of imputation of missing data in other years. As estimates of the Gini coefficient might be sensitive to the choice of common threshold it is required to use a threshold that only omits a small share of total tax assessed wealth. We choose the 1967 tax threshold, 5 000 NOK in 1967-prices and just above 50 000 NOK (4 200 Euros) in 2019-prices, as our common threshold.[18] This threshold represents a reasonable trade-off as our empirical evaluation shows that it only excludes an insignificant share of total wealth, which shows to only have a minor effect on the annual estimates of the Gini coefficient in years where wealth below the threshold is set equal to zero (see Figure A.2 and A.3). The development of the common threshold in nominal prices as well as the actual tax threshold is displayed in Figure A.1.[19]

Figure 4 illustrates the implementation of the common lower threshold in 1970 based on lower segment information from 1969. 1970 is chosen for the illustration as it is the year where inclusion of data from neighboring years leads to the largest change in the estimated Gini coefficient. The common threshold is higher than the tax threshold in 1969 $(b_{1,1969} < b_1)$ and lower than the tax threshold in 1970 $(b_{1,1970} > b_1)$. Panel (a) of Figure 4 shows the empirical cumulative wealth distribution for the two years. The population proportions with wealth above the tax threshold in 1969 and 1970, p_{1969} and p_{1970} , are 0.49 and 0.16, respectively. When the common lower threshold is implemented, the wealth between $b_{1,1969}$ and b_1 will be set equal to zero. As suggested by Panel (a), the omitted wealth is insignificant and has only a minor effect on the estimated Gini coefficient. The missing wealth segment between b_1 and $b_{1,1970}$ in 1970 in Panel (a) is imputed from the 1969 data. Panel (b) plots the Lorenz curves for 1970 both with and without the imputed wealth and shows that the inclusion of the missing segment has a significant effect on the estimated Lorenz curve. We refer to Appendix C.5 for a further discussion of the imputation method.

[18]Note that 5 000 NOK constituted approximately 1/3 of the price of a VW Beetle in the late 1960s in Norway.

[19]The tax thresholds in our data are lower than the chosen common threshold for 44 years and higher than the common threshold for 37 years. The largest deviations from the common threshold are found for the period 1970 - 1995.

Figure 4: The cumulative wealth distribution and the Lorenz curve for the years 1969 and 1970



(a) The empirical cumulative wealth distribution (b) The Lorenze curve

Notes: Panel (a) displays the empirical cumulative wealth distribution for the years 1969 and 1970, where $b_{1,1969}$ and $b_{1,1970}$ are the thresholds for taxation. For illustrative purposes the horizontal axis is capped from above at 110 000 1970-NOK. Panel (b) displays the Lorenz curves for the years 1969 and 1970, and the Lorenz curve for 1970 based on imputed wealth between the common lower threshold defined in Section 3.3. In 1969, wealth in the segment between the threshold for taxation and the common lower threshold is set equal to zero. However, since this segment is very small and does not appear in the graph of the Lorenz-curve, 1969 will only be represented by one Lorenz curve. The years 1969 and 1970 are chosen to illustrate application of the common lower threshold method as 1970 is the year where inclusion of data from a neighboring year leads to the largest change in the estimated Gini coefficient (see Figure 5).

3.4 Consistent estimates of long-run wealth inequality

Above we have discussed three alternative estimates of the long-run Gini coefficients of wealth. The first series, denoted the "non-parametric" estimator and described in Section 3.1, relies exclusively on the yearly tax reported wealth data and the population control total. The second series relies on the semi-parametric estimator discussed in Section 3.2, while the third series is an adjusted version of the semi-parametric series, where the lower segment for each year is determined by a common lower threshold as described in Section 3.3. We denote the latter series the "preferred long-run series".

The three Gini coefficient series are presented in Figure 5. It is evident from the figure that for most years the difference between the estimated Gini coefficients based on the non-parametric and the non-adjusted semi-parametric estimation methods is rather small. This can be attributed to the relatively high level of detail for the upper tabulation brackets. The largest difference between these two alternative Gini series emerges in 1930, and is owing to less detailed tabulation with few and broad wealth brackets.[20]

Next, we turn to the effect of including a common lower threshold, which is applied in combination with the semi-parametric estimation method. In Figure 5, the hollow diamonds

[20]The difference between the non-parametric and semi-parametric estimates is also significant for the years 1952-1955 because the lowest brackets of the tabulations are very broad and cover wealth holders up to the 90th percentile. As the lower part of the tabulated wealth distribution changes very slowly over time we impute the lower tail for 1952-55 from 1957 (see Appendix C.4). Note that the lower-tail adjustment has also been implemented for the non-parametric series presented in Figure 5 for the period 1952-1955, but not for other years.

represent years where the tax threshold is lower than the common threshold, while the solid diamonds represent years where missing segments above the common threshold are imputed from neighboring years. The tax thresholds of the following years are lower than the common threshold: 1912, 1930, the period 1952-1966, and for 1967, 1968, 1969 and 1995 onwards when we have access to modern administrative data. By contrast, the tax thresholds for the 1920s, the years between 1938 and 1951, and between 1970 and 1994 are higher than the common threshold, which require imputation of data from neighboring years.

Figure 5 shows that accounting for missing data in the lower part of the distribution has a substantial effect on the estimated Gini coefficient during the 1920s, 1930, 1938, and the period from 1970 to 1995, because the common lower threshold is much smaller than the tax threshold for these years. The largest difference between the Gini estimates occurred in 1970, where the non-adjusted estimate was 13 percentage points higher than the threshold-adjusted estimate. For the years with higher tax threshold than the common threshold there turns out to be large variation in the degree of information imputed from neighboring years. For the 1920s, less than one per cent of the population is covered by the tax tabulations and up to 70 per cent of the total wealth is imputed from neighboring years. By contrast, in the 1970s, minimum 20 per cent of the population is covered by the tax tabulations and maximum 34 per cent of the total wealth was imputed from neighboring years. Due to the low coverage in the original data sources, and the fact that the 1920s were affected by economic turbulence that may have had significant effect on the parts of the distribution that we do not observe, the estimates for these years should be interpreted with caution. However, according to a contemporary statistical report (Statistics Norway, 1931), the wealth tax tabulations accounted for between 22 and 29 per cent of total wealth during the 1920s, which matches well with the imputation results.

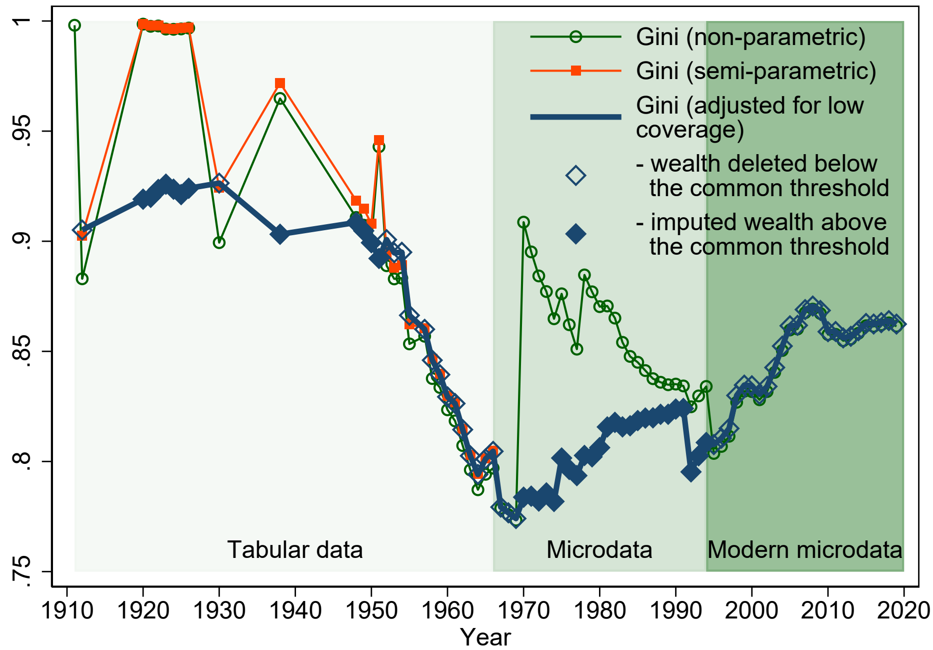
The effect on the Gini coefficient estimates of setting wealth below the common threshold equal to zero is insignificant for most other years, even though the population share who have had their wealth set equal to zero in some years is substantial. In 1995, for example, the wealth is set equal to zero for 10 per cent of the population recorded with positive taxable wealth. However, the effect on the Gini coefficient is modest as the poorest 10 per cent of the population only held 0.5 per cent of the total wealth in 1995. In the early fifties (1952-1955), the effect is larger as the share of wealth below the common threshold is larger (up to 3 per cent of total wealth, see Table A.4).

As can be observed from Figure 5, there are a few irregularities in the preferred long-run series, which most likely are due to changes in the tax rules. For a further discussion of the specific irregularities we refer to Appendix C.6.

4 Trends and fluctuations in long-run wealth inequality

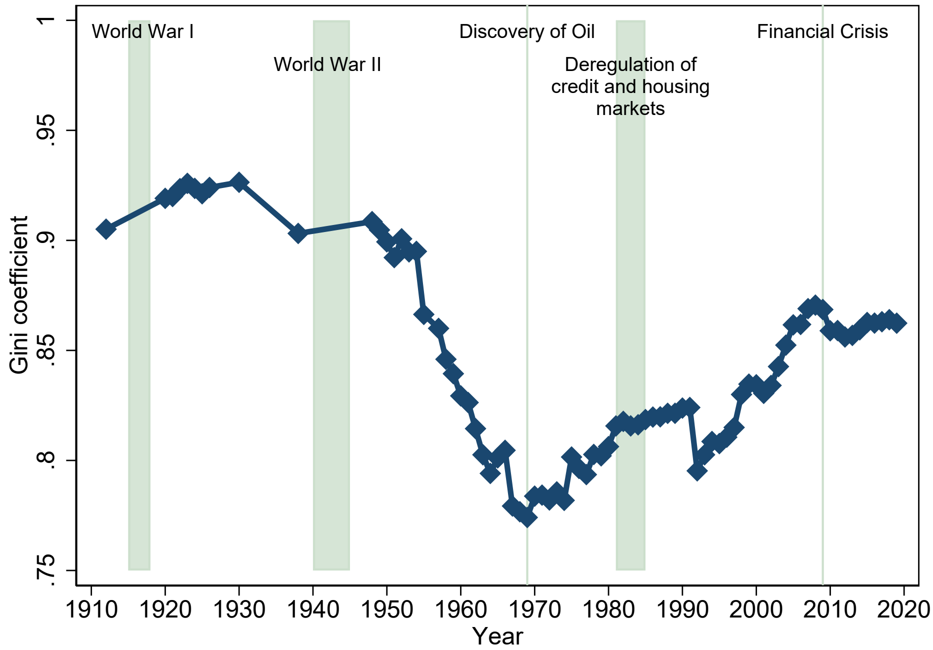
In this section, we present empirical results for the evolution of long-run wealth inequality in Norway, building on the data and methods described in Sections 2 and 3. Our preferred series

Figure 5: Alternative estimates of the Gini coefficient before and after adjusting for low coverage



Note: The non-parametric and semi-parametric estimators are defined in Section 3.2. The series that is adjusted for low coverage uses the semi-parametric method in the time period with tabular data. The hollow diamonds represent years where the tax threshold is lower than the common threshold and household wealth between the tax threshold and the common lower threshold is set to zero. The solid diamonds represent years where missing segments above the common threshold are imputed from neighboring years.

Figure 6: Gini coefficient for the distribution of tax assessed wealth in Norway, 1912-2019



Notes: The figure shows the Gini coefficient based on tax assessed wealth by application of the semi-parametric method presented in Section 3.2 and a common lower threshold presented in Section 3.3. The causes of the breaks in the Gini series in 1974 and 1992, where the Gini coefficient inclined by 2 percentage points and declined by 3 percentage points, respectively, are discussed in Section C.6.

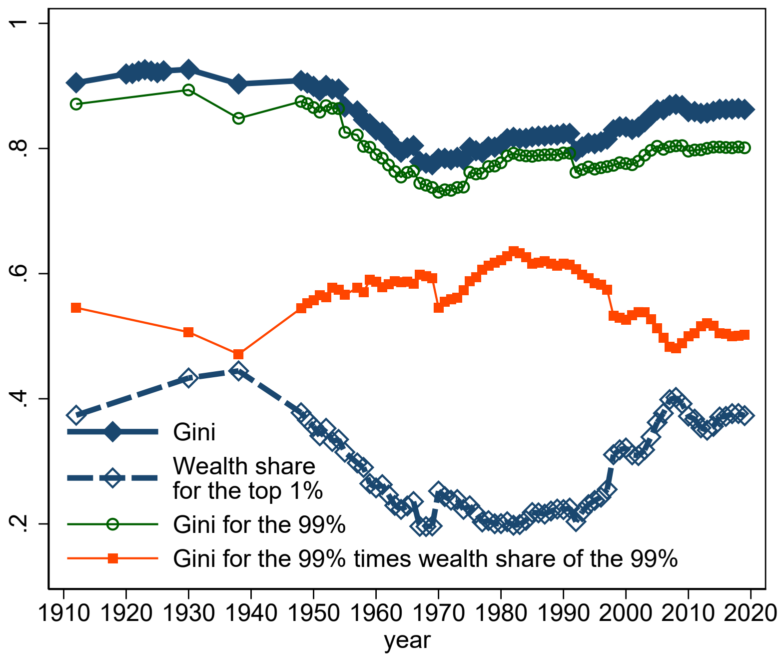
of the wealth Gini coefficient is shown in Figure 6.

As can be observed from the figure, the broad picture of the evolution of inequality in tax assessed wealth in Norway from 1912 onwards shows to be almost flat for the first half of the twentieth century, while the next six decades display a U-shaped pattern. Based on the trends shown in the figure it makes sense to split the description of wealth inequality over the period 1912 - 2019 into four phases where the accompanying "phase transitions" occur in 1953, 1969 and 1985.

The first phase from 1912 to 1953 is characterized by stable and extremely high levels of wealth inequality, with Gini coefficients ranging from 0.926 (1930) to 0.892 (1951). A Gini coefficient equal to 0.9 means that the average pairwise wealth difference in the population was 1.8 times the mean wealth; very close to the maximum theoretical value of 2, corresponding to a Gini coefficient equal to 1. In the second phase, from 1953 to 1969, the wealth Gini coefficient fell by 13.3 per cent from 0.895 to 0.776, corresponding to a decrease in the average wealth difference in the population from 1.79 to 1.55 times the mean wealth. The sharp decline in wealth inequality comes to an end by the early 1970s. In the third phase, during the 1970s and early 1980s, the wealth inequality slightly increased. In the final period, the wealth Gini coefficient increased more sharply; from 0.819 in 1985 to 0.871 in 2008, and kept stable around 0.86 for the next decade.[21]

[21]There is a trend break between 1991 to 1992, which is discussed in Appendix C.6.

Figure 7: Decomposition of the Gini coefficient for the distribution of wealth by the wealth share of the top 1 per cent and the Gini coefficient of the other 99 per cent



4.1 The relationship between top wealth shares and overall wealth inequality

The strong focus in the literature on the evolution of top wealth shares makes it relevant and interesting to examine the relationship between the concentration at the top of the wealth distribution and overall wealth inequality, and to investigate the role of changes in wealth shares at the top in shaping overall inequality. To this end, we will employ the following approximated decomposition (Atkinson, 2007, Alvaredo, 2011);

$$G \simeq P + (1-P)G_{99} - 0.01, \tag{9}$$

where P is the wealth share of the top 1 per cent and G_{99} is the Gini coefficient of the other 99 per cent. As demonstrated by the small differences between columns two and five in Table 1, approximation (9) shows to be rather precise.

The evolution of the share of the top 1 percent, the Gini coefficient for the entire distribution and the bottom 99 per cent is displayed in Figure 7, while Table 1 reports the decomposition results at the beginning and end years of each phase in columns (2)-(5). As can be observed from the figure, neither the share of the top 1 percent nor the Gini coefficient of the other 99 per cent fully captures the evolution of the overall Gini coefficient, even though these three quantities move closely together in some periods.

First, the changes in the share of the top 1 per cent are more significant than changes in the overall Gini coefficient. Over the entire period we find that top wealth shares vary between 19.7

Table 1: Decomposition of the changes in overall wealth inequality

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Changes over time from year s to year t			
Year	Overall Gini G	G_{99}	Top 1 pct share P	Approx. Gini $\hat{G}$	$\hat{G}_t - \hat{G}_s$	$(P_t - P_s) x$ $(1 - G_{99,s})$	$(1 - P_s) x$ $(G_{99,t} - G_{99,s})$	- $(P_t - P_s) x$ $(G_{99,t} - G_{99,s})$
1912	0.905	0.871	0.374	0.909				
					-0.010	-0.005	-0.004	-0.000
						(54%)	(43%)	(3%)
1953	0.895	0.864	0.332	0.899				
					-0.120	-0.018	-0.084	-0.017
						(15%)	(70%)	(14%)
1969	0.774	0.738	0.197	0.779				
					0.044	0.006	0.040	-0.001
						(13%)	(90%)	(-2%)
1985	0.819	0.788	0.218	0.824				
					0.041	0.033	0.011	-0.002
						(79%)	(26%)	(-5%)
2019	0.862	0.801	0.373	0.865				

Note: Column 2-4 report the Gini coefficient for the entire wealth distribution, the Gini coefficient for the other 99 per cent, and the wealth share of the top 1 per cent for the end years of the four phases introduced in Section 4. Column 4 presents the Gini estimates derived from the approximation in equation 9. Column 6 provides the changes in the Gini coefficient during the four phases and the latter three columnsreport the three terms of the decomposition 10. Each term's contribution to the change in the overall Gini coefficient, measured in per cent, is displayed in parentheses below the term. Since there are only small deviations between the Gini estimates derived from the approximation in equation 9 (column five) and the true estimates (column two), the approximations for the end years are used as a basis for evaluating the effects of the top 1 per cent wealth share and the Gini of the other 99 per cent on changes in the overall Gini coefficient during the phases in column six to nine.

per cent (1968) and 44.4 per cent (1938). During the highest-inequality period, the wealth share of the richest 1 per cent was more than twice as high as during the lowest-inequality period. By contrast, the Gini coefficient for the bottom 99 per cent attained its highest level (0.894) in 1930, and lowest level (0.732) in 1970, which corresponds to a decline of 18.1 per cent. Over the same period the overall Gini coefficient declined by 15.1 per cent.

The lowest levels of overall inequality were attained between 1967 and 1974, where the Gini coefficient was measured in the range of (0.776, 0.787) and the top 1 per cent share dropped to around 20 per cent. The reversal from the levels of the late 1960s and early 1970s brought the Gini coefficient from 0.776 in 1969 to 0.862 in 2019 and the top 1 share back to the levels of the first half of the 20th century. This pattern is more in line with the evolution of top wealth shares in the US than with the evolution in most other European countries, where the post-war top wealth shares have been relatively stable.

Second, there are some notable differences in the pattern over time. While the trend for the overall Gini coefficient was almost flat before 1954, the share of the top 1 per cent increased from 1912 to 1938, and started to decrease after 1939. This is relevant both for understanding the development during the period before the Second World War, and for the start of the decrease in overall wealth inequality.

We now turn to a more in-depth examination of what parts of the wealth distribution that have driven the changes in overall wealth inequality. Later, in Section 4.3, we relate the changes to societal development in Norway over this period.

4.2 Decomposing changes in overall wealth inequality

To assess the contribution from the share of the top 1 per cent (P) and the Gini coefficient of the other 99 per cent (G_{99}) to changes in overall inequality (G) over a specific period, from year s to year t $(s < t)$, we will rely on the approximation defined by equation (9) and the following decomposition of the difference between the overall Gini coefficient in year t and year s:

$$\begin{aligned} G_t - G_s &\simeq (1-P_t)\,G_{99,t} + P_t - 0.01 - [(1-P_s)\,G_{99,s} + P_s - 0.01] \qquad (10) \\ &= (P_t - P_s)\,(1-G_{99,s}) + (1-P_s)\,(G_{99,t} - G_{99,s}) - (P_t - P_s)\,(G_{99,t} - G_{99,s}) \end{aligned}$$

As can be observed from the latter expression of equation (10), the decomposition of the change in the overall Gini coefficient from year s to year t consists of three terms: The first term accounts for the effect of changes in the wealth share of the top 1 per cent, given that G_{99} is kept fixed and equal to its level in year s. The second term accounts for the effect of changes in G_{99}, given that the wealth share of the top 1 per cent is kept fixed and equal to its level in year s. The third term captures the interaction between changes in the share of the top 1 per cent and changes in the Gini coefficient of the other 99 per cent. A positive interaction effect means that both the share of the top 1 per cent and the Gini coefficient of the other 99 per cent either increased or decreased from s to t, whereas a negative interaction effect means that either the share of the top 1 per cent increased and the Gini-coefficent of the other 99 per cent decreased or vice versa.

Column (6) in Table 1 displays the changes in the overall Gini coefficient for the four phases discussed in Section 4, while columns (7)-(9) display the three terms from equation 10. Below each term, the term's contribution to the change in the overall Gini coefficient is measured in per cent.

Wealth inequality is shown to have been stable during the first phase from 1912 to 1953, while the second phase, from 1953 to 1969, is characterized by significant equalization. The decline in inequality made up only 1.1 per cent of the initial overall inequality level in the first phase and as much as 13.3 per cent in the second phase. Both the top 1 percent and the Gini coefficient for the 99 per cent contributed to the equalization in the second phase, but equalization among the 99 per cent was clearly the dominant factor and accounted for 70 percent of the reduction in overall inequality.

It may appear puzzling that the turning point with rising wealth inequality started in the early 1970s, since major relaxation of the post-war economic planning regime first took place in the mid-1980s. However, as can be observed from Table 1, 90 per cent of the rise in inequality from 1969 to 1985 was driven by rise in the Gini coefficient for the 99 per cent, while the contribution of the wealth share of the top 1 per cent was rather modest. By contrast, the wealth share of the top 1 per cent shows to be the dominant factor and accounted for 79 per cent of the rise in the wealth inequality from 1985 to 2019. The inequality among the 99 per cent also contributed to the rise in overall inequality during this phase, while the interaction between changes in the share of the top 1 per cent and changes in the Gini coefficient of the 99 per cent only had a small equalizing contribution.

Thus, the evolution of overall inequality was strongly influenced by changes in the Gini coefficient among the poorest 99 per cent (G_{99}) during the entire period, while the wealth share of the top 1 per cent played a minor role during the equalization period from 1953 until 1969 and a more significant role during the disequalizing period after 1985. By contrast, the interaction between the changes in the wealth share of the top 1 per cent and G_{99} was modest through all phases.[22]

[22] Note that the decomposition results do also allow for comparison of the actual and counterfactual change in inequality, where we hold either the share of the top 1 per cent or G_{99} fixed at their levels in 1912 (1969) and let the other factor vary across time. This approach demonstrates that the wealth inequality would have decreased by 9 per cent from 1912 to 1969 if the share of the top 1 per cent had remained at its 1912 level, while it would have only decreased by 2.5 per cent if G_{99} had been kept fixed equal to its 1912 level. For the period 1969 - 2019 we find that the counterfactual exercise would have led to an increase in wealth inequality of around 6 per cent, independent of whether we keep the level of the share of the top 1 per cent or G_{99} fixed equal to their 1969 levels. Recall that the overall Gini coefficient rose by 11 per cent from 1969 to 2019.

4.3 The historical context

We now turn to a more qualitative description of the changes in wealth inequality over time and relate the changes to basic features of the development of the Norwegian economy. The same four phases as in the previous sections form the basis of the discussion. The first phase, from 1912 to 1953, concerns the period with extreme wealth inequality with Gini levels above 0.89.

This phase covers a range of different economic environments.[23] During the First World War, from 1914 to 1918, Norway was neutral and faced a combination of an economic boom and high price increases. There were high capital incomes (among other factors linked to the boom in Norwegian international shipping) as well as starvation and social unrest. On the other hand, the end of the war gave way to a post-war crisis, deflationary economic policies and slow growth during the 1920s (Sejersted, 2013; Furre, 2013). The global economic crisis of the 1930s was also felt in Norway, with high unemployment. The Second World War, when Norway was occupied by Germany from 1940-1945, led to an economic boom (Espeli, 2013), despite that the population endured brutal repression by the occupants and an isolation from Norway's traditional trading partners.

Throughout these widely different economic conditions and policies we find a stable and high wealth inequality, as measured by the Gini coefficient. We find more variability if we instead consider wealth concentration as measured by the share of wealth owned by the top 1 per cent, where 1938 clearly marks a high point with a top wealth share of 44 per cent, compared to 37 per cent in 1912. The high inequality during the 1930s does not come as surprise as this was a period of great social strife with strikes at a record high level in Norway, reflecting dismay about the division of income between capital and labor.

It is somewhat more surprising that we do not observe a reduction in overall wealth inequality during the Second World War. Piketty (2014) and Scheidel (2017) put forward the destruction of capital during the World Wars as a major explanation of the reduction of European top wealth concentration during the post-war period. A possible reason why we do not observe a decrease in overall wealth inequality during the war could be that material damages were less severe in Norway than in continental Europe. By contrast, the decomposition of overall inequality in Figure 7 shows that the top 1 per cent wealth share starts to decline from 1938 and declines at an almost constant rate until the late 1960s. Hence, it may be the case that any destruction of capital during the war only impacted the top 1 per cent and that the rise in inequality among the lower 99 per cent offset the decline in the wealth share of the top 1 per cent.

To conclude regarding the first phase, it appears that neither the early development of the Norwegian welfare state nor the two world wars were associated with any substantial decrease in overall wealth inequality, while the top 1 per cent wealth share increased until the late 1930s

[23] Many important policy reforms that aimed at reducing political, social and economic inequality were introduced in the early 20th century. Particularly important was universal suffrage for women, which was implemented for municipal elections in 1910 and for parliamentary elections in 1913.

and then started to decline.

We then move to the period when overall wealth inequality fell sharply, from 1953 to 1969. The decomposition in Table 1 shows that both the inequality among the bottom 99 per cent and the share of wealth owned by the top 1 per cent declined in this period, where most of the decline in overall inequality can be attributed to the decline in inequality among the bottom 99 per cent.

The second phase was characterized by a growth in the central government, both in size and range. It is characterized by central planning where many new state-owned industrial enterprises emerged. The comprehensive modern welfare state can be said to have found its shape in this period, with the social insurance system (Folketrygden), including public pensions for all, was enacted in 1966 (Sejersted, 2013). GDP per capita growth was on average 3.8 per cent per year during this period, with some year-on-year variation (see Appendix Figure A.4).[24]

High inflation and/or high growth relative to interest rates are often used as explanations for decreasing inequality (Piketty, 2014; Albers et al., 2022). While the second phase is when we see the largest decline in wealth inequality in Norway, the period does not stand out in terms of neither inflation nor growth. Between 1954 and 1969, when we observe wealth inequality to fall the most, inflation is only moderate; in no year is inflation above six per cent. This means that an explanation where inflation "erodes" away nominal wealth and redistributes surplus from those with capital income from nominal assets to those with wage income, would not fit well with the Norwegian picture. In the same way, as economic growth is not particularly high during the period of falling wealth inequality, we find little evidence of an "$r < g$ mechanism" (Piketty, 2014), where growth in "new" production (g) outstrips return on "old" wealth (r).

To conclude regarding the second phase, it appears that neither the high inflation nor particularly high growth can explain the strong decline in inequality. It is however beyond the scope of this paper to provide a causal identification of whether the policies implemented in the second phase are driving the strong decline in inequality during the period.

The third phase, from 1970 to the mid-1980s, saw little variation in the wealth Gini. The moderate increase in overall Gini that we observe in the third phase can almost solely be attributed to changes in the distribution among the bottom 99 per cent. Though growth was still high in this period, the global economy was hit by the oil crisis of the early 1970s. The industrial share of production fell, and the Norwegian economy was also hit by the global crisis. From the time series, wealth inequality could have appeared to have reached a new "steady state" under a relatively regulated economic system. However, Sejersted (2013, p. 400) describes an "end of the hegemony of social democracy" following the crises of the 1970s, and as we see in the fourth phase, the 1970s did indeed represent a low point in the evolution of Norwegian wealth inequality.

We observe an increase in wealth inequality and wealth concentration from the 1980s on-

[24]GDP growth in the 1950s was the lowest of all the post-war decades. Average growth in GDP per capita at fixed prices was 3.16 per cent in the 1940s, 3.12 per cent in the 1950s and 3.70 per cent in the 1960s

wards - and have denoted this period our fourth phase. This final phase differs in the sense that changes in the wealth share of the top 1 per cent accounted for most of the changes in overall wealth inequality (see Table 1). Traditionally, the deregulation of the credit and housing markets is seen as important changes in the Norwegian economic system in this period, where tax rates on capital income also fell and dividend was tax free for most years between 1992 and 2006. There was also increased integration between Norwegian and international capital markets. If deregulated capital markets lead to higher productivity, the increase in wealth inequality can then be seen as a consequence - intended or not - of growth-inducing changes in the economy.

It is also of interest to compare the evolution of wealth inequality in Norway to that of income inequality. In Appendix D we compare changes over time in the wealth Gini coefficient to changes in the income Gini coefficient, and shows that before 1980, they did not move in parallel. In particular, the mid-century decrease in wealth inequality takes place a decade later than the decrease in income inequality. In the last three decades changes in inequality have been more similar across wealth and income.

To summarize the discussion of the development of wealth inequality throughout the twentieth century, we find little evidence of the traditional economic explanations of changes in wealth inequality. Two major wars and turbulent economic environments during the first half of the century had little influence on how wealth was distributed overall, and the decline in inequality does not coincide with wars nor particularly high inflation or growth. On the other hand, the empirical evidence suggests that policy changes - both in shape of increased role of the state in economic planning during the the post-war years and as economic liberalization during the 1980s – had major influences on the evolution of wealth inequality in Norway.

5 Accounting for market values of housing

The Gini coefficient estimates based on historical taxable wealth data that was described in Section 3.4 constitutes our preferred long-run overall wealth inequality series. However, as housing is the key asset for most households and known to be systematically underestimated in tax records, this section will introduce an alternative series of wealth inequality for the most recent five decades, where tax assessed housing wealth will be replaced by assessed market values. First, we will give a description of available housing price data from 1995 onwards and explain how these data can be used to account for market values of housing in measurement of wealth inequality from 1969 to 2016.

Statistics Norway has provided official estimates of market values for housing wealth in Norway from 2010 onwards. These estimates rely on a hedonic price model, where transaction prices and housing characteristics have formed the data basis (Thomassen and Melbye, 2009). Stubhaug (2017) has extended the hedonic price assessment back to 1995 by relying on register data that include transaction prices and housing characteristics for the period 1995-2009. We have access to the micro data from this study (that constructs a series ending in 2016), including individual-level identifiers for owners. This has made it possible to merge these estimates with the data set used in the previous sections of this paper for every year from 1995 to 2016. Furthermore, individual-level information on housing is available for the entire population from the 1970 census, including type of house and number of rooms, which in combination with data for 1995-2004 will be used as a basis for assessing market values of housing over the period 1969-1994.

5.1 Estimation: Accounting for market assessed housing wealth

Assessing non-housing wealth. We convert our preferred wealth measure to a measure of non-housing wealth by subtracting the tax assessed values of housing from the observed tax-assessed wealth. For years with modern micro data, starting in 1995, this is a straightforward exercise since the sources for market assessed value of housing and taxable wealth is recorded at the same point in time and both the assessed value of housing and negative assessed wealth is observable in the sources for taxable wealth.

Prior to 1995, data limitations make it necessary to combine data from several sources to achieve reliable assessment of non-housing wealth. For this reason, we estimate two series including housing wealth: One starting in 1995, which requires less assumptions, and one starting in 1969 where a different approach is required. First, we assess housing values in 1969 from a combination of the 1970 census housing data and an estimate of the relationship between housing characteristics and prices from a later period. To this end, we estimate a hedonic price model using the housing attributes (detached house, row house and multi-dwelling house), number of rooms and labor market region on 1995-2004 data. Next, we use the price model to predict the housing values of the 1970 housing stock as measured by 1995 housing prices, which gives estimates of housing values in 1995 prices for the 1970 housing stock. To obtain values in 1969 prices, we adjust by the growth rate of total housing prices, using the price indexes provided by Eitrheim and Erlandsen (2004).[25]

Secondly, we rely on the assumption that the ratio between tax assessed and market assessed values of housing is the same in 1969 as in 1995, which is the closest year where this ratio is observed. In 1995 the tax assessed value was on average 25 per cent of the market value of housing. Assessed wealth below the threshold for taxation has however not been recorded in the sources of taxable wealth for 1969. Thus, to construct a series that is comparable between 1969 and the period 1995-2016, we have for all years set wealth below the common lower threshold defined in Section 3 equal to zero before subtracting the tax assessed value of housing.[26] The

[25]While taxable wealth is measured at the end of the year, the date of the 1970 census was 1 November 1970. We assume that the housing stock was constant throughout 1970, and use estimates on housing wealth from the 1970 census in combination with the end-of-year wealth estimates for 1969, because the wealth micro data has better coverage in 1969 than in 1970.

[26]The value of tax assessed housing is significantly undervalued, whereas actual values of mortgages are accounted for in the measure of assessed (net) wealth after 1995. Hence, setting wealth below the common lower

aggregate numbers for the different wealth components are listed in Table E.1 of the Appendix.

Using a decomposition method to account for market values of housing in measurement of wealth inequality. Between 1970 and 1994, we have to impute housing wealth based on the data for the two interval endpoints and the development of wealth inequality over the period. To this end, we use the following factor decomposition of the Gini coefficient introduced by Rao (1969);

$$G = \frac{\mu_N}{\mu}\gamma_N + \frac{\mu_H}{\mu}\gamma_H, \tag{11}$$

where μ is the mean of total wealth, μ_N and μ_H are the means of non-housing and housing wealth, and γ_N and γ_H are the interaction coefficients of non-housing and housing wealth. Note that the interaction coefficients γ_N and γ_H can be interpreted as the Gini coefficients of the conditional distribution functions of non-housing and housing wealth given the ranking in total wealth. The product of the interaction coefficient and the wealth share of an asset defines the asset's contribution to the overall Gini coefficient.

Thus, in this case the decomposition depends on four parameters: The shares of housing and non-housing of total wealth, the association (interaction coefficient) between housing wealth and total wealth and the association (interaction coefficient) between non-housing wealth and total wealth. It is straightforward to estimate these four parameters from the available micro data for 1969 and 1995. The estimates are displayed in Table E.1.

The next step is to assess overall wealth inequality when accounting for the market value of housing for the period 1970-1994. For that purpose, we assume that the interaction coefficients (γ_N, γ_H) change proportionally with the changes in the Gini coefficient for assessed wealth estimated in Section 3. Second, we assume that the ratio μ_N/μ_H changes proportionally with the ratio between the total wealth estimated in Section 3 and an estimated housing value index, where the housing price index of Eitrheim and Erlandsen (2004) is multiplied by the growth in the number of households from 1969 to 1995.[27]

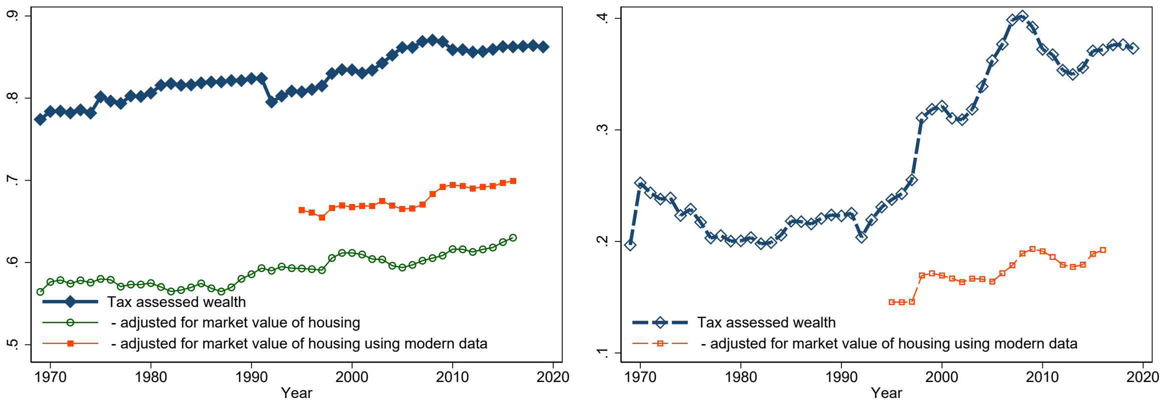
Due to data limitations in 1969, we have set values of assessed wealth below the common lower threshold from Section 3 equal to zero before assessed values of housing is replaced by market values for the entire series 1969-2016. The impact of this assumption can be evaluated on the basis of data for the period 1995-2016, since data for this period also allow us to set negative wealth values equal to zero after having accounted for the market value of housing. For this reason, we estimate two separate series of total wealth and wealth inequality after 1995; one that includes the period 1969-1994 and one that only covers the period 1995-2016.

Our two alternative series of wealth inequality that account for market value of housing are

threshold defined in Section 3 equal to zero increases the wealth of many households with negative assessed wealth.

[27]The number of owner-occupied households is assumed to grow proportionally to our reference population. For further details see Appendix E.2.

Figure 8: Inequality and concentration of taxable wealth with and without correction for market value of housing



(a) Gini coefficients (b) Top 1 per cent wealth shares

Notes: "Adjusted for market value of housing using modern data" means that tax assessed housing wealth is subtracted from tax assessed wealth before market value of housing is added and negative values are set to zero for the period 1995 - 2019, while "adjusted for market value of housing" means that tax assessed wealth below the common lower threshold from Section 3 is set to zero before an approximation of tax assessed value of housing (25% market value) is subtracted and the market value for housing is added.

presented in Figure 8. It is evident from the comparison that setting wealth below the common lower threshold equal to zero before replacing the tax-assessed value of housing with the market value leads to downward bias of wealth inequality for the period 1995-2016, which suggests that the series including the market value of housing back to 1969 might also be downward biased prior to 1995. It is however reassuring that the these two series of wealth inequality are moving in parallel after 1995.

5.2 Results: Long run wealth inequality when accounting for the market values of housing

The 1969-2016 series of wealth inequality where market values of housing are accounted for is displayed in Figure 8 along with the 1912-2019 tax assessed series presented in Section 4. As demonstrated by the left panel of Figure 8, the level of wealth inequality is significantly lower when we replace the tax-based measure of housing wealth with a market based measure of housing. The decline in measured inequality is driven by two factors. Firstly, housing wealth is significantly less unequally distributed than non-housing wealth, and secondly, the change from tax-based to market based measurement of housing wealth increases the housing wealth's share of total wealth. The level of downward adjustment depends on how wealth below the measurement threshold is adjusted. The series starting in 1969 has more data restrictions and is downward biased. Nonetheless, it is evident that the development between 1995 and 2016 is similar, with a steady increase, for both series.

The right panel of Figure 8 shows the top 1 per cent wealth share for the 1995-2016 series of wealth including housing, compared to our baseline estimate. Again, we see lower concentration when housing is included. The increase from 1995 to 2016 is found to be much lower when housing is accounted for.

Since the main objective of this paper has been to describe the evolution of wealth inequality over more than 100 years, we find it reassuring that the pattern of the historic series captures the basic features of the series from respectively 1969 and 1995 onwards, since these series are based on more complete measurement of housing wealth. However, it should be noted that inclusion of market values of housing changes the turning point for overall wealth inequality from the early 1970s to the mid 1980s. The shifted turning point for wealth inequality might be due to a larger rise in the housing prices than what has been captured by the tax assessed housing values during the 1970s and early 1980s. Moreover, when we include market value of housing, we find a stronger increase in the wealth inequality during the late 1980s and early 1990s, which was a period with falling housing prices.

6 Excess wealth from the National Accounts

The absence of tax-assessed household wealth data and undervaluation in assessment of wealth have motivated researchers to use aggregate wealth assessments from the System of National Accounts (SNA) as a basis for estimating wealth inequality. The analysis in the present paper has so far been based on distributional information of tax-assessed wealth. Our sources provide detailed information on how wealth is distributed, but the assessed tax value of some assets may differ significantly from the associated market values, whilst other assets may be exempted from tax and consequently not reported in the tax records. The purpose of this section is to account for total household wealth from the Systems of National Accounts (SNA) in measurement of overall wealth inequality.There is one major limitation in using National Accounts to study wealth inequality: it lacks information on the distribution of household wealth. For this reason application of SNA aggregates requires use of assumptions, many of which cannot be tested.

Relying on the "distributional national accounts" (DINA) approach proposed by Piketty et al. (2018), it has become commonplace to use distributional information from micro data sources as a basis for allocating aggregate SNA totals for income and wealth to households. Due to better data availability, there is already substantial progress with regard to measurement of income inequality, whereas less progress has been achieved for wealth inequality (Waltl and Chakraborty, 2022). An important exception is Garbinti et al. (2020), who consider the distribution of wealth in France for the top 10%, middle 40% and bottom 50% of the population, though with no estimate of a summary measure of overall inequality like the Gini coefficient. For wealth assets that generate taxable income, Garbinti et al. (2020) use the income capitalization method deployed by Saez and Zucman (2016). For assets that do not generate taxable income flows (e.g. life insurance and pension funds, deposits, and owner-occupied housing assets), Garbinti et al. (2020) use imputation methods based on survey data. In this study we will apply alternative methods for allocating excess SNA wealth based on the distributional information provided by tax-assessed wealth. This exercise has two objectives: First, to explore the evolution of the ratio between total tax assessed wealth and total household wealth from SNA, and second, to explore whether accounting for excess wealth from SNA changes the description of the evolution of inequality over time.

In order to perform this adjustment we must first go through the necessary sources of data in the Norwegian National Accounts in order to provide estimates of total wealth between 1912 and 2019.

6.1 Adjusting tax assessed total household wealth by use of data from balance sheets

To adjust for the incomplete measurement of wealth in the tax assessment, the first step will use SNA data for constructing a series of total household wealth. In recent years, historical series of total national household wealth have been published for several countries (Piketty and Zucman (2014) for the United States, United Kingdom, Germany, and France, Waldenström (2016) and Lindmark and Andersson (2016) for Sweden and Abildgren (2016) for Denmark).

Balance sheets as sources. To provide similar series for Norway we rely on the information from the SNA balance sheets made available by Statistics Norway. From 1974 onwards, we construct our measure for total household wealth solely based on data from SNA balance sheets. However, prior to 1995 the financial asset balance sheets do not provide a breakdown between the household sector and the nonprofit sector. Following the approach of Kopczuk and Saez (2004), we assume that the fraction of financial assets in the non-profit sector remained constant and equal to the fraction for 1995 (the earliest year this estimate is available). Furthermore, while the value of dwellings is reported separately for the household sector, the SNA balance sheets do not provide a breakdown of non-dwelling real assets between the household and non-profit sectors. We assume that the household sector's fraction of non-dwelling real assets relative to the non-profit sector is equal to the corresponding ratio for financial assets. See Appendix F.1 for further details.

Before 1974, annual balance sheets detailing the value held by the household sector in various financial assets were regularly published, while values for fixed capital are only available for 1939.[28] To obtain estimates for total household wealth prior to 1974, we combine estimates for financial capital and fixed capital with data for private (household) capital accumulation from SNA and price changes for different wealth assets.

To account for price changes for different types of assets, wealth is divided into the following five asset groups: Two types of domestic financial assets (stocks and other assets), two

[28]Statistics Norway warns on page 126 in (Statistics Norway, 1946) to place too much trust in the wealth estimates for 1939, as "they are by no way exact, and only gives an impression of the magnitude". We use these estimates as they are - as far as we know - the only available estimates for this time period.

types of foreign financial assets (stocks and other assets), and fixed capital. To obtain total wealth in nominal values, we compute the following relationship recursively on the basis of the years where market values for all assets groups are available:

$$V_{i,t} = (1 + c_{i,t}) \cdot V_{i,t-1} + S_{i,t} \tag{12}$$

where $V_{i,t}$ is the wealth held in assets group i in year t, $c_{i,t}$ is the price change of asset class i from year $t-1$ to t, and $S_{i,t}$ is the net accumulation of the asset category i in year t. Let $W_t = \sum_i V_{i,t}$ be total wealth in year t.

Changes over time. It is evident from equation (12) that changes in private wealth are due to changes in quantity (S_i) and/or price changes (c_i). Changes in quantities are determined differently for different asset categories. Financial wealth is recorded by face value. Hence, for the two types of domestic financial assets, the change in quantity in year t ($S_{i,t}$) is equal to the difference between the recorded face value in year t and recorded face value in year $t-1$. For foreign financial assets, we use the same approach, but adjust for changes in exchange rates. For fixed capital, the change in quantity is defined by the difference between capital accumulation from SNA and change in quantity of financial wealth.

For both foreign and domestic stocks, we use domestic stock prices provided by Eitrheim et al. (2004) to account for price changes. We assume that foreign stocks fluctuate proportionally with domestic stocks. For other domestic financial assets, we set the market value equal to the face value. For foreign stocks and other assets, exchange rate fluctuations are assessed on the basis of a weighted average of the four most important trading partners (Great Britain, USA, Sweden and (West) Germany). For fixed capital, we use a price index for gross investment estimated by Statistics Norway.[29]

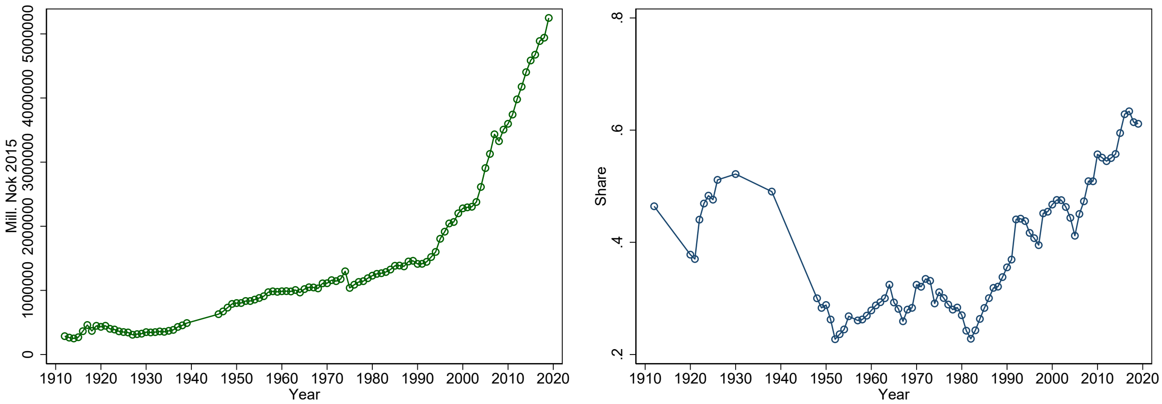
Limitations. There are several concerns associated with the approach discussed above. First, consolidating different sources requires harmonization of sector definitions. Estimates are only reported for the aggregate private sector, not separately for the household sector. To alleviate this problem, we assume that the non-household units own the same fraction in other assets as in stocks and deflate all private wealth by one minus the share of stocks in the private sector held by foreign and public investors.

Second, limitations in the sources restrain us from including all asset types, since the Norwegian SNA wealth estimates only include the value of fixed capital that is produced. This limitation implies that our assessments underestimate, for example, the growth in property values.

Third, solving equation (12) recursively requires yearly estimates for capital accumulation and price changes. Yearly estimates for private capital accumulation are not available during the Second World War (1940-1945). To alleviate this problem, we use estimates for the reduction in fixed capital during the war made by Statistics Norway (1946).

[29] See Appendix F.3 for details on sources and estimation.

Figure 9: Evolution of household SNA wealth and the ratio between three alternative wealth totals based on tax records and the SNA wealth total



(a) Total houshold SNA wealth

(b) Ratio between total wealth based on tax records and the SNA wealth total

Notes: Panel a) displays the evolution of total household SNA wealth measured in million of 2015 NOK. Panel b) figure shows total wealth for our preferred measure of tax assessed wealth from Section 3 as shares of the total private (household) SNA wealth.

Fourth, private capital accumulation and the price changes for fixed capital are not observed directly, but estimated by Statistics Norway. Small measurement errors in these estimates might lead to larger inaccuracies over time. Calculating equation (12) both forward in time from 1939 and backward from 1974 offers benchmarks for examining the consistency of the estimates. Not surprisingly, there are some differences between the two resulting wealth series. We assume that there is measurement error both in the estimates of capital accumulation and in the price changes for fixed capital, and make adjustments such that the estimates of total wealth are equal regardless of which year we use as benchmark for the calculations.[30] The adjustment corresponds to assuming that private savings in official statistics has been overestimated by 13 per cent and price growth for capital by 8 per cent. These assumptions of the measurement error have also been applied for the years before 1939.

Final series of total wealth. We then arrive at our series for total household wealth from national accounts. The series is presented in panel (a) of Figure 9. Total household wealth increases from 5.2 billion NOK in 1912 to 5815.3 billion NOK in 2019, the last year for which we have data. If we were to adjust the 1912 value for inflation using the consumer price index, we get a value of 317.3 billion in 2019 NOK. This means that according to our national account-based estimates, total household wealth grew by a factor of 18.3 over the 107-year period, corresponding to an average annual growth of 2.76 per cent. Population (measured as the number of households) more than tripled in the same period; average annual growth in per household wealth was 1.59 per cent. We now move to a comparison of the different estimates of total wealth.

[30]For an discussion of how the results change with different assumptions, see Section F.3.4.

Panel (b) of Figure 9 shows the estimated total tax assessed wealth from Section 3 as share of total SNA wealth. The tax assessed wealth from Section 3 accounted for around 50 per cent of the SNA wealth until the Second World War. The share decreased to around 25 percent at the beginning of the 1950s before it stabilized at around 30 per cent until the the early 1980s, when tax assessed wealth accounted for a growing share of the SNA wealth ending at around 60 per cent in 2018. Appendix F.4 shows the relationship between total SNA wealth and total tax assessed wealth when tax assessed values of housing is replaced with market values of housing.

6.2 Accounting for excess SNA wealth in measurement of wealth inequality

We now turn to the question of how to account for the excess wealth aggregates from the historical SNA sources in measurement of long-run wealth inequality. In line with the distributional SNA literature (see e.g. Saez and Zucman (2016); Piketty et al. (2018); Smith et al. (2023)), we will rely on distributional information from recent micro data sources as a basis for distributing the excess SNA wealth across time. The most relevant micro data source in Norway is the register wealth data for households reported in the modern tax records. However, as will become clear in the discussion below, accounting for total excess SNA wealth does nevertheless require use of non-testable assumptions. Distributing the excess wealth on the basis of merged information from micro data of tax assessed wealth and wealth data by asset classes from SNA is only possible from 2000 onwards. As will be demonstrated below, this information will however form a useful basis for estimating consistent historical series where excess SNA wealth is accounted for.

A location-scale model. For most years since 1912 our extended data basis are given by the total wealth from SNA and the estimated Gini coefficient for tax assessed wealth presented in Section 3. Thus, it will be required to introduce a method for utilizing the excess SNA totals in combination with the Gini series of tax assessed wealth. To this end, let $\Delta = \mu_z - \mu_y$ where μ_z and μ_y denote the means of the SNA- and tax-recorded wealth; i.e. Δ defines the SNA (mean) excess wealth. Next, we introduce the following transparent location-scale model;

$$z = k\Delta + by, \tag{13}$$

where y is tax-assessed wealth and z is the tax assessed wealth plus the excess SNA wealth, and the allocation parameters $k \leq 1$ and $b \geq 1$ are assumed to be the same for all households. This means that the excess wealth will be distributed as a combination of a lump-sum amount ($k\Delta$) and an amount proportional to the household's tax assessed wealth (by). Since equation (13) implies that $\mu_z = k\Delta + b\mu_y$ we get the following relationship between the parameters b and k;

$$b = 1 + (1-k)\frac{\Delta}{\mu_y}, \tag{14}$$

which means that the remaining problem is to determine k. This issue will be discussed below.

As can be observed from equation (14), $b = 1 + \frac{\Delta}{\mu_y}$ if $k = 0$. In this case the SNA excess wealth ($\mathit{\Delta}$) will be allocated proportionally to the observed tax-assessed wealth with rate $\mathit{\Delta}/\mu_y$, which means that wealth inequality will remain unchanged. When $k = 1$ ($b = 1$), all households will receive the mean excess wealth (Δ), which provides the strongest possible redistribution effect. For $0 < k < 1$ the allocation rule is defined by a mixture of lump-sum ($k\Delta$) and proportional transfer ($(b-1)y$) of the excess wealth ($\mathit{\Delta}$), which means that wealth inequality will diminish. To allow for a rise in wealth inequality, k has to take negative values, which initially corresponds to allocating the excess wealth (Δ) proportionally and then introduce a lump-sum tax ($k\Delta$) that will be allocated proportionally to each household's tax assessed wealth (y). The excess SNA wealth can be negative if the SNA estimate is lower than the total wealth assessed from taxable wealth, which might happen since land values are included in taxable wealth but not in SNA wealth.

These allocation rules respect the wealth ordering given by the observed tax data irrespective of whether the SNA excess wealth is considered to be more ($k > 0$) or less ($k < 0$) equally distributed than the tax reported wealth data. From equations (13) and (14) we obtain the following convenient relationship between the Gini coefficient for the distributions of SNA extended wealth (G_z) and tax- assessed wealth (G_y),

$$G_z = \left(1 - k\frac{\Delta}{\mu_z}\right) G_y = \left[1 - k\left(1 - \frac{\mu_y}{\mu_z}\right)\right] G_y\,. \tag{15}$$

It is clear that the Gini coefficient remains unchanged ($G_z = G_y$) when $k = 0$. When $k = 1$ we get $G_z = \frac{\mu_y}{\mu_z} G_y$, which corresponds to allocate the entire excess SNA wealth as equal lump-sum transfers. In this case the reduction in the Gini coefficient is equal to the SNA excess wealth's share of the total SNA wealth. We observe from (15) that the difference between the Gini coefficient assessed on the basis of the SNA extended taxable wealth data and the Gini coefficient based on the taxable wealth data might vary over time owing to changes in the ratio between the tax reported total wealth and the total SNA wealth, even though the allocation parameter k is kept fixed over time. Note that the ratio of wealth means $\frac{\mu_y}{\mu_z}$ is the same as the ratio between wealth totals displayed in Figure 9, as the population is the same in both cases.

Determining the allocation parameter k. The next issue to be discussed concerns the assessment of the allocation parameter k. To this end, we use distributional information from detailed micro data and assumptions on the relationship between tax assessed wealth and SNA wealth to estimate the Gini coefficient for the distribution of SNA extended wealth (G_z) in 2000 and 2019.[31] Next, we use the estimated G_z and the associated preferred estimated Gini

[31]The years 2000 and 2019 are at the beginning and end of the period when the required detailed wealth data

for taxable wealth from Section 3 (G_y) to solve equation (15) for the allocation parameter k;

$$k = \left(\frac{\mu_z}{\mu_z - \mu_y}\right)\left(\frac{G_y - G_z}{G_y}\right). \tag{16}$$

In order to estimate the Gini coefficient for SNA extended wealth (G_z) on the basis of totals from SNA and detailed micro data, we need to impose some structure on how the excess SNA wealth is distributed relative to the taxable wealth. To make the structure flexible, we divide total wealth into asset classes. Specifically, we divide the taxable wealth into five asset classes that correspond closely to the asset classes in the System of National Accounts: *Deposits*, *other gross financial wealth*, *debt*, *housing*, and *other fixed capital*. In addition to these five asset-classes, the SNA wealth include specific *pension wealth* that is not included in taxable wealth. We assume that pension wealth is distributed proportionally to taxable deposits.[32]

Next, we introduce two alternative assumptions about how the excess SNA wealth is distributed relative to the taxable wealth within each asset-class; called "constant proportionality" and "constant interaction". The "constant proportionality" method uses the ratios between asset-class totals from SNA data and from tax data as basis for carrying out scale transformations of households' wealth holdings. This assumption is related to the assumption Saez and Zucman (2016) used for the capitalization method. The "constant interaction" method relies on the assumption that the association between wealth in each asset-class and total wealth is the same for SNA wealth as for taxable wealth. Specifically, we utilize that the Rao decomposition of inequality introduced in Section 5 expresses total inequality in terms of asset-class interaction coefficients and ratios of asset-class totals to total wealth. The interaction coefficients quantify the association between the wealth of each of the asset-classes and total wealth. We use the decompsition to combine the interaction coefficient for each asset-class from tax data with the ratios of asset-class totals to total wealth from SNA data. The assumptions are explained in further detail in Appendix F.5.

Based on these two sets of assumptions we can allocate the SNA excess wealth in respectively 2000 and 2019, and use the resulted SNA extended household wealth data to estimate

have been available. Both the share of net wealth held in different assets in the SNA (used in the method we later will refer to as "constant interaction") and the ratio of aggregate wealth from the SNA to taxable wealth for the different assets (used in the method we later will refer to as "constant proportionality") evolved linearly between the two years. The linear development suggests, all else equal, that the end years represents the extreme values of the data for the entire period.

[32] Pension wealth in the SNA only includes the pension wealth in funded pension schemes. In Norway occupational pensions in the private sector and the municipal sector are funded schemes. The pension wealth in funded schemes constitutes about 12% of the total pension wealth in Norway in 2018 (Halvorsen and Hetland (2021)). As an alternative to assuming proportional distribution with respect to taxable deposits, we have also calculated estimates where we assume that pension wealth is allocated proportionally to gross financial wealth. These estimates are shown in Appendix F.5. At our request Elin Halvorsen has estimated the interaction coefficient of pension wealth relative to net household wealth to be 0.34 based on estimates of individual pensions from Halvorsen and Hetland (2021). This is closer to the interaction coefficient for taxable deposits than for gross financial wealth. We interpret this as support for allocating pension wealth proportionally to deposits rather than to gross financial wealth.

the Gini coefficient (G_z) and assess the allocation parameter k. Next, each of the four resulting allocation parameters (k) is used as a basis for assessing historical SNA extended series of wealth inequality.

6.3 The effect of accounting for SNA wealth

We apply the method presented in Section 6.2 to data for the years 2000 and 2019. Table 2 shows that both the "constant proportionality" and the "constant interaction" approach give lower inequality estimates for the SNA Gini (G_z) than for the tax Gini (G_y) when applied to data from 2000. We also see that the total tax wealth accounted for 46.8 per cent of total SNA wealth in 2000 ($\frac{\mu_Y}{\mu_Z} = 0.468$). The lower panel shows the values used to calculate the SNA based Gini coefficients. The second and third column gives the wealth share for each asset-class based on tax and SNA data, respectively. For some asset classes, such as deposits and debts, the shares are similar for the two sources, while for others, such as real capital, there is a substantial discrepancy, stemming from the difference in definition across the sources. The interaction component, fourth column, shows substantial variation across asset groups, where other gross financial wealth and debt exhibit respectively the strongest and weakest association with total tax assessed wealth. In the constant interaction approach, the wealth share held in each asset-class is used to weigh together the interaction coefficient of each assets-class. Hence, the SNA Gini is lower than the tax Gini because less wealth is held in asset-classes with high interaction coefficients in the SNA data.

From the four rightmost columns, we see that the tax data accounts for a larger share of the in SNA data 2019 than in 2000, and that both of the SNA Gini coefficients are slightly higher than the tax Gini coefficient when based on 2019 data. In general, the interaction components do not exhibit large differences from 2000, but for some wealth shares, there are higher discrepancies. We see that the increase in housing wealth is captured both by the tax and SNA wealth shares, but the increase is much higher in the tax data, reflecting that land values are counted as taxable wealth but not as wealth in the national accounts.

Estimates for k based on Equation (16) are given in the top panel of Table 2 and range from -0.062 to 0.320. The assessed k-values displayed in Table 2 have been used to estimate four series of wealth inequality for the entire 1912-2019 period.

Figure 10 shows the series of wealth Gini coefficients adjusted for national accounts wealth, in addition to the benchmark series from Section 4. The series differ in which value of the allocation parameter k is used: how the SNA excess wealth has been distributed (constant proportionality or constant interaction) and whether the parameter is based on data for 2000 or 2019. As each assessed allocation parameter k is kept fixed across time, the evolution of each series of the Gini coefficient is determined by changes in the Gini coefficient of taxable wealth and the ratio between taxable wealth and SNA wealth.

It is evident from the figure that the allocation parameter matters substantially for the es-

Table 2: Allocation methods

	2000				2019			
Total wealth	G_y	$\frac{\mu_y}{\mu_z}$	G_z	k	G_y	$\frac{\mu_y}{\mu_z}$	G_z	k
Constant proportionality	0.832	0.468	0.785	0.107	0.861	0.608	0.882	-0.062
Constant interaction			0.691	0.320			0.863	-0.004
Asset classes		$\frac{\mu_{yi}}{\mu_y}$	$\frac{\mu_{zi}}{\mu_z}$	γ_{yi}		$\frac{\mu_{yi}}{\mu_y}$	$\frac{\mu_{zi}}{\mu_z}$	γ_{yi}
Deposits		0.44	0.44	0.61		0.36	0.52	0.57
Other gross financial wealth		0.46	0.32	0.80		0.48	0.37	0.86
Debt		-0.57	-0.50	-0.05		-0.61	-0.67	-0.04
Housing		0.40	0.67	0.17		0.66	0.72	0.28
Other real capital		0.27	0.08	0.35		0.11	0.06	0.29

Note: The table displays Gini coefficient for the distribution of SNA extended wealth (G_z), the allocation parameter k, and the parameters used to calculate the two based on data from 2000 and 2019. G, μ, γ denotes Gini coefficient, mean and interaction coefficient. The subscript y and z denotes that the parameter is based on tax data or SNA data, and i denotes that the parameter is asset-class specific.

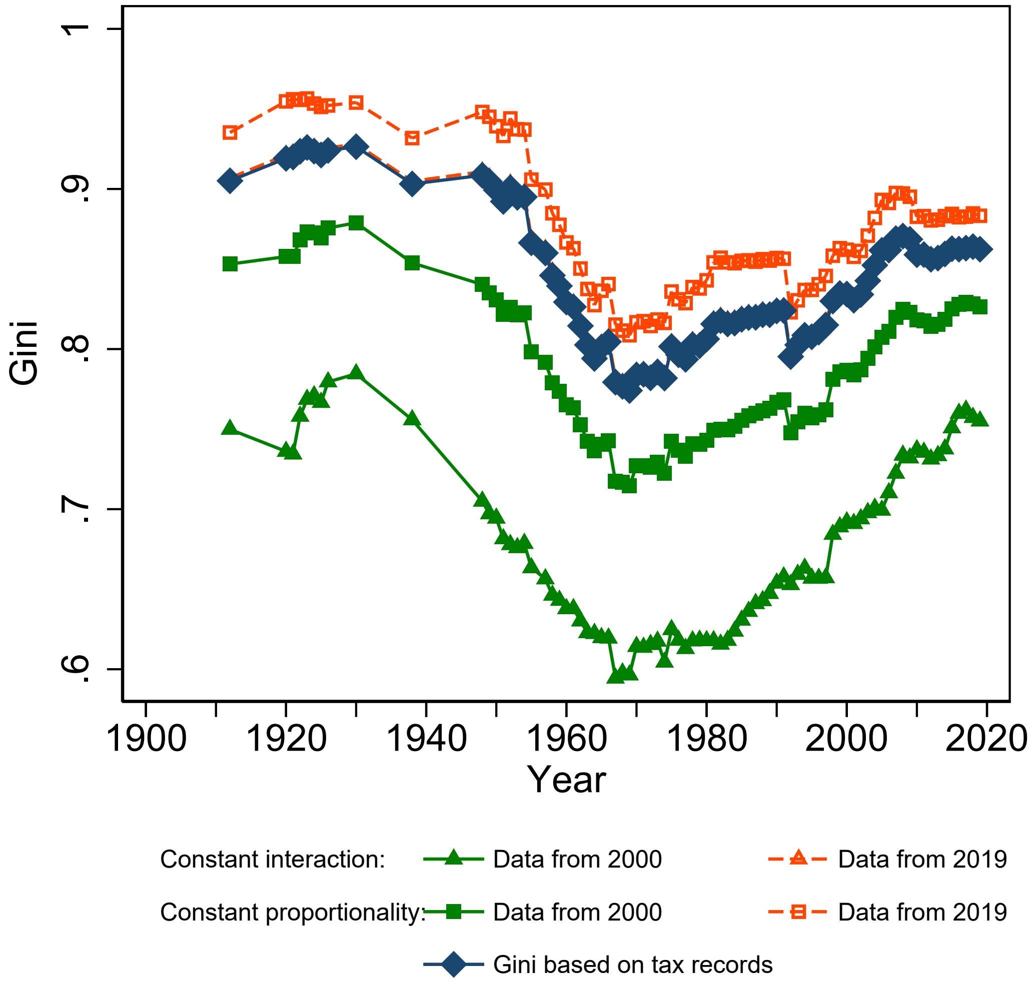
timated level of wealth inequality. The series associated with the 2019 data are higher than the corresponding series associated with the 2000 data. The allocation assumptions have a stronger effect for the 2000 data since there is more excess wealth to be allocated. Moreover, assuming constant proportionality leads to higher estimated inequality than assuming constant interaction.

When it comes to changes over time, however, the trend is less dependent on the allocation assumptions, even though the ratio between taxable wealth and SNA wealth varies significantly across time. All series show a similar evolution as that found for taxable wealth. Initial wealth inequality is high, followed by a large decrease in the mid-twentieth century. Then wealth inequality begins to increase again. There are subtle differences in the timing of the initial change, with estimates based on 2000 data showing earlier onset of the wealth inequality decrease than estimates based on 2019 data. Estimates of changes during the 1920s, which rely heavily on data of the top wealth holders, are also sensitive to the choice of allocation parameter.

In sum, given that we have used a wide set of assumptions, we conclude that taxable wealth provides a reliable description of the evolution of wealth inequality even though the level of wealth inequality might be biased. The difference between the SNA Gini coefficients is largest between 1940 and 1990 when the ratio of total taxable wealth to total SNA wealth is the lowest, as shown in Figure 9, which means this is the period with the highest share of excess wealth.

Since the main objective of this paper has been to describe the evolution of wealth inequality over more than 100 years, we find it reassuring that the pattern of the historic series does not change much when the study is extended to include excess SNA wealth, although the share of excess SNA wealth varies significantly across time.

Figure 10: Evolution of the Gini coefficient when accounting for excess SNA wealth



Notes: The figure shows the distribution of the excess wealth from SNA based on the "constant proportionality" assumption and "constant interaction" assumption described in Section 6.2 applied on detailed micro data from 2000 and from 2019. The series labeled "Gini based on tax records" is our preferred series from Section 4. The series where the constant interaction assumption is applied on data from 2019 is not visible in the figure as it overlaps to closely with the Gini based on tax records.

7 Discussion and concluding comments

This paper has shown how different sources of data on the wealth distribution can be combined to chart the long-run evolution of wealth inequality. As is evident from the results, the choice of data and methodology matters a lot for the attained estimates of wealth inequality. A naive use of the published sources of taxable wealth gives large spurious fluctuations in the estimated series of inequality and concentration of wealth, which weaken the comparability across time. To strengthen the comparability, this study draws on additional sources by making an adjustment for total population, by introducing a common lower bound for wealth and by using a semi-parametric method for allocating wealth within wealth brackets. The proposed framework can be used as a recipe for any country where historical tabulations of taxable wealth are available.

Our preferred long-run series shows that wealth inequality in Norway, as measured by the Gini coefficient, was extremely high in the early twentieth century, fell significantly from 1955 until the mid-1970s, and has increased significantly since the mid-1980s. The evolution is consistent with an often-told narrative of how the twentieth century unfolded in Western countries based on evidence from top wealth shares. Initially, resources were extremely unequally distributed, while the crisis of the 1930s had moderately equalizing impact on the wealth distribution. As compared to Continental European countries, material destruction from the Second World War were moderate in Norway. However, the war period had still a large impact on the Norwegian economy, since the German occupants imposed large economic controls. The post-war period was marked by a strict economic planning regime, high growth and an optimism regarding the economic role of the state, and saw a lower level of wealth inequality than before the war.

This study does also provide a comparison of the evolution of overall wealth inequality and wealth concentration, as measured by the top 1 percent wealth share. The results show some interesting relationships. For example, the mid-century fall in the top wealth share starts earlier (during the war) than the fall in overall wealth inequality (in the mid-1950s). Top 1 per cent wealth shares are also found to be quantitatively important to understand the increase in wealth inequality from the 1980s onwards. Wealth concentration (top 1 per cent wealth shares) during the last decade shows to be at the same level as at the beginning of the twentieth century, while contemporary Gini coefficients are only 3-4 per cent lower than one hundred years ago.

It is evident from our analysis that the choice of data base - whether one uses taxable wealth, includes market value of housing, or includes excess wealth from the National Accounts - matters for the estimated level of wealth inequality, while the basic patterns of the evolution show to be robust to the choice of measurement approach. Our benchmark estimate, based on taxable wealth, shows a Gini-coefficient for wealth of above 0.90 during the first half of the twentieth century, decreased to 0.78 at the lowest point around 1970, and increased to 0.86 in 2019. The estimated series from 1995 onwards that accounts for the market value of housing, on the other hand, lowers the wealth Gini by around 15 percentage points, but finds the same increase from the 1970s onwards as the benchmark estimate. Incorporating estimates of total wealth from the National Accounts, we again find the same U-shape as for the tax-based long-run series of the Gini coefficient, but the level of wealth inequality was found to be either lower or higher than the level of the tax-based Gini series depending on the chosen assumptions for allocation of excess SNA wealth.

The alternative series of overall wealth inequality presented in this paper differ in terms of data sources and the assumptions used. Thus, one might question which of the series that show similar levels of inequality to those attained in studies solely based on contemporary microdata? The series from 1995 onwards based on market values of housing clearly stands out as most similar to estimates based on contemporary data - with a Gini coefficient of 0.66 in 1995 increasing to 0.70 in 2016. Note however that the valuation of unlisted companies related to this series of wealth inequality is based on book values, which might be significantly lower than the market values. Moreover, since most owners of unlisted companies is located at the top of the wealth distribution, replacement of book values with market value of unlisted companies would likely have led to a substantial rise in both wealth concentration and wealth inequality.[33]

Most previous long-run studies for other countries have been limited to produce results for the evolution of top wealth shares, where the U-shapes - if they exist - are less pronounced than what we have found for Norway. Six country-specific long-run series reviewed by Waldenström (2024, p. 101) have shown stable or decreasing wealth concentration over time, with only a small increase at the end of the period for a few countries. Albers et al. (2022) also find wealth concentration in Germany to have been decreasing for the first half of the century, with only a moderate increase starting in the late 1960s. The strongest evidence for a U-shape evolution is found by Saez and Zucman (2016) for the United States, which is a country with institutions very different from Norway. There are few long-run series of overall inequality (using summary measures such as the the Gini coefficient), but some of those that do exist (Albers et al. (2022) for Germany starting in 1978) only provide evidence of a late twentieth-century increase.[34]

The difference in the trend in recent decades for Norway compared to other European countries could arise both from differences in economic conditions or from differences in data and methodological approach. Comparability problems between countries are still substantial, which make it hard to provide a reliable ranking of countries by wealth concentration and inequality. Future work on estimating complete measures of inequality - such as Gini coef-

[33] As an illustration of the significance of the valuation of unlisted companies for wealth inequality, Aaberge et al. (2021) produced an alternative series for the period 2001 - 2018 based on a capitalization method by relying on the companies' observed annual profit and an assumed rate of return of four percent. The results show that the Gini coefficient rose by between 12 and 17 percentage points and reached 0.82 in 2018. Aaberge et al. (2021) emphasize that the results must be interpreted with caution, not least because there is reason to believe that the rates of return vary substantially across companies. The results nevertheless suggest that wealth inequality is significantly higher than what emerges when the measurement of the value of unlisted companies is based on book values. For further discussion on the assessment of the market value of unlisted companies see Andresen and Bø (2022), Andresen (2022), and Grindaker and Vestad (2025).

[34] We also note that the wealth Gini coefficient estimated from estate data by Bengtsson et al. (2018) for Sweden in 1900, at 0.91, is close to the estimate 0.905 for Norway in 1912.

ficients - also for countries other than Norway might help improving our understanding of to what extent Western countries have development paths that diverge or converge in terms of wealth inequality.

References

Aaberge, R., A. B. Atkinson, and J. Modalsli (2013). The ins and outs of top income mobility. *Discussion Paper 762, Statistics Norway*.

Aaberge, R., A. B. Atkinson, and J. Modalsli (2020). Estimating long-run income inequality from mixed tabular data: Empirical evidence from Norway, 1875–2017. *Journal of Public Economics 187*, 104–196.

Aaberge, R., J. H. Modalsli, and O. L. Vestad (2020). Ulikheten–betydelig større enn statistikken viser. *SSB Analyse 13*.

Aaberge, R. and M. Mogstad (2011). Robust inequality comparisons. *The Journal of Economic Inequality 9*(3), 353–371.

Aaberge, R., M. Mogstad, O. Vestad, and A. Vestre (2021). Økonomisk ulikhet i Norge i det 21. århundre. *Rapporter 2021/33, Statistics Norway*.

Aaberge, R. and M. Stubhaug (2018). Formuesulikheten øker. *SSB analyse 18*.

Abildgren, K. (2016). The national wealth of Denmark 1845-2013 in a European perspective. *Nationaløkonomisk Tidsskrift*, 1.

Acciari, P., F. Alvaredo, and S. Morelli (2024). The concentration of personal wealth in italy 1995–2016. *Journal of the European Economic Association 22*(3), 1228–1274.

Albers, T. N. H., C. Bartels, and M. Schularick (2022). Wealth and its distribution in Germany, 1895–2018.

Alstadsæter, A., M. Jacob, W. Kopczuk, and K. Telle (2017). Accounting for business income in measuring top income shares: Integrated accrual approach using individual and firm data from Norway. *Proceedings. Annual Conference on Taxation and Minutes of the Annual Meeting of the National Tax Association 110*, 1–39.

Alvaredo, F. (2011). A note on the relationship between top income shares and the Gini coefficient. *Economics Letters 110*(3), 274–277.

Alvaredo, F., A. B. Atkinson, and S. Morelli (2018). Top wealth shares in the UK over more than a century. *Journal of Public Economics 162*.

Alvaredo, F., Y. Berman, and S. Morelli (2025). Evidence from the dead: New estimates of wealth inequality using the distribution of estates. *World Inequality Lab working paper*.

Alvaredo, F. and E. Saez (2009). Income and wealth concentration in Spain from a historical and fiscal perspective. *Journal of the European Economic Association 7*(5), 1140–1167.

Andresen, M. E. (2022). Latente eierinntekter og skatteplikt på unoterte aksjer etter aksjonærmodellen. Rapporter 2022/37, Statistisk sentralbyrå.

Andresen, M. E. and E. E. Bø (2022). Verdsetting av unoterte selskaper. Rapporter 2022/31, Statistisk Sentralbyrå.

Atkinson, A. B. (2007). *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English-Speaking Countries*, Chapter Measuring Top Incomes: Methodological Issues, pp. 18–42. Oxford: Oxford University Press.

Atkinson, A. B. (2017). Pareto and the upper tail of the income distribution in the UK: 1799 to the present. *Economica 84*, 129–156.

Atkinson, A. B., T. Piketty, and E. Saez (2011). Top incomes in the long run of history. *Journal of Economic Literature 49*(1), 3–71.

Aukrust, O. and P. J. Bjerve (1945). *Hva krigen kostet Norge*. Dreyers Forlag.

Balestra, C. and R. Tonkin (2018). Inequalities in household wealth across OECD countries: Evidence from the OECD wealth distribution database. Technical Report 2018-1, OECD Statistics Working Papers.

Bengtsson, E., A. Missiaia, I. Nummela, and M. Olsson (2019). Unequal poverty and equal industrialisation: Finnish wealth, 1750–1900. *Scandinavian Economic History Review 67*(3), 229–248.

Bengtsson, E., A. Missiaia, M. Olsson, and P. Svensson (2018). Wealth inequality in Sweden, 1750–1900. *Economic History Review 71*(3), 772–794.

Bjørneby, M., S. Markussen, and K. Røed (2023). An imperfect wealth tax and employment in closely held firms. *Economica 90*(358), 557–583.

Blanchet, T., J. Fournier, and T. Piketty (2021). Generalized Pareto curves: Theory and applications. *Review of Income and Wealth 68*(1), 263–288.

Charpentier, A. and E. Flachaire (2022). Pareto models for top incomes and wealth. *The Journal of Economic Inequality 20*(1), 1–25.

Cowell, F. A. and F. Mehta (1982). The estimation and interpolation of inequality measures. *The Review of Economic Studies 49*(2), 273.

Davies, J. B. and L. Di Matteo (2021). Long run Canadian wealth inequality in international context. *Review of Income and Wealth 67*(1), 134–164.

Davies, J. B. and A. F. Shorrocks (2000). The distribution of wealth. *Handbook of Income Distribution 1*, 605–675.

Eitrheim, Gerdrup, and Klovland (2004). Historical stock price indices in Norway 1814-2003. *Norges Bank Occational Papers No. 35*, 336–347.

Eitrheim, O. and S. K. Erlandsen (2004). House price indices for Norway 1819-2003. In *Historical monetary statistics for Norway 1819-2003*. Norges Bank.

Eitrheim, Ø., J. T. Klovland, and J. F. Qvigstad (2004). Historical monetary statistics for Norway 1819-2003. *Norges Bank Occasional Papers No. 35*, 289–328.

Espeli, H. (2013). Economic consequences of the German occupation of Norway. *Scandinavian Journal of History*.

Fagereng, A., L. Guiso, D. Malacrino, and L. Pistaferri (2016). Heterogeneity in returns to wealthand the measurement of wealth inequality. *American Economic Review: Papers and Proceedings 106*(5), 651–655.

Furre, B. (2013). *Norsk historie* (7. oppl. ed.), Volume Bd. 6. Oslo: Det Norske Samlaget.

Gabbuti, G. and S. Morelli (2023). Wealth, inheritance, and concentration: An ”old” new perspective on italy and its regions from unification to the great war. *LEM Working Paper Series 2023/43*.

Garbinti, B., J. Goupille-Lebret, and T. Piketty (2020). Accounting for wealth-inequality dynamics: Methods, estimates, and simulations for France. *Journal of the European Economic Association 19*(1), 620–663.

Grindaker, M. and O. Vestad (2025). Latente eierinntekter og skatteforpliktelser på unoterte aksjer i perioden 2011–2022. Rapporter 2025/21, Statistisk sentralbyrå.

Halvorsen, E. and A. Hetland (2021). Pensjonsformue i Norge 2018. *Rapporter 2021/16, Statistics Norway*.

Hansen, M. N. and M. Toft (2021). Wealth accumulation and opportunity hoarding: Class-origin wealth gaps over a quarter of a century in a Scandinavian country. *American Sociological Review 86*(4), 603–638.

Jakobsen, K., K. Jakobsen, H. Kleven, and G. Zucman (2020). Wealth taxation and wealth accumulation: Theory and evidence from Denmark. *Quarterly Journal of Economics 135*(1).

Jenkins, S. P. (2016). Pareto models, top incomes and recent trends in UK income inequality. *Economica 84*(334), 261–289.

Jorda, V., J. M. Sarabia, and M. Jäntti (2021). Inequality measurement with grouped data: Parametric and non-parametric methods. *Journal of the Royal Statistical Society Series A: Statistics in Society 184*(3), 964–984.

Kopczuk, W. and E. Saez (2004). Top wealth shares in the United States, 1916–2000: Evidence from estate tax returns. *National Tax Journal 57*(2.2), 445–487.

Kuhn, M., M. Schularick, and U. Steins (2017). Income and wealth inequality in America, 1949-2012. *CEPR Discussion Paper 12218*.

Lindmark, M. and L. F. Andersson (2016). An historical wealth assessment–measuring the Swedish national wealth for the nineteenth and twentieth centuries. *Scandinavian Economic History Review 64*(2), 122–137.

Piketty, T. (2014). *Capital in the Twenty-First Century*. Cambridge, MA: Harvard University Press.

Piketty, T., G. Postel-Vinay, and J.-l. Rosenthal (2006). Wealth concentration in a developing economy: Paris and France, 1807-1994. *American Economic Review 96*(1), 236–256.

Piketty, T., E. Saez, and G. Zucman (2018). Distributional national accounts: Methods and estimates for the United States. *The Quarterly Journal of Economics 133*(2), 553–609.

Piketty, T. and G. Zucman (2014). Capital is back: Wealth-income rations in rich countries 1700–2010. *Quarterly Journal of Economics 129*(3), 1255–1310.

Roine, J. and D. Waldenström (2009). Wealth concentration over the path of development: Sweden, 1873-2006. *Scandinavian Journal of Economics 111*(1), 151–187.

Roine, J. and D. Waldenström (2015). Long run trends in the distribution of income and wealth. *Handbook of Income Distribution 2A*, 469–592.

Saez, E. and G. Zucman (2016). Wealth inequality in the United States since 1913: Evidence from capitalized income tax data. *The Quarterly Journal of Economics 131*(2), 519–578.

Scheidel, W. (2017). *The Great Leveler: Violence and the History of Inequality from the Stone Age to the Twenty-First Century*. Princeton University Press.

Sejersted, F. (2013). *Sosialdemokratiets tidsalder*. Oslo: Pax.

Smith, M., O. Zidar, and E. Zwick (2023). Top wealth in America: New estimates under heterogeneous returns. *Quarterly Journal of Economics 138*(1), 515–573.

Statistics Norway (1931). Den ekstraordinære formuesbeskatning i 1927/28. In *Statistiske Meddelelser*, Number 9-10, pp. 216–219. Statistics Norway.

Statistics Norway (1946). Nasjonalinntekten i Norge 1935-1943. *NOS X 102*.

Statistics Norway (1967). Det norske kreditmarked siden 1900. *SØS 19*.

Statistics Norway (1972). Nasjonalregnskap 1954-1970. *NOS A 474*.

Statistics Norway (1979). Skatter og overføringer til private. historisk oversikt over satser mv. årene 1969-1979. *Rapport 1979/12*.

Statistics Norway (1981). Nasjonalregnskap 1969-1980. *NOS B 222*.

Statistics Norway (1982). Nasjonalregnskap 1975-1976. *Rapport 1982/14*.

Statistics Norway (1994a). Historisk statistikk 1994. *Historisk Statistikk*.

Statistics Norway (1994b). Skatter og overføringer til private: Historisk oversikt over satser mv. Årene 1975-1994. *Rappport 1994/21*.

Stubhaug, M. (2017). Housing and wealth inequality. *Master's thesis in Economics, University of Oslo*.

Thomassen, A. and I. Melbye (2009). Beregning av boligformue. *Notater 53, Statistics Norway*.

Waldenström, D. (2016). The national wealth of Sweden, 1810–2014. *Scandinavian Economic History Review 64*(1), 36–54.

Waldenström, D. (2024). *Richer and More Equal: A New History of Wealth in the West*. Polity Press.

Waltl, S. R. and R. Chakraborty (2022). Missing the wealthy in the HFCS: micro problems with macro implications. *The Journal of Economic Inequality 20*, 169–203.

Wolff, E. and M. Marley (1989). Long-term trends in u.s. wealth inequality: Methodological issues and results. In R. E. Lipsey and H. S. Tice (Eds.), *The Measurement of Saving, Investment, and Wealth*. NBER.

Zimmer, F. (2022). Skatteretten – et lengdesnitt. *Skatterett 41*(2), 124–179.

Zucman, G. (2019). Global wealth inequality. *Annual Review of Economics 11*, 109–138.

Appendix

A Detailed tables and figures

A.1 Tables of wealth inequality indices

Table A.1 and A.2 shows estimated wealth inequality, wealth concentration and totals as illustrated in the figures in the main text.

Table A.1: Wealth concentration, total wealth and total population in Norway, 1912-2019

	Assessed wealth				National account	Household
Year	Gini	Top 1% share	Gini bottom 99%	Total	household wealth	population
1912	0.905	0.37	0.871	2,393	5,154	956,864
1913	.	.	.	.	5,009	971,143
1914	.	.	.	.	4,763	985,835
1915	.	.	.	.	5,660	1,005,440
1916	.	.	.	.	9,453	1,023,594
1917	.	.	.	.	14,718	1,043,318
1918	.	.	.	.	16,546	1,058,702
1919	.	.	.	.	21,493	1,079,950
1920	0.919	.	.	8,974	23,740	1,101,368
1921	0.920	.	.	8,464	22,860	1,123,444
1922	0.924	.	.	7,592	17,237	1,142,368
1923	0.926	.	.	7,320	15,602	1,151,702
1924	0.924	.	.	7,683	15,900	1,167,979
1925	0.921	.	.	7,508	15,771	1,185,037
1926	0.924	.	.	6,686	13,075	1,200,674
1927	.	.	.	.	10,782	1,212,410
1928	.	.	.	.	10,168	1,227,545
1929	.	.	.	.	10,074	1,243,338
1930	0.926	0.43	0.894	5,465	10,476	1,256,326
1931	.	.	.	.	9,638	1,273,270
1932	.	.	.	.	9,787	1,292,244
1933	.	.	.	.	9,721	1,312,431
1934	.	.	.	.	9,915	1,333,840
1935	.	.	.	.	10,346	1,350,968
1936	.	.	.	.	11,143	1,369,994
1937	.	.	.	.	13,336	1,391,066
1938	0.903	0.44	0.848	7,141	14,558	1,412,323
1939	.	.	.	.	15,698	1,429,656
1940	.	.	.	.	.	1,454,358
1941	.	.	.	.	.	1,474,101
1942	.	.	.	.	.	1,491,368
1943	.	.	.	.	.	1,508,496
1944	.	.	.	.	.	1,522,238
1945	.	.	.	.	.	1,534,560

Table A.1: Wealth concentration, total wealth and total population in Norway, 1912-2019

	Assessed wealth				National account	Household
Year	Gini	Top 1% share	Gini bottom 99%	Total	household wealth	population
1946	.	.	.	.	32,096	1,534,587
1947	.	.	.	.	34,264	1,537,382
1948	0.909	0.38	0.875	11,198	37,297	1,540,067
1949	0.905	0.37	0.872	11,394	40,246	1,540,697
1950	0.899	0.36	0.866	12,255	42,520	1,541,591
1951	0.892	0.34	0.858	13,066	49,795	1,543,947
1952	0.901	0.35	0.869	12,707	55,910	1,545,226
1953	0.895	0.33	0.864	13,594	57,551	1,543,682
1954	0.895	0.34	0.864	14,884	60,814	1,541,141
1955	0.866	0.31	0.826	17,033	63,503	1,546,259
1956	.	.	.	.	68,185	1,544,967
1957	0.860	0.30	0.822	19,514	74,839	1,548,081
1958	0.846	0.29	0.803	20,947	79,819	1,550,703
1959	0.839	0.26	0.802	21,852	81,142	1,554,001
1960	0.829	0.26	0.790	22,812	81,864	1,557,094
1961	0.826	0.26	0.784	24,159	84,022	1,560,080
1962	0.814	0.25	0.774	25,668	87,532	1,568,075
1963	0.803	0.23	0.763	27,799	92,546	1,577,533
1964	0.794	0.22	0.754	30,439	93,814	1,593,213
1965	0.801	0.23	0.762	30,170	103,041	1,611,266
1966	0.805	0.24	0.764	30,691	109,078	1,635,566
1967	0.779	0.20	0.745	29,542	113,953	1,646,904
1968	0.777	0.20	0.741	32,635	116,528	1,675,840
1969	0.774	0.20	0.738	36,464	128,759	1,692,591
1970	0.784	0.25	0.730	46,143	142,273	1,713,818
1971	0.784	0.24	0.734	50,971	158,876	1,730,003
1972	0.782	0.24	0.733	55,930	167,057	1,749,294
1973	0.786	0.24	0.738	61,218	184,738	1,769,910
1974	0.782	0.22	0.738	64,963	223,183	1,790,223
1975	0.802	0.23	0.762	62,024	199,404	1,811,897
1976	0.796	0.22	0.759	68,728	228,580	1,834,952
1977	0.794	0.20	0.760	74,910	259,133	1,856,478
1978	0.803	0.21	0.771	79,129	282,534	1,882,988
1979	0.802	0.20	0.772	87,448	308,179	1,906,944
1980	0.806	0.20	0.777	95,265	352,832	1,931,605
1981	0.816	0.20	0.788	99,418	409,996	1,957,993
1982	0.818	0.20	0.792	104,978	460,273	1,986,459
1983	0.816	0.20	0.789	123,241	506,956	2,015,023
1984	0.816	0.21	0.788	146,269	555,201	2,046,338
1985	0.819	0.22	0.788	173,109	611,634	2,078,523
1986	0.820	0.22	0.789	197,589	657,596	2,112,101
1987	0.820	0.22	0.790	226,090	709,191	2,149,753
1988	0.821	0.22	0.790	256,150	797,960	2,186,075
1989	0.821	0.22	0.790	283,991	840,222	2,214,315

Table A.1: Wealth concentration, total wealth and total population in Norway, 1912-2019

	Assessed wealth				National account	Household
Year	Gini	Top 1% share	Gini bottom 99%	Total	household wealth	population
1990	0.824	0.22	0.793	300,823	846,470	2,243,836
1991	0.824	0.23	0.792	323,299	875,560	2,277,652
1992	0.795	0.20	0.762	403,877	916,219	2,312,574
1993	0.803	0.22	0.766	435,537	984,970	2,343,027
1994	0.809	0.23	0.771	460,405	1,051,248	2,371,121
1995	0.808	0.24	0.767	506,327	1,214,634	2,394,828
1996	0.811	0.24	0.769	532,188	1,306,263	2,412,582
1997	0.815	0.26	0.771	564,348	1,428,724	2,429,599
1998	0.830	0.31	0.773	667,393	1,477,632	2,450,516
1999	0.835	0.32	0.777	732,710	1,611,677	2,471,217
2000	0.834	0.32	0.776	804,177	1,720,975	2,488,344
2001	0.831	0.31	0.774	847,882	1,783,098	2,505,540
2002	0.834	0.31	0.780	861,642	1,813,222	2,525,851
2003	0.843	0.32	0.789	888,622	1,919,115	2,544,658
2004	0.852	0.34	0.797	939,090	2,116,536	2,567,263
2005	0.862	0.36	0.804	985,326	2,392,798	2,594,150
2006	0.862	0.38	0.799	1,186,620	2,633,842	2,627,166
2007	0.869	0.40	0.803	1,377,725	2,912,148	2,670,777
2008	0.871	0.40	0.804	1,490,177	2,927,923	2,718,325
2009	0.869	0.39	0.805	1,604,328	3,152,770	2,762,986
2010	0.859	0.37	0.796	1,845,433	3,313,923	2,815,559
2011	0.859	0.37	0.798	1,923,596	3,491,182	2,873,201
2012	0.856	0.35	0.798	2,035,557	3,736,722	2,927,575
2013	0.857	0.35	0.800	2,203,788	4,005,240	2,977,349
2014	0.859	0.36	0.802	2,402,960	4,310,345	3,028,232
2015	0.863	0.37	0.802	2,727,448	4,585,352	3,071,408
2016	0.862	0.37	0.802	3,043,835	4,843,986	3,111,323
2017	0.863	0.38	0.801	3,267,605	5,157,229	3,148,387
2018	0.864	0.38	0.803	3,289,511	5,355,259	3,186,370
2019	0.862	0.37	0.801	3,555,090	5,815,344	3,233,016

Note: The table lists the main results from the paper. Columns 2-5 list the Gini coefficient, wealth share of the richest 1 %, the Gini coefficient for the bottom 99 %, and the total assessed wealth resulting from the methods presented in Section 3. Column 6 lists total household wealth according to the National Account and the calculations presented in Section 6.1. Column 7 lists the number of households according to the definition of households presented in Section 2.2. Total assessed wealth, column 5, and total household wealth according to the National Account, column 6, are measured in millions of nominal Norwegian Kroner.

Table A.2: Wealth concentration and wealth inequality when accounting for the market value of housing

	Accounting for market value of housing		Accounting for market value of housing using modern data			
Year	Gini	Total	Gini	Top 1% share	Gini bottom 99%	Total
1969	0.564	93,793	.	.	.	.
1970	0.576	.	.	.	.	.
1971	0.579	.	.	.	.	.
1972	0.574	.	.	.	.	.
1973	0.578	.	.	.	.	.
1974	0.576	.	.	.	.	.
1975	0.580	.	.	.	.	.
1976	0.579	.	.	.	.	.
1977	0.571	.	.	.	.	.
1978	0.573	.	.	.	.	.
1979	0.573	.	.	.	.	.
1980	0.575	.	.	.	.	.
1981	0.570	.	.	.	.	.
1982	0.565	.	.	.	.	.
1983	0.567	.	.	.	.	.
1984	0.570	.	.	.	.	.
1985	0.575	.	.	.	.	.
1986	0.569	.	.	.	.	.
1987	0.565	.	.	.	.	.
1988	0.570	.	.	.	.	.
1989	0.580	.	.	.	.	.
1990	0.586	.	.	.	.	.
1991	0.593	.	.	.	.	.
1992	0.590	.	.	.	.	.
1993	0.595	.	.	.	.	.
1994	0.593	.	.	.	.	.
1995	0.593	1,285,072	0.664	0.15	0.624	1,153,265
1996	0.592	1,380,717	0.661	0.15	0.620	1,254,980
1997	0.591	1,541,184	0.655	0.15	0.613	1,433,311
1998	0.606	1,766,287	0.666	0.17	0.616	1,664,604
1999	0.612	1,955,866	0.670	0.17	0.619	1,866,503
2000	0.612	2,212,329	0.667	0.17	0.617	2,130,949
2001	0.610	2,377,308	0.669	0.17	0.620	2,266,271
2002	0.604	2,518,932	0.669	0.16	0.621	2,390,244
2003	0.604	2,625,007	0.675	0.17	0.627	2,476,040
2004	0.596	2,951,056	0.669	0.17	0.620	2,800,329
2005	0.594	3,275,520	0.665	0.16	0.617	3,131,630
2006	0.597	3,799,971	0.666	0.17	0.614	3,623,720
2007	0.602	4,363,225	0.671	0.18	0.616	4,161,579
2008	0.605	4,488,466	0.683	0.19	0.627	4,161,092
2009	0.609	4,630,130	0.692	0.19	0.636	4,205,434
2010	0.616	5,176,112	0.694	0.19	0.640	4,552,540
2011	0.616	5,563,011	0.693	0.19	0.640	4,879,150

Table A.2: Wealth concentration and wealth inequality when accounting for the market value of housing

	Accounting for market value of housing		Accounting for market value of housing using modern data			
Year	Gini	Total	Gini	Top 1% share	Gini bottom 99%	Total
2012	0.613	5,981,778	0.690	0.18	0.640	5,215,868
2013	0.616	6,369,280	0.692	0.18	0.644	5,504,740
2014	0.618	6,869,071	0.693	0.18	0.643	5,939,434
2015	0.625	7,536,998	0.697	0.19	0.644	6,502,466
2016	0.630	8,196,394	0.699	0.19	0.645	7,042,877

Note: The table lists the main results from the paper. Columns 2 and 3 list the Gini coefficient and the total wealth resulting from the series based on the decomposition in Section 5.1. Columns 4-7 list the Gini coefficient, wealth share of the richest 1 %, the Gini coefficient for the bottom 99 %, and the total wealth based on the series using modern micro data presented in Section 5. Total wealth in column 3 and 7 are measured in millions of nominal Norwegian Kroner.

A.2 Parameter estimates

Table A.3 shows estimated parameters from the semi-parametric method.

Table A.4 shows how the adjustment affect the estimated Gini coefficient.

Figure A.1, A.2 and A.3 show parameters relevant to the discussion of common lower threshold in Section 3.3 and Section 3.4.

Table A.3: Estimated parameters from the semi-parametric method

Year	1912	1920	1921	1922	1923	1924	1925	1926	1930	1938
$1-p$	0.70	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.75	0.92
b_1	0	300	200	200	125	125	125	125	1	5
$F(b_1)$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
α_1	0.00	1.26	1.31	1.33	1.33	1.32	1.36	1.34	0.31	0.43
a_1	0	300	200	200	125	125	125	125	1	5
b_2	0	500	500	500	200	200	200	200	5	11
$F(b_2)$	0.02	0.47	0.70	0.70	0.46	0.46	0.47	0.47	0.39	0.29
α_2	0.16	1.44	1.46	1.50	1.35	1.37	1.43	1.43	0.77	0.88
a_2	0	320	219	222	126	127	128	129	3	8
b_3	1	1000	1000	1000	500	500	500	500	10	51
$F(b_3)$	0.12	0.81	0.89	0.90	0.84	0.85	0.86	0.86	0.64	0.82
α_3	0.37	1.53	1.58	1.63	1.50	1.54	1.54	1.55	1.00	1.27
a_3	1	342	248	250	144	149	142	143	4	14
b_4	2	2000	2000	2000	1000	1000	1000	1000	20	101
$F(b_4)$	0.32	0.93	0.96	0.97	0.94	0.95	0.95	0.95	0.82	0.92
α_4	0.57	1.55	1.35	1.38	1.53	1.53	1.51	1.53	1.12	1.36
a_4	1	349	174	171	151	146	135	139	4	15
b_5	3	3000	3000	3000	2000	2000	2000	2000	50	151
$F(b_5)$	0.46	0.96	0.98	0.98	0.98	0.98	0.98	0.98	0.94	0.96
α_5	0.74	1.42	1.64	1.75	1.33	1.44	1.58	1.69	1.24	1.36
a_5	1	287	285	315	102	124	153	178	5	15
b_6	5	5000	5000	5000	3000	3000	3000	3000	100	201
$F(b_6)$	0.63	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.97	0.97
α_6	0.98	2.16	2.07	2.09	1.75	1.90	2.07	2.18	1.24	1.39
a_6	2	764	519	494	230	269	308	339	5	16
b_7	10	10000	10000	10000	5000	5000	5000	5000	.	301
$F(b_7)$	0.81	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.	0.98
α_7	1.18	1.49	2.26	1.16	2.17	1.95	2.26	2.25	.	1.43
a_7	2	245	664	44	417	290	392	365	.	18
b_8	20	15000	15000	15000	10000	10000	10000	10000	.	501
$F(b_8)$	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.	0.99
α_8	1.31	2.41	1.00	1.78	1.71	1.71	1.26	1.14	.	1.52
a_8	3	1169	13	335	177	175	30	15	.	22
b_9	50	20000	20000	20000	15000	15000	15000	.	.	1001
$F(b_9)$	0.98	1.00	1.00	1.00	1.00	1.00	1.00	.	.	1.00
α_9	1.42	1.82	4.92	1.09	2.41	1.15	1.18	.	.	1.68
a_9	4	463	4512	25	643	20	20	.	.	31
b_{10}	100	25000	25000	.	20000	.	.	.	.	2001
$F(b_{10})$	0.99	1.00	1.00	.	1.00	.	.	.	.	1.00
α_{10}	1.42	1.82	4.92	.	1.24	.	.	.	.	1.70
a_{10}	4	463	4512	.	25	.	.	.	.	32
b_{11}	.	.	.	.	.	.	.	.	.	4001
$F(b_{11})$	.	.	.	.	.	.	.	.	.	1.00
α_{11}	.	.	.	.	.	.	.	.	.	1.70
a_{11}	.	.	.	.	.	.	.	.	.	32
b_{12}	.	.	.	.	.	.	.	.	.	.
$F(b_{12})$	.	.	.	.	.	.	.	.	.	.
α_{12}	.	.	.	.	.	.	.	.	.	.
a_{12}	.	.	.	.	.	.	.	.	.	.
b_{13}	.	.	.	.	.	.	.	.	.	.
$F(b_{13})$	.	.	.	.	.	.	.	.	.	.
α_{13}	.	.	.	.	.	.	.	.	.	.
a_{13}	.	.	.	.	.	.	.	.	.	.

Note: G denotes the Gini coefficient, p denotes the proportion of families with larger wealth than the tax threshold, $\tilde{G}$ denotes the Gini coefficient of the conditional distribution of wealth given that the wealth, b_i denotes the bracket threshold, $F(b_1)$ the cumulative wealth distribution, and $\alpha_i$and a_i refers to equation (3) and (4). The bracket thresholds (b_i) are listed in thousands.

Year	1948	1949	1950	1951	1952	1953	1954	1955	1957	1958
$1-p$	0.79	0.79	0.77	0.89	0.67	0.65	0.65	0.62	0.66	0.63
b_1	5	5	5	20	1	1	1	1	1	1
$F(b_1)$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
α_1	0.53	0.53	0.52	1.08	0.19	0.19	0.18	0.11	0.00	0.00
a_1	5	5	5	20	1	1	1	1	1	1
b_2	10	10	10	30	6	6	6	6	6	6
$F(b_2)$	0.31	0.31	0.30	0.36	0.29	0.29	0.27	0.19	0.00	0.00
α_2	0.69	0.71	0.70	1.24	0.74	0.70	0.68	0.53	0.49	0.47
a_2	6	6	6	21	4	4	4	4	6	6
b_3	20	20	20	50	10	10	10	10	10	10
$F(b_3)$	0.57	0.58	0.57	0.66	0.51	0.51	0.49	0.38	0.22	0.21
α_3	1.13	1.12	1.11	1.42	1.33	1.23	1.16	0.82	0.73	0.76
a_3	9	9	9	24	6	6	6	6	7	7
b_4	30	30	30	100	15	15	15	15	15	15
$F(b_4)$	0.73	0.73	0.73	0.87	0.72	0.70	0.68	0.56	0.42	0.42
α_4	1.26	1.25	1.25	1.65	0.21	0.21	0.20	1.03	0.88	0.91
a_4	11	10	11	29	0	0	0	7	8	8
b_5	50	50	50	200	20	20	20	20	20	20
$F(b_5)$	0.86	0.86	0.86	0.96	0.73	0.72	0.70	0.67	0.55	0.55
α_5	1.44	1.45	1.48	1.65	0.27	0.27	0.25	1.13	0.93	0.97
a_5	13	13	14	29	0	0	0	8	8	9
b_6	100	100	100	300	25	25	25	25	25	25
$F(b_6)$	0.95	0.95	0.95	0.98	0.75	0.73	0.71	0.74	0.63	0.64
α_6	1.56	1.61	1.61	1.63	1.15	1.14	1.10	1.05	1.12	1.16
a_6	15	16	16	28	7	8	8	7	10	10
b_7	200	200	200	500	50	50	50	50	50	50
$F(b_7)$	0.98	0.98	0.98	0.99	0.89	0.88	0.87	0.88	0.83	0.84
α_7	1.63	1.72	1.59	1.61	1.45	1.48	1.43	1.39	1.38	1.41
a_7	17	19	15	27	11	12	12	11	14	14
b_8	300	300	300	700	100	100	100	100	100	100
$F(b_8)$	0.99	0.99	0.99	0.99	0.96	0.96	0.95	0.95	0.94	0.94
α_8	1.61	1.61	1.64	1.85	1.68	1.72	1.68	1.66	1.62	1.60
a_8	16	16	17	41	15	16	17	16	18	17
b_9	500	500	500	1000	200	200	200	200	200	200
$F(b_9)$	1.00	1.00	1.00	1.00	0.99	0.99	0.98	0.99	0.98	0.98
α_9	1.61	1.61	1.64	1.85	1.69	1.71	1.76	1.73	1.78	1.74
a_9	16	16	17	41	15	16	19	18	23	21
b_{10}	.	.	.	.	300	300	300	300	300	300
$F(b_{10})$	.	.	.	.	0.99	0.99	0.99	0.99	0.99	0.99
α_{10}	.	.	.	.	1.66	1.73	1.72	1.67	1.74	1.71
a_{10}	.	.	.	.	15	16	18	16	22	20
b_{11}	.	.	.	.	500	500	500	500	500	500
$F(b_{11})$	.	.	.	.	1.00	1.00	1.00	1.00	1.00	1.00
α_{11}	.	.	.	.	1.70	1.82	1.82	1.67	1.73	1.71
a_{11}	.	.	.	.	16	19	21	16	21	20
b_{12}	.	.	.	.	700	700	700	.	700	.
$F(b_{12})$	.	.	.	.	1.00	1.00	1.00	.	1.00	.
α_{12}	.	.	.	.	1.74	1.81	1.72	.	1.76	.
a_{12}	.	.	.	.	17	19	17	.	22	.
b_{13}	.	.	.	.	1000	1000	1000	.	1000	.
$F(b_{13})$	.	.	.	.	1.00	1.00	1.00	.	1.00	.
α_{13}	.	.	.	.	1.74	1.81	1.72	.	1.76	.
a_{13}	.	.	.	.	17	19	17	.	22	.

Note: G denotes the Gini coefficient, p denotes the proportion of families with larger wealth than the tax threshold, $\tilde{G}$ denotes the Gini coefficient of the conditional distribution of wealth given that the wealth, b_i denotes the bracket threshold, $F(b_1)$ the cumulative wealth distribution, and $\alpha_i$and a_i refers to equation (3) and (4). The bracket thresholds (b_i) are listed in thousands.

Year	1959	1960	1961	1962	1963	1964	1965	1966
$1-p$	0.63	0.61	0.60	0.58	0.56	0.54	0.55	0.55
b_1	1	1	1	1	1	1	1	1
$F(b_1)$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
α_1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
a_1	1	1	1	1	1	1	1	1
b_2	6	6	6	6	6	6	6	6
$F(b_2)$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
α_2	0.43	0.42	0.41	0.41	0.37	0.35	0.35	0.35
a_2	6	6	6	6	6	6	6	6
b_3	10	10	10	10	10	10	10	10
$F(b_3)$	0.20	0.19	0.19	0.19	0.17	0.16	0.16	0.16
α_3	0.68	0.68	0.66	0.63	0.61	0.56	0.56	0.57
a_3	7	7	7	7	7	7	7	7
b_4	15	15	15	15	15	15	15	15
$F(b_4)$	0.39	0.39	0.38	0.37	0.35	0.33	0.33	0.34
α_4	0.85	0.88	0.86	0.83	0.78	0.74	0.75	0.78
a_4	8	9	9	9	9	9	9	9
b_5	20	20	20	20	20	20	20	20
$F(b_5)$	0.52	0.52	0.51	0.51	0.48	0.46	0.46	0.47
α_5	0.92	0.95	0.93	0.93	0.88	0.86	0.86	0.94
a_5	9	9	9	9	9	10	10	10
b_6	25	25	25	25	25	25	25	25
$F(b_6)$	0.61	0.61	0.61	0.60	0.58	0.55	0.56	0.57
α_6	1.13	1.17	1.17	1.15	1.14	1.13	1.12	1.08
a_6	11	11	11	11	12	12	12	11
b_7	50	50	50	50	50	50	50	50
$F(b_7)$	0.82	0.83	0.82	0.82	0.81	0.80	0.80	0.80
α_7	1.41	1.39	1.41	1.43	1.43	1.43	1.40	1.38
a_7	15	14	15	15	16	16	16	16
b_8	100	100	100	100	100	100	100	100
$F(b_8)$	0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.92
α_8	1.72	1.72	1.67	1.71	1.71	1.70	1.69	1.67
a_8	21	20	20	21	21	22	22	22
b_9	200	200	200	200	200	200	200	200
$F(b_9)$	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
α_9	1.80	1.77	1.75	1.88	1.95	1.87	1.85	1.85
a_9	23	22	22	25	28	27	27	27
b_{10}	300	300	300	300	300	300	300	300
$F(b_{10})$	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
α_{10}	1.85	1.87	1.79	1.82	1.92	1.97	1.96	1.91
a_{10}	25	25	23	23	27	30	31	29
b_{11}	500	500	500	500	500	500	500	500
$F(b_{11})$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
α_{11}	1.85	1.87	1.79	1.82	1.92	1.97	1.96	1.91
a_{11}	25	25	23	23	27	30	31	29
b_{12}	.	.	.	.	.	.	.	.
$F(b_{12})$	.	.	.	.	.	.	.	.
α_{12}	.	.	.	.	.	.	.	.
a_{12}	.	.	.	.	.	.	.	.
b_{13}	.	.	.	.	.	.	.	.
$F(b_{13})$	.	.	.	.	.	.	.	.
α_{13}	.	.	.	.	.	.	.	.
a_{13}	.	.	.	.	.	.	.	.

Note: G denotes the Gini coefficient, p denotes the proportion of families with larger wealth than the tax threshold, $\tilde{G}$ denotes the Gini coefficient of the conditional distribution of wealth given that the wealth, b_i denotes the bracket threshold, $F(b_1)$ the cumulative wealth distribution, and $\alpha_i$and a_i refers to equation (3) and (4). The bracket thresholds (b_i) are listed in thousands.

Table A.4: Gini coefficients and associated variables

Year	Gini			Lower threshold		Use data from other years	With wealth below common threshold		Imputed from other years			Above common threshold in source[a]		
	Unadjusted data	Adjusted tabular data	Adjusted with common threshold	Mill. NOK	Mill. 1967 NOK		Population proportion	Wealth share	Population proportion	Wealth share	Gini	Population proportion	Mean wealth	Gini
1912	0.883	0.903	0.905	0.000	0.000	No	0.029	0.006	0.000	0.000	0.000	0.267	0.009	0.644
1920	0.999	0.999	0.919	0.300	0.595	Yes	0.000	0.000	0.250	0.725	0.576	0.003	0.880	0.457
1921	0.998	0.998	0.920	0.200	0.427	Yes	0.000	0.000	0.246	0.675	0.556	0.004	0.600	0.469
1922	0.998	0.998	0.924	0.200	0.507	Yes	0.000	0.000	0.245	0.669	0.568	0.004	0.589	0.464
1923	0.996	0.997	0.926	0.125	0.341	Yes	0.000	0.000	0.240	0.584	0.539	0.007	0.386	0.485
1924	0.996	0.996	0.924	0.125	0.310	Yes	0.000	0.000	0.237	0.601	0.531	0.007	0.380	0.479
1925	0.996	0.997	0.921	0.125	0.303	Yes	0.000	0.000	0.234	0.631	0.530	0.006	0.364	0.466
1926	0.997	0.997	0.924	0.125	0.359	Yes	0.000	0.000	0.233	0.635	0.543	0.006	0.359	0.456
1930	0.899	0.924	0.926	0.001	0.004	No	0.023	0.006	0.000	0.000	0.000	0.225	0.019	0.673
1938	0.965	0.972	0.903	0.020	0.068	Yes	0.000	0.000	0.191	0.267	0.377	0.083	0.045	0.657
1948	0.911	0.918	0.909	0.005	0.011	Yes	0.000	0.000	0.050	0.025	0.138	0.206	0.034	0.600
1949	0.907	0.915	0.905	0.005	0.011	Yes	0.000	0.000	0.049	0.025	0.138	0.213	0.034	0.596
1950	0.900	0.908	0.899	0.005	0.010	Yes	0.000	0.000	0.043	0.020	0.134	0.228	0.034	0.594
1951	0.943	0.946	0.892	0.020	0.035	Yes	0.000	0.000	0.180	0.182	0.234	0.105	0.066	0.484
1952	0.889	0.894	0.901	0.001	0.002	No	0.064	0.014	0.000	0.000	0.000	0.267	0.031	0.627
1953	0.883	0.888	0.895	0.001	0.002	No	0.069	0.014	0.000	0.000	0.000	0.277	0.032	0.621
1954	0.883	0.889	0.895	0.001	0.002	No	0.066	0.013	0.000	0.000	0.000	0.282	0.034	0.627
1955	0.853	0.862	0.866	0.001	0.002	No	0.049	0.008	0.000	0.000	0.000	0.332	0.033	0.597

Year	Gini			Lower threshold		Use data from other years	With wealth below common threshold		Imputed from other years			Above common threshold in source[a]		
	Unadjusted data	Adjusted tabular data	Adjusted with common threshold	Mill. NOK	Mill. 1967 NOK		Population proportion	Wealth share	Population proportion	Wealth share	Gini	Population proportion	Mean wealth	Gini
1957	0.857	0.860	0.860	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.335	0.038	0.582
1958	0.838	0.847	0.846	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.365	0.037	0.578
1959	0.834	0.840	0.839	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.370	0.038	0.566
1960	0.823	0.830	0.829	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.390	0.038	0.562
1961	0.818	0.827	0.826	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.401	0.039	0.567
1962	0.807	0.815	0.814	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.424	0.039	0.562
1963	0.796	0.803	0.803	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.444	0.040	0.555
1964	0.787	0.794	0.794	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.462	0.041	0.554
1965	0.794	0.801	0.801	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.450	0.042	0.558
1966	0.797	0.805	0.805	0.001	0.001	No	0.000	0.000	0.000	0.000	0.000	0.448	0.042	0.564
1967	0.779	.	0.779	0.005	0.005	No	0.005	0.001	0.000	0.000	0.000	0.471	0.038	0.531
1968	0.776	.	0.777	0.005	0.005	No	0.006	0.001	0.000	0.000	0.000	0.479	0.041	0.534
1969	0.773	.	0.774	0.005	0.005	No	0.006	0.001	0.000	0.000	0.000	0.493	0.044	0.542
1970	0.909	.	0.784	0.040	0.034	Yes	0.012	0.002	0.322	0.236	0.270	0.194	0.106	0.532
1971	0.895	.	0.784	0.040	0.032	Yes	0.014	0.002	0.299	0.205	0.259	0.214	0.109	0.514
1972	0.884	.	0.782	0.040	0.030	Yes	0.013	0.002	0.281	0.183	0.252	0.234	0.112	0.508
1973	0.877	.	0.786	0.040	0.028	Yes	0.015	0.002	0.261	0.162	0.243	0.247	0.117	0.507
1974	0.865	.	0.782	0.040	0.025	Yes	0.015	0.002	0.237	0.144	0.231	0.266	0.117	0.495
1975	0.876	.	0.802	0.040	0.023	Yes	0.002	0.000	0.216	0.147	0.221	0.231	0.126	0.465
1976	0.862	.	0.796	0.040	0.021	Yes	0.000	0.000	0.197	0.126	0.211	0.251	0.130	0.451

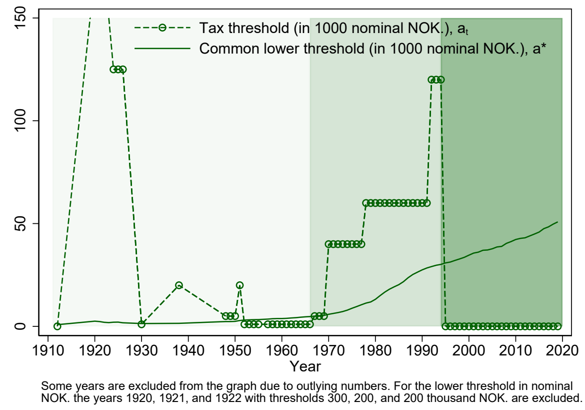
Year	Gini			Lower threshold		Use data from other years	With wealth below common threshold		Imputed from other years			Above common threshold in source[a]		
	Unadjusted data	Adjusted tabular data	Adjusted with common threshold	Mill. NOK	Mill. 1967 NOK		Population proportion	Wealth share	Population proportion	Wealth share	Gini	Population proportion	Mean wealth	Gini
1977	0.851	.	0.794	0.040	0.019	Yes	0.000	0.000	0.177	0.108	0.201	0.269	0.134	0.446
1978	0.885	.	0.803	0.060	0.026	Yes	0.000	0.000	0.230	0.180	0.238	0.197	0.175	0.416
1979	0.877	.	0.802	0.060	0.025	Yes	0.000	0.000	0.217	0.160	0.234	0.212	0.182	0.420
1980	0.870	.	0.806	0.060	0.023	Yes	0.000	0.000	0.192	0.136	0.222	0.226	0.189	0.425
1981	0.871	.	0.816	0.060	0.020	Yes	0.000	0.000	0.167	0.120	0.208	0.228	0.196	0.432
1982	0.865	.	0.818	0.060	0.018	Yes	0.000	0.000	0.147	0.104	0.197	0.236	0.200	0.429
1983	0.854	.	0.816	0.060	0.017	Yes	0.000	0.000	0.129	0.080	0.185	0.261	0.216	0.441
1984	0.848	.	0.816	0.060	0.016	Yes	0.002	0.000	0.116	0.062	0.176	0.282	0.237	0.461
1985	0.845	.	0.819	0.060	0.015	Yes	0.002	0.000	0.107	0.050	0.170	0.298	0.265	0.481
1986	0.841	.	0.820	0.060	0.014	Yes	0.001	0.000	0.095	0.040	0.159	0.309	0.290	0.487
1987	0.838	.	0.820	0.060	0.013	Yes	0.001	0.000	0.084	0.032	0.145	0.320	0.318	0.493
1988	0.836	.	0.821	0.060	0.012	Yes	0.001	0.000	0.074	0.026	0.136	0.329	0.347	0.502
1989	0.835	.	0.821	0.060	0.011	Yes	0.001	0.000	0.071	0.024	0.132	0.336	0.372	0.509
1990	0.835	.	0.824	0.060	0.011	Yes	0.001	0.000	0.063	0.020	0.125	0.336	0.391	0.510
1991	0.834	.	0.824	0.060	0.011	Yes	0.001	0.000	0.059	0.018	0.121	0.340	0.410	0.513
1992	0.825	.	0.795	0.120	0.021	Yes	0.001	0.000	0.130	0.051	0.217	0.325	0.510	0.460
1993	0.830	.	0.803	0.120	0.020	Yes	0.001	0.000	0.125	0.047	0.214	0.326	0.543	0.479
1994	0.834	.	0.809	0.120	0.020	Yes	0.001	0.000	0.121	0.044	0.212	0.326	0.570	0.491
1995	0.804	.	0.808	0.000	0.000	No	0.096	0.005	0.000	0.000	0.000	0.453	0.467	0.575
1996	0.807	.	0.811	0.000	0.000	No	0.092	0.005	0.000	0.000	0.000	0.452	0.489	0.581

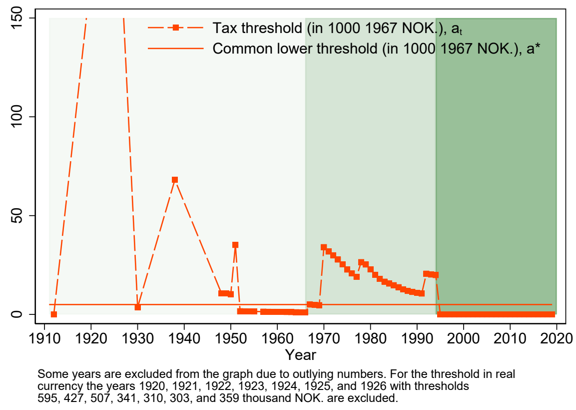
Year	Gini			Lower threshold		Use data from other years	With wealth below common threshold		Imputed from other years			Above common threshold in source[a]		
	Unadjusted data	Adjusted tabular data	Adjusted with common threshold	Mill. NOK	Mill. 1967 NOK		Population proportion	Wealth share	Population proportion	Wealth share	Gini	Population proportion	Mean wealth	Gini
1997	0.811	.	0.815	0.000	0.000	No	0.088	0.005	0.000	0.000	0.000	0.450	0.516	0.589
1998	0.827	.	0.830	0.000	0.000	No	0.085	0.004	0.000	0.000	0.000	0.454	0.600	0.625
1999	0.832	.	0.835	0.000	0.000	No	0.082	0.004	0.000	0.000	0.000	0.454	0.654	0.636
2000	0.832	.	0.834	0.000	0.000	No	0.080	0.003	0.000	0.000	0.000	0.457	0.707	0.638
2001	0.828	.	0.831	0.000	0.000	No	0.077	0.003	0.000	0.000	0.000	0.457	0.740	0.629
2002	0.832	.	0.834	0.000	0.000	No	0.075	0.003	0.000	0.000	0.000	0.446	0.764	0.628
2003	0.840	.	0.843	0.000	0.000	No	0.074	0.003	0.000	0.000	0.000	0.432	0.808	0.636
2004	0.850	.	0.852	0.000	0.000	No	0.071	0.003	0.000	0.000	0.000	0.420	0.870	0.649
2005	0.860	.	0.862	0.000	0.000	No	0.070	0.003	0.000	0.000	0.000	0.410	0.927	0.662
2006	0.860	.	0.862	0.000	0.000	No	0.068	0.002	0.000	0.000	0.000	0.422	1.070	0.673
2007	0.868	.	0.869	0.000	0.000	No	0.065	0.002	0.000	0.000	0.000	0.421	1.224	0.689
2008	0.869	.	0.871	0.000	0.000	No	0.066	0.002	0.000	0.000	0.000	0.420	1.307	0.692
2009	0.867	.	0.869	0.000	0.000	No	0.069	0.002	0.000	0.000	0.000	0.422	1.375	0.689
2010	0.858	.	0.859	0.000	0.000	No	0.070	0.002	0.000	0.000	0.000	0.439	1.492	0.679
2011	0.858	.	0.859	0.000	0.000	No	0.073	0.002	0.000	0.000	0.000	0.436	1.537	0.676
2012	0.855	.	0.856	0.000	0.000	No	0.074	0.002	0.000	0.000	0.000	0.439	1.585	0.672
2013	0.856	.	0.857	0.000	0.000	No	0.073	0.002	0.000	0.000	0.000	0.439	1.687	0.674
2014	0.858	.	0.859	0.000	0.000	No	0.074	0.001	0.000	0.000	0.000	0.441	1.799	0.681
2015	0.862	.	0.863	0.000	0.000	No	0.073	0.001	0.000	0.000	0.000	0.446	1.989	0.692
2016	0.861	.	0.862	0.000	0.000	No	0.078	0.001	0.000	0.000	0.000	0.455	2.151	0.698

Year	Gini			Lower threshold		Use data from other years	With wealth below common threshold		Imputed from other years			Above common threshold in source[a]		
	Unadjusted data	Adjusted tabular data	Adjusted with common threshold	Mill. NOK	Mill. 1967 NOK		Population proportion	Wealth share	Population proportion	Wealth share	Gini	Population proportion	Mean wealth	Gini
2017	0.862	.	0.863	0.000	0.000	No	0.076	0.001	0.000	0.000	0.000	0.458	2.266	0.701
2018	0.863	.	0.864	0.000	0.000	No	0.075	0.001	0.000	0.000	0.000	0.452	2.283	0.699
2019	0.861	.	0.862	0.000	0.000	No	0.073	0.001	0.000	0.000	0.000	0.461	2.388	0.701

a) The wealth share for this group is 1 for the years where the threshold for taxation is lower than the common threshold and one minus the wealth share for the group imputed from others years for years where the threshold for taxation is higher than the common threshold.
b) The computer files for 1967-1995 contain some households with recorded wealth below the threshold for taxable wealth even though only taxable wealth are suppose to be recorded. The wealth of these household is not included in the analysis.

Figure A.1: Common lower threshold



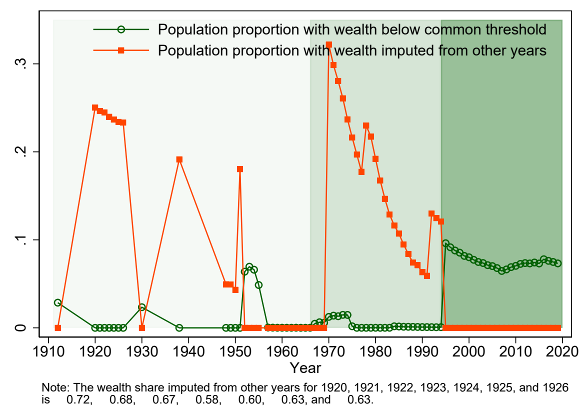


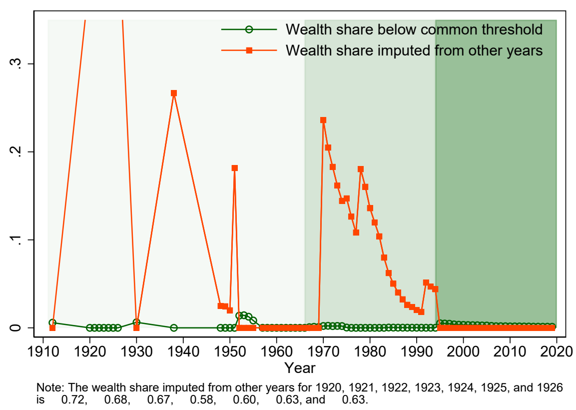
(a) The common lower threshold, nominal NOK

(b) The common lower thresholds, real NOK

Notes: Panel (a) and (b) show the tax threshold and the common lower threshold in real and nominal Norwegian Kroner (NOK), respectively.

Figure A.2: Population proportion and wealth share below the lower common threshold and imputed population proportion and wealth share above the lower common threshold



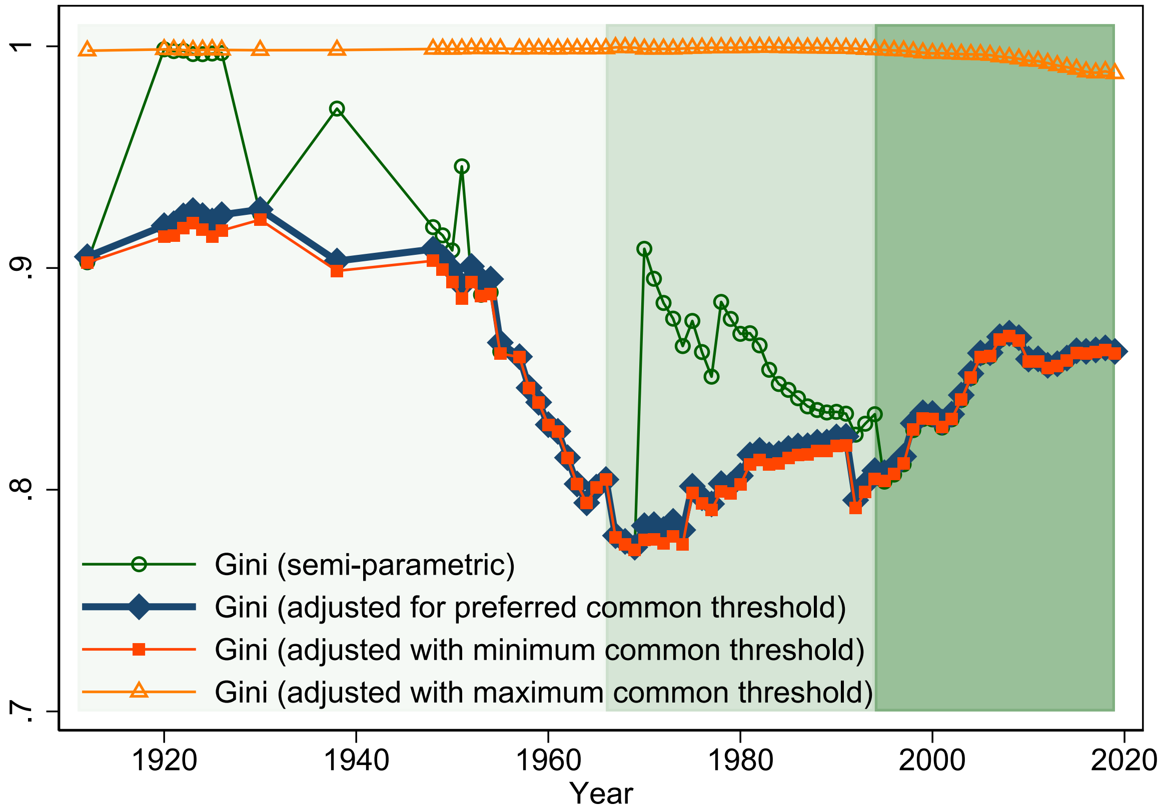


(a) Population proportion below common threshold and imputed population proportion above common threshold

(b) Wealth share below common threshold and imputed wealth share above common threshold

Notes: Panel (a) and (b) show the population proportion and wealth share below the preferred common threshold in the years where the tax threshold is lower than the preferred common threshold, and the population proportion and wealth share that is imputed from neighboring years in the years where the tax threshold is higher than the preferred common threshold.

Figure A.3: Adjusted Ginis - different common lower thresholds



Notes: The figure shows four series for the Gini coefficient calculated using four different common thresholds: (i) the lower wealth threshold in the sources, (ii) our preferred common threshold (5000 in 1967 NOK.), (iii) the minimum lower threshold in the tabulations (1048 in 1967 NOK from 1966) is used as a common threshold for all years, and (iv) the maximum lower threshold in the tabulations (594 548 1967 NOK from 1920) is used as a common threshold for all years. All series are calculated using the semi-parametric method presented in Section 3.2 for the tabular data.

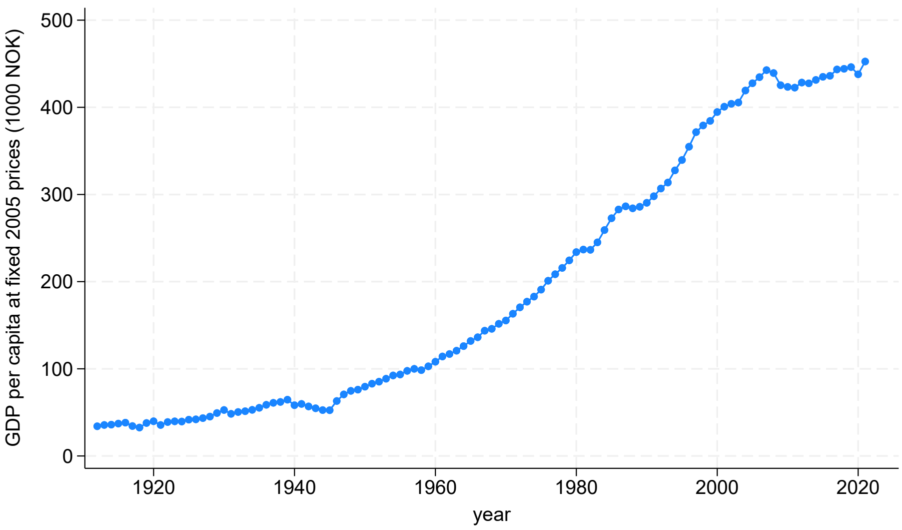
A.3 Other relevant time series

GDP per capita in Norway, 1912-2021. GDP per capita in Norway, in fixed 2005 prices, is presented in Figure A.4. The official Statistics Norway series of long-run GDP (available from https://www.ssb.no/a/kortnavn/hist_tab/ht-0901-bnp.html and covering the 1865-2011 period) has been supplemented by modern series for GDP in fixed 2015 prices (Statbank table 09189) and population (Statbank table 06913).

GDP per capita in fixed prices is used to assess economic growth, and is distinct from our use of national accounts data to estimate wealth inequality. That use of national accounts data is presented in Appendix E.

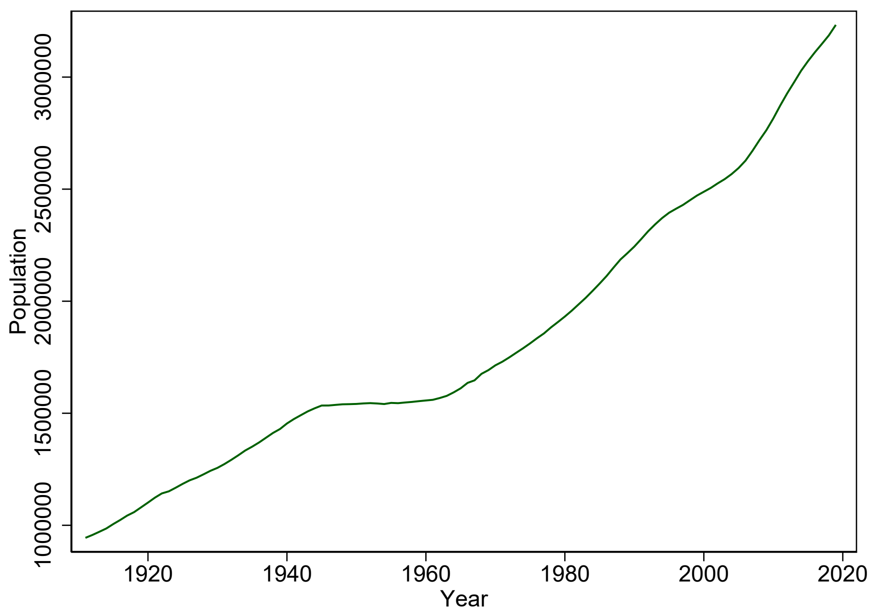
Population growth. The evolution of the population measure used in the estimation (individuals and married couples above 20 years of age) is illustrated in Figure A.5.

Figure A.4: GDP per capital in Norway, 1912-2021



Source: Statistics Norway

Figure A.5: Population (married couples and individuals above age 20), 1912-2019



B Sources

B.1 Taxable wealth

Net wealth at central government taxation

This asset concept is the basis for calculating the wealth tax to the state. The basis for the measurement of net wealth as given in the tax laws is given by the following statement: ”wealth is determined as the amount as of 1 January of the year the tax assessment is made, at regular prices constitute the real value of the taxable persons’ immovable wealth and outstanding accounts receivables after deducting debts”. In addition to this principle, there are a number of additional rules in the tax laws. The term ”current prices ” is not unique. In some cases the tax laws specify what is meant by ”current prices”. But normally the valuation must be characterized by discretion, since marked prices are absent. It is especially in the valuation of real assets that the term ”current prices” creates difficulties. It is generally acknowledged that the basis should be the prices that would be obtained from any sales. But often there is no market price. The tax authorities must therefore rely on other pricing concepts, for example cost or capitalized value when the return is taken into account. For some capital types, for example real estate, there is a general perception that wealth assets often are low compared to real sales values.

The tax assessed value of wealth also deviates from the market value because some asset types are subjected to explicit tax rebates. Details on the tax rebates can be found in Bjørneby et al. (2023).

Net wealth at municipal taxation

This asset concept is the basis for the assessment of wealth taxes to the municipality. The employment of net assets in municipal taxation is based on the same main rules as applies to net assets in the central government tax.

Table B.1: Sources of tabulated wealth data

Year	Source	Taxpayer categories	Number of taxpayers w/ positive wealth	Number of brackets	Include bracket wealth
1912	NOS VI.57, Table 3 page 41, 63, 101 and 117	MUN	282 807	10	No
1920	Stat Medd 1931, no 9 and 10, page 219	CG	2808	10	Yes
1921	Stat Medd 1931, no 9 and 10, page 219	CG	4580	10	Yes
1922	Stat Medd 1931, no 9 and 10, page 219	CG	4268	10	Yes
1923	Stat Medd 1931, no 9 and 10, page 219	CG	7893	11	Yes
1924	Stat Medd 1931, no 9 and 10, page 219	CG	8075	11	Yes
1925	Stat Medd 1931, no 9 and 10, page 219	CG	7617	11	Yes
1926	Stat Medd 1931, no 9 and 10, page 219	CG	6807	11	Yes
1929	NOS IX.47, page 64*	CG/MUN	312 432	6	No
1938	Stat Medd 1941, no 11 and 12, Table 3, page 329	CG	117 047	11	Yes
1948	NOS XI.72, Table V, page 326	CG	316 664	9	Yes
1949	NOS XI.116, Table VI , page 168	CG	327 497	9	Yes
1950	NOS XI.158, Table VI, page 252	CG	351 692	9	Yes
1951	NOS XI. 169, Table VI, page 250-253	CG	162 617	9	Yes
1952	NOS XI.199, Table IX, page 313 combined with HS1978, Table 313, page 570	CG/MUN	510 388	11	No
1953	NOS XI.230, Table IX, page 317 combined with HS1978, Table 313, page 570	CG/MUN	535 435	11	No
1954	NOS XI.259, Table VI, page 274 combined with HS1978, Table 313, page 570	CG/MUN	536 142	11	No
1955	HS1978, Table 313, page 570	CG/MUN	588 654	7	No
1957	NOS XII.18, Table 8 , page 44	CG/MUN	518 610	13	Yes
1958	NOS XII.38, Table 11 , page 48	CG/MUN	566 336	11	Yes
1959	NOS XII.67, Table 11 , page 48	CG/MUN	575 077	11	Yes
1960	NOS XII.95, Table 11 , page 36	CG/MUN	607 043	11	Yes
1961	NOS XII.125, Table 11 , page 48	CG/MUN	625 621	11	Yes
1962	NOS XII.154, Table 11 , page 36	CG/MUN	664 315	11	Yes
1963	NOS XII.182, Table 11, page 38	CG/MUN	700 212	11	Yes
1964	NOS XII.212, Table 11, page 40	CG/MUN	736 307	11	Yes
1965	NOS XII.226, Table 11, page 42	CG/MUN	725 309	11	Yes
1966	NOS A.251, Table 11, page 36	CG/MUN	733 598	11	Yes
1967-	Administrative microdata				

Notes: CG=Tax collected by the central government
MUN=tax collected by the municipalities
In NOS XI.199 (Table IX, page 313) the table heading states that the table includes wealth brackets and in the table it says income brackets are stated. We have controlled the numbers with the wealth brackets in HS1978, and concluded that it is wealth brackets.
The year 1938: Wealth between 5 000 and 20 00 NOK is only recorded in the source if the wealth holders also have income above a certain threshold. In the analysis we use 20 000 as the lower threshold for observation of wealth in the source, since the recording of wealth below this threshold is conditional on income. Source: NOS IX 165 Skattestatistikken for budsjettåret 1938/39

C Supplementary details on estimation methods

C.1 The non-parametric method

As explained in Section 3 the preliminary results for the evolution of the Gini coefficient displayed by Figure 2 is obtained by replacing the theoretical distribution function F by the average of the left and right continuous empirical distribution function $\hat{F}$; i.e.

$$\hat{G} = \frac{1}{\hat{\mu}} \int \hat{F}(x)\left(1-\hat{F}(x)dx\right) = \frac{1}{\hat{\mu}} \sum_{i=1}^{s-1} \left(\frac{\hat{F}(b_i)+\hat{F}(b_{i+1})}{2}\right)\left(1-\frac{\hat{F}(b_i)+\hat{F}(b_{i+1})}{2}\right)(b_{i+1}-b_i), \tag{C1}$$

where $\hat{\mu} = \sum_{i=1}^{s-1}\left(1-\frac{\hat{F}(b_i)+\hat{F}(b_{i+1})}{2}\right)(b_{i+1}-b_i)$ and we assume that $F(b_s)$ =1 for the cases where the top bracket is open.

The conditional distribution F_i^* of Y given that $b_i \le Y \le b_{i+1}$ is given by

$$F_i^*(y) = Pr(Y \le y \mid b_i \le Y \le b_{i+1}) = \frac{F(y)-F(b_i)}{F(b_{i+1})-F(b_i)}, \quad b_i \le y \le b_{i+1}$$

Then the mean of bracket i is given by

$$\hat{\mu}_i^* = \int_{b_i}^{b_{i+1}} y dF_i^*(y) = -y(1-F_i^*(y)) \overset{[}{b_i}]b_{i+1}| + \int_{b_i}^{b_{i+1}} (1-F_i^*(y))dy$$

$$= b_i + \int_{b_i}^{b_{i+1}} (1-F_i^*(y))dy = b_i + \frac{1}{F(b_{i+1})-F(b_i)} \int_{b_i}^{b_{i+1}} (F(b_{i+1})-F(x))dx$$

$$= b_i + \frac{1}{F(b_{i+1})-F(b_i)}\left[F(b_{i+1})(b_{i+1}-b_i) - \frac{F(b_i)+F(b_{i+1})}{2}(b_{i+1}-b_i)\right] = \frac{b_i+b_{i+1}}{2}$$

C.2 The derivative of the Lorenz curve associated with the semi-parametric method

It follows by straightforward derivation of equation 6 that the Lorenz curve and its derivative are given by

$$\frac{dL(u)}{du} = \frac{F^{-1}(u)}{\mu} = \begin{cases} 0, \quad if \;\; u < 1-p \\ \frac{a_i}{\mu}(1-u)^{-\frac{1}{\alpha_i}}, \quad if \;\; 1-(\frac{a_i}{b_i})^{\alpha_i} \le u \le 1-(\frac{a_i}{b_{i+1}})^{\alpha_i}, i = 1,2,...,s-1 \\ \frac{a_s}{\mu}(1-u)^{-\frac{1}{\alpha_s}}, \quad if \;\; 1-(\frac{a_s}{b_s})^{\alpha_s} \le u \le 1, \end{cases} \tag{C2}$$

which means that the Lorenz curve for F exhibits an approximately linear shape for smaller u and and a strict convex curvature for larger u. Note that we have assumed that $\alpha_s = \alpha_{s-1}$.

C.3 The bracket-specific distribution associated with the semi-parametric method

The purpose of this sub-section is to evaluate the performance of the semi-parametric method introduced in Section 3.1 for years wherewith information on bracket-specific wealth means. The wealth means are not used for estimating the unknown parameters of the bracket-specific parametric distributions.The method defined by equations (1) - (5) will be used to predict the mean of each bracket. Next, the predicted means will be compared with the observed means.

C.3.1 Calculating wealth means from the semi-parametric method

The bracket-specific means can be derived from the semi-parametric distribution (5) in Section 3.1, which we for convenience also include below

$$F(y) = \begin{cases} 1-p & \text{if } 0 \leq y \leq b_1 \\ 1-(a_i/y)^{\alpha_i} & \text{if } b_i < y \leq b_{i+1}, i = 1,2....,s-1 \\ 1-(a_s/y)^{\alpha_s} & \text{if } b_s \leq y. \end{cases} \tag{C3}$$

Then the conditional distribution F_i^* of Y given that $b_i \leq Y \leq b_{i+1}$ is given by

$$F_i^*(y) = Pr(Y \leq y \mid b_i \leq Y \leq b_{i+1}) = \frac{F(y)-F(b_i)}{F(b_{i+1})-F(b_i)},\ b_i \leq y \leq b_{i+1}. \tag{C4}$$

Inserting for (C3) in (C4) yields distribution of wealth for bracket i,

$$F_i^*(y) = \frac{\left(\frac{a_i}{b_i}\right)^{\alpha_i} - \left(\frac{a_i}{y}\right)^{\alpha_i}}{\left(\frac{a_i}{b_i}\right)^{\alpha_i} - \left(\frac{a_i}{b_{i+1}}\right)^{\alpha_i}} = \frac{b_i^{-\alpha_i} - y^{-\alpha_i}}{b_i^{-\alpha_i} - b_{i+1}^{-\alpha_i}},\ b_i \leq y \leq b_{i+1}. \tag{C5}$$

Thus, by straightforward calculation we get the following expression for the mean (μ_i^*) of the distribution F_i^*,

$$\mu_i^* = \left(\frac{\alpha_i}{\alpha_i - 1}\right)\left(\frac{b_i^{1-\alpha_i} - b_{i+1}^{1-\alpha_i}}{b_i^{-\alpha_i} - b_{i+1}^{-\alpha_i}}\right),\ i = 1,2,...,s. \tag{C6}$$

As $b_{s+1} \to \infty$ note that

$$\mu_s^* = \left(\frac{\alpha_s}{\alpha_s - 1}\right) b_s. \tag{C7}$$

C.3.2 Comparing predicted and observed bracket-specific means

In our baseline estimate, we do not use the information on group averages, as it is not available for all years. However, we can use the information of group averages from the years in which it is available to assess how well our method works in predicting group mean wealth.

Table C.1 shows bracket specific predicted means as shares of observed bracket means. Overall, the predicted means reproduce the observed means pretty well. However, since the top brackets in 1920 and 1938 emerge as exceptions where the semi-parametric method fails to reproduce the means we have re-estimated α_s of expression C7 and a_s defined by (4) in these two cases by including the observed means as part of the data basis. The resulting re-estimated Gini coefficient for 1920 does only slightly change , while the Gini coefficient for 1938 declines by 2 per centage points from 0.97 to 0.95.

Table C.2 shows bracket means predicted by the non-parametric method as shares of observed bracket means. By comparing Table C.1 and Table C.2, we see that the semi-parametric method performs better than the non-parametric method for 253 of the 261 brackets.

Table C.1: Bracket-specific means predicted by the semi-parametric method displayed as shares of observed bracket-specific means

Year	Bracket												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1920	0.99	1.00	1.00	1.01	1.01	0.97	0.99	1.03	0.92	1.81	.	.	.
1921	1.00	1.00	0.99	1.00	1.05	0.96	0.99	0.97	0.99	1.09	.	.	.
1922	0.99	1.01	0.98	0.97	1.03	0.97	1.03	1.03	11.79	.	.	.	.
1923	0.99	0.99	1.00	0.99	1.00	1.06	1.00	1.01	0.98	5.04	.	.	.
1924	1.00	1.00	1.00	1.00	0.99	1.00	1.01	0.99	5.93	.	.	.	.
1925	1.01	0.99	1.00	0.97	0.99	1.00	0.94	0.92	5.68	.	.	.	.
1926	0.98	0.99	0.99	1.00	1.01	1.02	0.97	6.47	.	.	.	.	.
1938	1.06	0.88	1.00	1.00	1.01	1.00	1.00	1.00	1.01	1.01	1.49	.	.
1948	1.05	1.02	1.02	1.01	1.00	1.01	1.00	1.00	1.14	.	.	.	.
1949	1.05	1.03	1.02	1.01	0.99	1.00	1.00	1.00	1.12	.	.	.	.
1950	1.04	1.02	1.01	1.01	0.99	1.00	1.00	1.01	1.09	.	.	.	.
1951	1.02	1.01	1.00	1.00	1.00	1.00	1.00	1.01	0.88	.	.	.	.
1952	.	.	.	.	.	0.98	1.00	0.99	1.00	1.01	0.99	1.00	0.98
1953	.	.	.	.	.	0.98	0.99	1.00	1.00	1.01	0.99	1.00	0.90
1954	.	.	.	.	.	0.99	0.98	1.00	1.00	1.01	1.00	1.01	1.00
1957	0.87	1.05	1.04	1.03	1.03	1.00	1.00	1.00	1.00	1.01	1.06	1.00	0.90
1958	1.10	1.05	1.04	1.03	1.03	1.00	0.99	0.99	1.00	1.00	1.05	.	.
1959	0.96	1.05	1.04	1.03	1.03	1.00	0.99	1.00	1.00	1.00	0.95	.	.
1960	1.08	1.04	1.04	1.03	1.03	1.00	1.00	0.99	1.00	1.01	0.95	.	.
1961	1.03	1.04	1.04	1.03	1.03	1.00	1.00	1.00	1.00	1.00	1.00	.	.
1962	1.04	1.04	1.04	1.03	1.03	1.00	0.99	0.99	1.00	1.01	1.00	.	.
1963	1.25	1.05	1.04	1.03	1.03	1.00	1.00	0.99	1.00	1.00	0.94	.	.
1964	0.84	1.04	1.04	1.03	1.02	1.00	1.00	1.00	1.00	1.00	0.89	.	.
1965	0.92	1.05	1.04	1.03	1.03	1.00	1.00	0.99	1.00	1.00	0.91	.	.
1966	0.91	1.05	1.04	1.03	1.02	1.01	0.99	0.99	1.00	1.00	0.94	.	.
1967	0.76	1.04	1.04	1.03	1.02	1.01	1.00	1.00	1.00	1.00	1.00	1.00	0.97

Notes: Note that the numbering of the brackets only refers to their ordering in the tabulations and that brackets with the same number may have different bracket boundaries. Data for the four lowest brackets for 1952-1954 are missing as these brackets are formed on the basis of combining one bracket of the original tabulations with bracket-specific information from 1957, see Appendix C.4 for further details.

Table C.2: Bracket-specific means predicted by the non-parametric method displayed as shares of observed bracket-specific means

Year	Bracket												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1920	1.04	1.10	1.11	1.05	1.07	1.10	1.03	1.05	0.93	0.98	.	.	.
1921	1.17	1.10	1.10	1.04	1.11	1.09	1.04	0.98	1.01	1.05	.	.	.
1922	1.16	1.11	1.08	1.00	1.10	1.09	1.06	1.05	.	.	.	.	.
1923	1.03	1.16	1.10	1.10	1.04	1.12	1.14	1.05	1.00	.	.	.	.
1924	1.04	1.17	1.10	1.10	1.02	1.06	1.14	1.02	.	.	.	.	.
1925	1.06	1.17	1.11	1.07	1.03	1.07	1.07	0.95	.	.	.	.	.
1926	1.03	1.17	1.10	1.11	1.04	1.10	1.10	.	.	.	.	.	.
1938	1.14	1.25	1.09	1.03	1.02	1.03	1.05	1.10	1.12	1.12	0.73	.	.
1948	1.11	1.10	1.05	1.06	1.10	1.11	1.04	1.06	0.52	.	.	.	.
1949	1.11	1.10	1.05	1.06	1.09	1.11	1.04	1.06	0.51	.	.	.	.
1950	1.11	1.09	1.04	1.06	1.10	1.10	1.04	1.07	0.51	.	.	.	.
1951	1.05	1.06	1.10	1.11	1.04	1.06	1.02	1.04	0.49	.	.	.	.
1952	.	.	.	.	.	1.07	1.10	1.10	1.04	1.07	1.02	1.03	0.50
1953	.	.	.	.	.	1.07	1.09	1.11	1.04	1.07	1.02	1.03	0.48
1954	.	.	.	.	.	1.08	1.08	1.11	1.04	1.07	1.03	1.04	0.50
1957	1.09	1.08	1.07	1.04	1.03	1.09	1.09	1.11	1.04	1.07	1.08	1.03	0.46
1958	1.38	1.08	1.06	1.04	1.04	1.09	1.09	1.09	1.04	1.06	0.52	.	.
1959	1.21	1.08	1.06	1.04	1.04	1.09	1.09	1.11	1.04	1.07	0.52	.	.
1960	1.35	1.08	1.06	1.04	1.03	1.09	1.10	1.10	1.04	1.07	0.53	.	.
1961	1.29	1.07	1.06	1.04	1.03	1.09	1.10	1.11	1.04	1.06	0.53	.	.
1962	1.31	1.08	1.06	1.04	1.03	1.09	1.09	1.10	1.04	1.07	0.54	.	.
1963	1.56	1.08	1.06	1.04	1.04	1.08	1.10	1.10	1.04	1.07	0.54	.	.
1964	1.05	1.07	1.06	1.04	1.03	1.08	1.10	1.11	1.04	1.07	0.53	.	.
1965	1.15	1.08	1.06	1.04	1.03	1.09	1.10	1.10	1.04	1.07	0.54	.	.
1966	1.15	1.08	1.06	1.04	1.03	1.10	1.09	1.10	1.04	1.07	0.54	.	.
1967	0.96	1.07	1.06	1.04	1.03	1.09	1.10	1.11	1.04	1.06	1.03	1.03	0.52

Notes: Note that the numbering of the brackets only refers to their ordering in the tabulations and that brackets with the same number may have different bracket boundaries. Data for the four lowest brackets for 1952-1954 are missing as these brackets are formed on the basis of combining one bracket of the original tabulations with bracket-specific information from 1957, see Appendix C.4 for further details.

C.4 The treatment of wide lower brackets

To reduce the uncertainty associated with the broad lower bracket in 1952-55 we take advantage of the fact that the wide 1952-55 bracket is divided into several brackets in 1957. To this end, the proportions of the population located in the wide wealth interval for 1952-55 have been allocated in accordance with the more detailed distribution in 1957.

Figure C.1 displays the estimated household wealth distribution based on the non-parametric and semi-parametric estimators from the sources for 1955 and 1957. The dots show the bracket thresholds from the original tabulations (on the horizontal axis) as well as the cumulative population shares across the groups (on the vertical axis).

First, note the large difference in the width of the poorest bracket (the vertical difference between the first two bracket threshold markers) between the two years. The lower threshold for taxation is the same in two years (1000 kr.). However, the upper threshold for the poorest bracket is a lot higher in 1955 than in 1957 (24 000 vs. 5000 kr.). The lower bracket in 1955 cover the five lowest brackets in 1957.

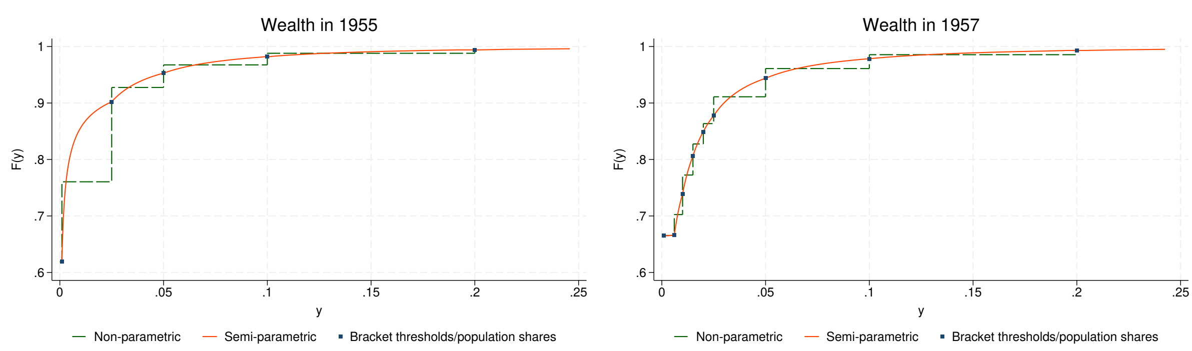
Second, note how the wide poorest bracket in 1955 causes a large difference between the calculated household wealth depending on what estimator is used. This creates a much larger difference between the Gini coefficient based on non-parametric estimator and the Gini coefficient based on the semi-parametric estimator in 1955 than in 1957.

Third, note how the wide lower bracket in 1955 causes the calculated household wealth for the population in the poorest bracket to be a lot higher in 1955 than in 1957 when using the non-parametric estimator. This leads to a lower Gini coefficient in 1955 than in 1957 when using the non-parametric estimator.

Fourth, note how the wide lower bracket in 1955 causes the calculated household wealth for the population in the poorest bracket to be a lot lower in 1955 than in 1957 when using the semi-parametric estimator. This leads to a higher estimated for the Gini coefficient using the semi-parametric estimator in 1955 than in 1957.

We still choose the semi-parametric estimator as our main method as it better approximates the true bracket totals for the most common tabulation formats, as displayed in Appendix C.3.2,

Figure C.1: Distribution of household wealth assessed by two alternative estimation methods



and it allows for decomposition without further assumptions.

C.5 Accounting for bottom-censored wealth data

The following appendix explains how the common lower threshold introduced in Section 3.3 is implemented. Both in years where the year tax threshold is higher and lower than the common lower threshold we continue to base our method on expressions (6) and (7) in Section 3.2. However, we redefine p to be the proportion of household with larger wealth than the common lower threshold (b_1) rather then the yearly tax threshold (b_{1t}).

In years where the true tax threshold (b_{1t}) is lower than the chosen common lower threshold (b_1), $b_{1t} < b_1$, wealth below the common threshold is set equal to zero. Analytically, the new p is calculated by inserting b1 into equation (5) using α_i and a_i from the interval including b_1. Further, only wealth above the b_1 is included in expressions (6) and (7).

Imputation framework. In years where the true tax threshold is higher than the common lower threshold, $b_{1t} > b_1$, the missing segment above the common threshold is imputed from neighboring years in the following manner: Let the population without wealth $(x = 0)$ be group 0, the missing segment above the common threshold $(b_1 \leq x < b_{1t})$ be group 1, and the observed segment above the threshold for taxation $(b_{1t} \leq x)$ be group 2. Since the three groups do not overlap, we can assess the associated Gini coefficient on the basis of expressions (6) and (7). In the following it is helpful to keep in mind that both expressions (6) and (7) are weighted sums over the wealth intervals that make up the wealth distribution, and that group 1 may consist of one or more intervals.

The parameters α_i and a_i for the intervals in group 1 and p are not observed in year t and will be imputed from the closest preceding and subsequent year to year t. In this setting p equals the sum of the population share of group 1 and group 2. To find the population share in group 1 we insert b_1 and b_{1t} in expression (5). We use α_i and a_i from the intervals that include b_1 and b_{1t}, respectively, from the closest neighboring years, say year k. Further, we introduce group 1 in expressions (6) and (7) by using the parameters from year k for the intervals included in group 1. We combine estimates from preceding and subsequent years by weighing the populations share in group 1, and the intervals in group 1 in expressions (6) and (7) by the relative distance to year t. [35]

To relax the linearity assumption underlying the interpolation between the closest preceding and subsequent year, we divide the missing segment, group 1, into sub-groups if this increases the proximity between the observed years and year t. Hence, the parameters for the sub-group with wealth between some threshold $\hat{b}$ and b_{1t}, where $b_1 < \hat{b} < b_{1t}$, are measured in year $t+d$ if year $t+d$ is the closest year to year t where this sub-group is observed. The parameters for

[35] Specifically, let year $t - d^{pre}$ be the last year prior to year t where group 1 is observed, and let year $t + d^{post}$ be the first year after year t where group 1 is observed, then we weight the estimates from preceding years with $\frac{d^{pre}}{d^{post}+d^{pre}}$ and the estimates from subsequent years $\frac{d^{post}}{d^{post}+d^{pre}}$.

the remaining sub-groups of group 1, from b_1 to $\hat{b}$, are accordingly measured in the year closest to year t where they are observed.

Implementation for register data. From 1967 onwards non-parametric estimates of missing segments are based on microdata from neighboring years. The estimate of the overall Gini coefficient is obtained by piecing together the Gini estimates for the missing segments (for some cases only one segment) with the Gini coefficient of the observed data for the year in question.

C.6 Breaks in the long-run series

After making the adjustments described in Appendix C3 and C4 there are still some jumps in the series which we don't find to reflect real economic changes. Between 1954 to 1955 our estimates show a large change from 0.895 to 0.866; between 1966 and 1967 from 0.805 to 0.784, from 1974 to 1975 from 0.783 to 0.803, and from 1991 to 1992 a change from 0.824 to 0.795.

The change from **1954 to 1955** comes during a period when the wealth Gini coefficient is rapidly decreasing. That the change between these two years is larger than later years is likely due to better measurement of wealth in the lower parts of the distribution starting in 1955.

The decrease in the estimated Gini coefficient from **1966 to 1967** is probably connected to an improved measurement of low-wealth categories, since this is the first year with microdata. The data shows an increase in the population share with wealth above the common threshold and a decrease in the mean wealth above the common threshold. The change in the estimated Gini coefficient is not in itself driven by a change in our source material from tabular data in 1966 to microdata in 1967; re-calculating 1967 based on tabular data shows the same change. We cannot see that the change in the lower tax threshold from 1966 to 1967 would lead to this change, as both thresholds are lower than the applied common wealth threshold .

The change from **1974 to 1975** is likely connected to the doubling of the standard deduction of "savings capital" (sparekapital) (Statistics Norway, 1979) . The doubling of the deduction would have led to a reduction in the measured wealth of those with relatively low wealth. This is consistent with an increase in the estimated Gini coefficient.

Between **1991 and 1992** there are several major changes in the tax valuation of some wealth objects that affect the tax base and lead to a jump in the estimated Gini coefficient. The standard deduction for savings capital and life insurance was removed (Statistics Norway, 1994b); the valuation of stocks was reduced as a part of the 1992 tax reform, and the standard deduction for financial capital was removed. There was also a change in the tax threshold, but this change is corrected for by use of a common lower threshold. Statistics Norway acknowledge in later publications that these change weakens the comparability of official wealth statistics before and after 1992.

D The relationship between the evolution of income and wealth inequality

As is well known, wealth distributions will normally exhibit considerably higher inequality than income distributions, even when measurement of income is restricted to market income. This means that a Gini coefficient of 0.6 would be seen as expressing a high level of inequality for the distribution of market income, while, perhaps to the surprise of many readers, it would express a relatively low level of inequality for the distribution of wealth.

Figure D.1 compares the evolution of our preferred estimate of wealth inequality to the evidence of the evolution of income inequality in Norway provided by Aaberge et al. (2020). The figure shows that there are both similarities and differences in the changes over time in income and wealth inequality. Both income and wealth inequality were relatively high before the Second World War (WWII). While income inequality started to decrease at the beginning of WWII, wealth inequality maintained its extreme levels until the mid-1950s. The turning point with increasing Gini coefficient for the wealth distribution occurred in the early 1970s, while the turning point for income inequality arose 15-20 years later. Moreover, estimates of current wealth inequality are closer to the high initial levels than estimates of current income inequality. Aaberge et al. (2020) characterized the evolution of income inequality in Norway by a series of episodes, which is summarized in Table D.1 along with a summary of the corresponding changes in wealth inequality.

Income inequality was shown to be very high before the Second World War and actually similar to the levels associated with South American countries today. For income, the largest reduction in inequality took place from 1940 to 1953. As indicated by Aaberge et al. (2020), the reduction in income inequality during the Second World War was partly a result of the German occupier's command economy with restricted profit opportunities for most capital owners and increased labor demand for extensive construction projects and subsequent larger mean income for the bottom half of the population. The strict economic planning regime introduced during the early post-war period lead to further equalization of the distribution of income and contributed to stable low inequality during the late 1950's and 1960's, while the equalizing effect on wealth inequality first became visible in the mid-1950s.

The turning point with increasing income inequality in the late 1980s was primarily a result of increased wage inequality triggered by the oil sector (Aaberge and Mogstad, 2011). The significant rise in income inequality in the late 1990s and the first decade of the new millennium was however driven by increased capital incomes at the top of the income distribution, and might partly be considered as delayed effects of a major financial market reform in the mid-1980s that gave expanded opportunities to borrow and earn money, and partly as an effect of the 1992 tax reform where taxes on capital incomes were significantly reduced. Thus, while changes in the income share of the top 1 per cent had a modest effect on the fall in overall income inequality during the equalization period, the rise in income inequality after 1990 has

Table D.1: Changes in the overall Gini coefficient (G), the share of the top 1 per cent and the Gini coefficient of the remaining 99 per cent for distributions of income and wealth. Percentage points

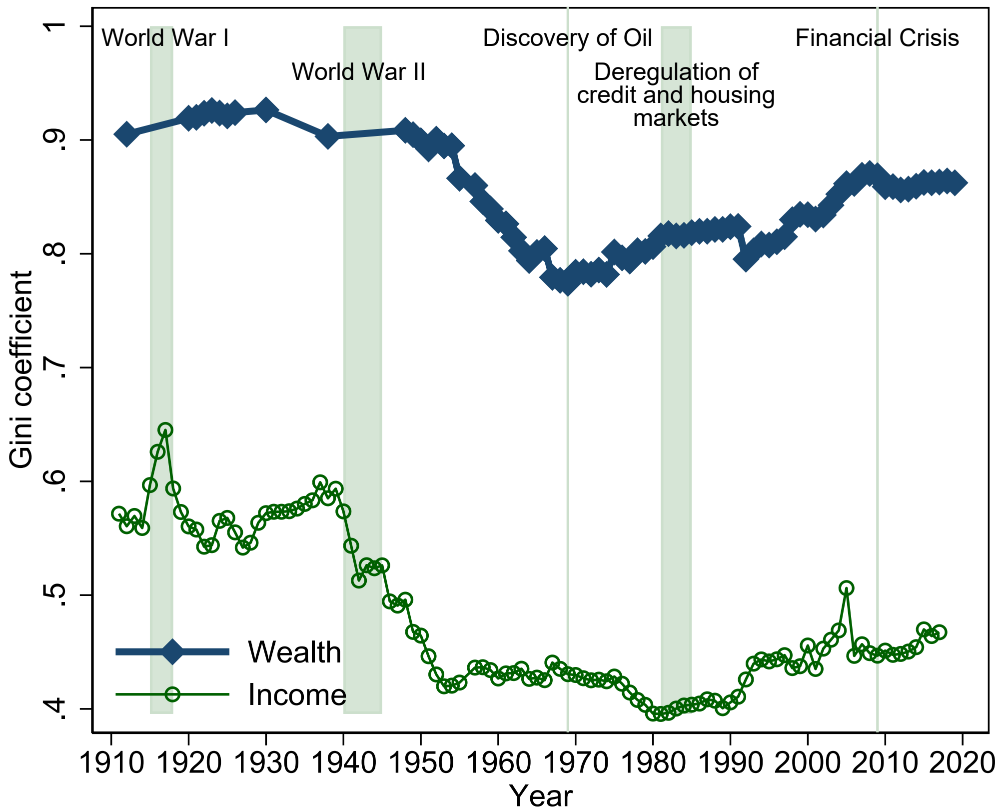
Period $t-s$	Overall Gini coefficient $G_t - G_s$		Wealth share of the top 1% $P_t - P_s$		Gini coefficient for the 99% $G_{99,t} - G_{99,s}$	
	Income	Wealth	Income	Wealth	Income	Wealth
1912-1938	Small increase (2.5)	Insignificant decrease (-0.2)	Decrease (-5.4)	Increase (7.1)	Increase (6.1)	Small decrease (-2.3)
1938-1953	Significant decrease (-16.5)	Insignificant decrease (-0.8)	Decrease (-5.9)	Significant decrease (-11.3)	Significant decrease (-14.8)	Small increase (1.6)
1953-1980	Small decrease (-2.4)	Significant decrease (-8.8)	Small decrease (-1.8)	Significant decrease (-13.1)	Small decrease (-1.4)	Significant decrease (-8.7)
1980-2017	Increase (7.2)	Increase (5.7)	Increase (6.1)	Significant increase (17.6)	Small increase (3.7)	Small increase (2.4)

primarily been a result of the increased income shares for the richest capital owners which has carried over to a rise in the wealth share of the top 1 percent as well as a rise in overall wealth inequality.[36]

Figure D.1 and Table D.1 show that there is co-movement between the Gini coefficients for the distributions of wealth and income over the recent three decades, whereas for earlier periods inequality in the distributions of income and wealth has moved differently.

[36]Note that the dramatic fall in tax assessed income inequality in 2006 is solely due to changes in the income reporting behavior of business owners as a response to the introduction of taxes on dividends in 2006. This tax reform gave owners of small and medium-sized enterprises strong incentives to reduce dividends and save most of the the profit in holding companies. Analyses of the effects of the reform, discussed by Aaberge et al. (2013), Alstadsæter et al. (2017) and Aaberge et al. (2020), show that top income shares and the level of income inequality have been significantly larger after dividend taxation was implemented in 2006 than what has been reported by official income statistics.

Figure D.1: Evolution of the Gini coefficient for distributions of tax assessed income and wealth, 1912 - 2018



Notes: The figure provides a comparison of the Gini coefficients for tax assessed wealth and income (Aaberge et al., 2020).

E Estimating housing wealth

E.1 Housing and non-housing wealth in 1969 and 1995

Table E.1 shows the values used in interpolation of housing wealth, as described in Section 5.2. The upper panel shows estimated wealth for each at the steps used to arrive at estimated total wealth, while the lower panel shows the factor shares and interaction components used in the decomposition in the two years.

E.2 Interpolating housing wealth between 1969 and 1995

The first step of the interpolation method in Section 5 calculates decompositions of housing and non-housing wealth for 1969 and 1995. This section explains in more detail how other information is used to interpolate these values in the intervening period. For this interpolation, we have to anchor the estimated parameters for 1969 and 1995 to other values for which we have annual information.

First, we define two ratios R_N and R_H between the interaction components γ and the overall Gini coefficient G from the estimates based on tax wealth only:

$$R_N = \gamma_N / G \tag{C8}$$

$$R_H = \gamma_H / G \tag{C9}$$

Second, to interpolate housing shares, the ratio of the two wealth shares (housing and non-housing) are anchored in separate growth indices for non-housing wealth and housing wealth as it is measured annually. Non-housing wealth is interpolated using total tax assessed wealth, while total housing wealth is interpolated using the house price index multiplied by the population size with the base level of the housing price index chosen so the value of $R_S$in 1969 is set to 100. We denote this ratio

$$R_S = \frac{TotalTaxAssessedWealth}{HousePriceIndex * HouseVolume} / \frac{\mu_N}{\mu_H} \tag{C10}$$

The values are shown in Table X.

We linearly interpolate these three parameters between 1969 and 1995. As is evident from the table, there is very low discrepancy in the table for R_N and $R_H-$the values are similar at the start and end of the period, so the choice of interpolation is not of large consequence. For R_S, the difference is more substantial. As we can only account for housing values in 1969 and 1995 and no way of doing this for the intermediate period, we are left with interpolation as our only possible approach.

Table E.1: Estimates of total and housing wealth, as well as housing shares and inequality components, 1969 and 1995. Million NOK

		1969	1995	
Combining housing and non-housing wealth				
1	Estimated market value of housing	76439	1038327	
2	Total tax-assessed wealth	36464	506327	wealth below the common threshold from Section 3 is set to zero
3	- tax-assessed housing value	19110	259582	25% of estimated market value (Row 1)
4	= Estimated non-housing wealth	17354	246745	
5	Estimated total wealth	93793	1285072	Row 1 + Row 4
Interpolating housing wealth using a decomposition method				
6	Non-housing factor share	0.185	0.192	
7	Non-housing interaction component	0.855	0.932	
8	Housing factor share	0.815	0.808	
9	Housing interaction component	0.498	0.512	
10	Estimated Gini coefficient	0.564	0.593	See equation (11)

Table E.2: Parameters used for interpolating housing wealth

		1969	1995
Ratio of non-housing interaction component to wealth Gini coefficient	R_N	1.10	1.154
Ratio of housing interaction component to wealth Gini coefficient	R_H	0.64	0.634
Ratio of growth in tax assessed wealth to growth in housing values	R_S	100.00	125.07

Using these ratios, we then again get the annual interpolated values for interaction components and wealth ratio:

$$\gamma_N = R_N G \tag{C11}$$

$$\gamma_H = R_H G \tag{C12}$$

$$\frac{\mu_N}{\mu_H} = \frac{TotalTaxAssessedWealth}{HousePriceIndex * HouseVolume}/R_S \tag{C13}$$

We then get the interpolated total Gini from Equation (11).

E.3 Estimate of total wealth

For the purpose of the calculations in Section 5.1, we also need an estimate of total wealth including housing. For the purpose of this exercise, we assume that the tax assessed value of housing is 25% of total wealth in the reference series from Section 3 for the entire period. We divide by total population to get an estimated average non-housing wealth share $\tilde{\mu_N}$.We then multiply this by the estimate of the relative wealth ratio from the previous section to arrive at estimated average housing wealth, and sum the two components together to arrive at estimated average total wealth::

$$EstimatedAverageTotalWealth = \tilde{\mu_N} + \tilde{\mu_N}\left(\frac{\mu_H}{\mu_N}\right)$$

F Estimates using data from national accounts

F.1 Sources after 1974

From 1974 onwards the measurement of total household wealth is assessed solely on the basis of SNA balance sheet data. The sources for these balance sheets are listed in Table F.1.

For the period from 1995 onwards we use the financial balance sheets for the household sector directly from the source data. However, the non-financial accounts do not distinguish between the household and non-profit sectors. Consequently, some adjustments are required for real assets. First, for dwellings, we use one of the sources to the non-financial accounts that report the value of dwellings separately for the household sector. Second, to estimate the household portion of non-dwelling real assets, we scale the combined value for both sectors using the household sector's fraction of both sector's financial assets in the financial accounts.

As noted in Section 6.1, prior to 1995, the financial asset balance sheets do not provide a breakdown between the household and non-profit sectors. We therefore assume that the non-profit sector's share of financial assets remained constant at its 1995 level. For real assets, we

Table F.1: Sources after 1974

	Year	Source
Financial balance sheets	1975-1994	An extract from the FINDATR database, received from the Section for Financial Accounts at Statistics Norway on 19 September 2017 upon request. Sector: sector 50 (which includes the household sector and Non-profit institutions serving households
	1995-2020	Table 10788: Financial accounts, yearly figures, by sector, item and counterpart sector (NOK million) 1995 - 2024 from Statistics Norway's database StatBank. Sector: S14 Households
Real assets		
- dwellings	1975-2020	Table 11189: Gross fixed capital formation and capital stocks, by industry 1970 – 2022, Contents: Fixed assets from Statistics Norway's database StatBank. Contents: Current prices (NOK million) Assets type: Building and construction. Industry: Imputed rents of owner-occupied dwellings
- non-dwellings real assets	1996-2020	Table 11123: Non-financial and financial accounts by institutional sector (NOK million), by year, contents and national accounts variable from Statistics Norway's database StatBank. Sector: S14-15 Households and NPISHs.

use the same sources for the value of dwellings as we do for the period after 1995. However, detailed non-financial accounts for the combined sectors are not available before 1996, which prevents us from calculating non-dwelling real assets in the same manner. Instead, we assume that the ratio of non-dwelling assets to dwellings for the household sector remained constant at its 1996 level (the earliest year this estimate is available).

F.2 Sources before 1974

F.2.1 Fixed capital

We have estimates for private fixed capital for from two sources for two periods.

1939 and 1946
We use estimates for 1939 from Statistics Norway (1946). Estimates for fixed capital is split by private and public ownership on Table 6 on page 126 and 127.

The estimates include all fixed capital that is a result of some type of economic activity, including forests and other land. These estimates were provided in order to calculate the destruction of capital during the Second World War, and aimed at estimating the market value of the fixed capital. The report does not distinguish the household sector from the rest of the private sector.

The reduction in fixed capital during the WW2 (1940-1945) is not presented separately for the public and the private sector. However, the private sector is divided by different sectors in Table 16 in Statistics Norway (1946, p. 156). The reduction in fixed capital is split in the same way on Table 18 in Statistics Norway (1946, p. 159). By combining these tables, we can estimate the fixed capital reduction in the private sector by assuming that the reduction is constant between public and private sector within industries.

1974

We use the estimates for 1974 from Statistics Norway (1982). These estimates differ somewhat in scope from the estimates for 1939. The published statistics are considered to supplement the National Accounts (NA) figures and concern only fixed capital that was included in the NA. Unlike the 1939 estimates, the balance sheets for 1974 offer separate estimates for the household sector.

We use the numbers from 01.01.1975 as the measure for 1974 to coordinate with the fact that the rest of the the financial stock measures are measured by the end of the year. For 1974 we use estimates for the private sector from Table B on page 70. For later years we use the estimates for the household sector from Table B on page 72.

F.2.2 Financial capital

Balance sheets for financial wealth in Norway are available from the annual credit market statistics from 1900 onwards. Two adjustments are introduced. First, before 1974, the balance sheets of the assets are reported in face values. For the years 1974 both the face value and market price of the assets are reported. This makes it possible to compute market values for the preceding years by using price indexes for the different financial assets. Second, until 1974 the balance sheets consolidate the asset holdings of the entire private sector (excluding the financial sector) [37]. Since both foreign investors and the government can have ownership in the private sector, it is necessary to distinguish the household sector from the rest of the private sector. The method for doing this adjustment is explained in Section 6.1.

The sources for financial capital is listed in Table F.2.

[37] This sector comprises all Norwegian economic unites excluding the Treasury, Public funds, Social insurance, Municipalities, Bank of Norway, Postal Current Account and Post Office Savings Bank, States Banks, Commercial and Savings Banks, Loan Associations, Insurance and State and Municipality Enterprises. Except for bearer bond loans, all items for this sector give consolidated figures estimates as residuals. Until 1952 state and municipality enterprises are included, due to data limitation. The same is partially true for municipalities until 1946 (Statistics Norway, 1967).

Table F.2: Sources for financial wealth stock

Wealth Years	Publication	Publication years
1900-1951	Norsk kredittmarked siden 1900 Table XI	1967
1952-1953	NOS XI 281 Kredittmarkedstatistikk 1955. Table 86	1957
1954-1955	NOS XI 321 Kredittmarkedstatistikk 1956. Table 92	1958
1956-1958	NOS XII 19 Kredittmarked-statistikk 1958. Table 91	1960
1959-1960	NOS XII 103. Kredittmarkedstatistikk 1961. Table 86	1963
1961-1962	NOS XII 162. Kredittmarked-statistikk 1963. Table 91	1965
1963-1964	NOS XII 223. Kredittmarked-statistikk 1965. Table 102	1967
1965-1966	NOS A 306. Kredittmarked-statistikk 1967. Table 99	1969
1967-1969	NOS A 488. Kredittmarked-statistikk 1969-1970. Table 101	1972
1970	NOS A 748 Kredittmarkedstatistikk 1972-1974. Table 97	1975
1971-1974	NOS A 931. Kredittmarked-statistikk finansielle sektorbalanser 1971-1976, Table 28	1978

F.2.3 Private capital accumulation

The sources used for private capital accumulation is listed in Table F.3. For the years before 1960 Statistics Norway have reconstructed national accounts numbers in multiple publications. We have consistently used the numbers from the latest available publication.

In the national accounts disposable income, consumption and real investments are measured directly. In principle the difference between disposable income and real investment and consumption for a given period should be equal to the difference between the net financial assets at the end and the begin of the period from the credit market statistics, corrected for price changes. Before 1925 the deviations between the two statistics might be quite large, but significantly smaller after 1925 (Statistics Norway, 1967, p. 105). For further details and a comprehensive discussion see Chapter 4 in Statistics Norway (1967).

Table F.3: Sources used for private capital accumulation

Wealth Years	Publication	Publication years
1865-1899	SØS 016: Langtidslinjer i norsk økonomi 1865-1960, Table XII	1966
1900-1929	SØS 016: Langtidslinjer i norsk økonomi 1865-1960, Table C	1966
1930-1960	NOS XII163: Nasjonalregnskap 1865-1960, Table 24	1965
1961	NOS A 474: Nasjonalregnskap 1954-1970, Table 19	1972
1962-1974	NOS B 48: Nasjonalregnskap 1962-1978, Table 34	1979

F.2.4 Prices

Stock prices

We use stock prices from Eitrheim et al. (2004).[38] We use the variable ”Total” measured in December each year. The data set available online only contains estimates back to 1914. After 1996 we use the share indices from Oslo stock exchange benchmark published by Oslo stock exchange on their web site.

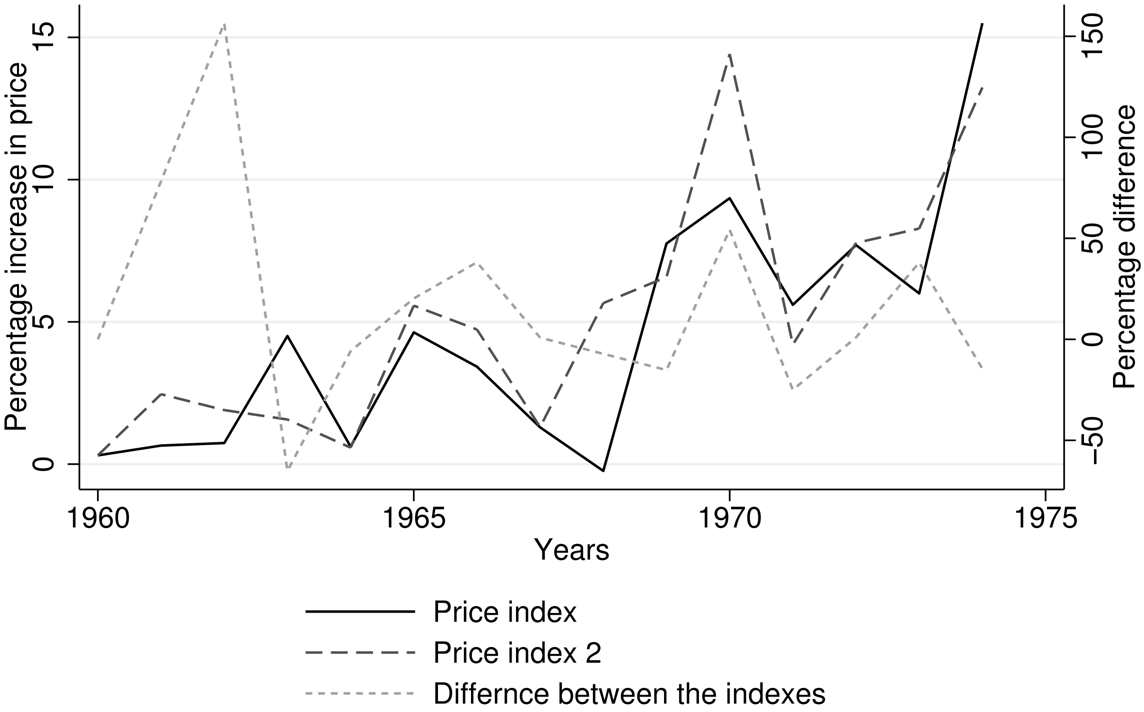
Fixed capital prices

We use price index for gross investments to measure the price growth for fixed capital. The sources used are listed in Table F.4.

Two assumptions have to hold for the gross investment index to measure the price growth for fixed capital. First, we need to assume that the the prices index is the same for private and

[38] The data is downloadable from http://www.norges-bank.no/en/Statistics/Historical-monetary-statistics/Stock-price-indices/.

Figure F.1: Differences in the price index for gross investment



Note: The percentage difference for 1961 and 1968 is excluded from the graph, the percentage difference for these years are 277% and −2466% respectively.

public investment. Second, we need to assume that the price growth for already exiting fixed capital is the same as the newly purchased fixed capital.

For some years, estimates for the price index for gross investments are published in several publications. Figure F.1 depicts the difference in the price indices published in Statistics Norway (1972) / Statistics Norway (1981) and Statistics Norway (1994a) for the years 1960-1975. We can see that the estimates from the publications differs greatly for some years. We consistently use the estimates from the latest available publication.

Exchange rates and wealth share in individual countries

We use exchange rates from Eitrheim et al. (2004).[39] We use the exchange rates measured in December each year.

We use the the share of assets and debt to foreign countries from the Credit Market publications listed in Table F.2. To split this share in to separate countries, we use the sources listed in Table F.5. We only record the shares for the four countries to which the Norwegian had the most debt in 1972: Great Britain, USA, Sweden and West Germany.

For the years between the years we have numbers for after 1958, we linearly interpolate between the existing data points. For the years before 1958, we hold the shares from 1958

[39]The dataset can be downloaded from `http://www.norges-bank.no/en/Statistics/Historical-monetary-statistics/Historical-exchange-rates/`

Table F.4: Sources for price indices for gross investments

Wealth years	Publication	Publication years	Comment
1865-1900	SØS 016: Langtidslinjer i Norsk Økonomi 1865-1960. Table XVII	1965	
1900-1930	NOS XI 143 Nasjonalregnskap 1900-1929. Table 13	1953	
1930-1960	NOS XII 163 Nasjonalregnskap 1865-1960. Table 42	1965	For the years 1930-1950 prices indexes are published both in NOS XI 143 and NOS XII 163. The numbers in NOS XII 163 are the latest update, so we use these.
1960-1969	NOS C 188 Historisk statistikk 1994. Table 22.3	1994	The estimates from NOS C 188 cover the same years as estimates in NOS A 474 and NOS B 222. The estimates are not the same.
1970-	Table 11189 Statistikkbanken Statistics Norway		

Table F.5: Sources for share of foreign assets in different countries

Wealth year	Publication	Publication year
1958	NOS XII 19 Kredittmarked-statistikk 1958. Table 96 and Table 97	1960
1963	NOS XII 162. Kredittmarked-statistikk 1963. Table 95 and Table 96	1965
1965	NOS XII 223. Kredittmarked-statistikk 1965. Table 106 and Table 107	1967
1969	NOS A 488. Kredittmarked-statistikk 1969-1970. Table 107 and Table 108	1972
1972	NOS A 748 Kredittmarkedstatistikk 1972-1974. Table 101 and 102	1975

fixed.

F.3 Control total of wealth

The following text explains in detail how the total control wealth is compute using equation (12) for the years before 1974 and expands on how we deal with the limitations presented in Section 6.1

F.3.1 Missing variables

In the following it is explained in detail how equation (12) is computed. It is evident from equation (12) that changes in private wealth are either due to changes in quantity and/ or price changes. The first column in Table F.6 lists private wealth and the variables needed to assess private wealth in the absence of yearly balance sheets. The following columns list time periods for which we wish to assess private wealth. The variables that are available in each period are denoted with an x. In the following we describe how we calculates the missing cells in Table F.6.

Table F.6: What data are available in what periods (the rest is estimated, see text)

Variable	1910-1938	1939	1940-1945	1946-1973	1974
W_t		x			x
S_t	x	x		x	x
F_t^{fv}	x	x	x	x	x
F_t					x
e_{t+1}	x	x	x	x	x
$c_{f,t+1}$	x	x		x	x
R_t		x			x
$c_{r,t+1}$	x	x	x	x	x

Note: x indicates that we have estimates for the variable

We use the the following definitions and relationships to compute the total wealth:[40]

$W_t = F_t + R_t$

$F_{t+1} = (1 + c_{f,t+1}) * F_t + S_{f,t+1}$

$R_{t+1} = (1 + c_{r,t+1}) * R_t + S_{r,t+1}$

$S_t = S_{f,t} + S_{r,t}$

$F_{t+1}^{fv} = (1 + e_{f,t+1}) F_t^{fv} + S_{f,t+1}$

$c_{t+1} = \frac{p_{t+1}}{p_t}$

$e_{t+1} = \frac{a_{t+1}}{a_t}$

where W_t is the private wealth in year t, F_t is the financial capital stock, R_t is the fixed capital stock, S_t is saving, p_t is price, c_{t+1} denotes the price changes, a_t denotes the exchanges rate, e_{t+1} denotes the change in exchange rate and the subscript f and r denotes financial and fixed capital. Stocks are listed in the financial market statistics at face value, however changes in exchanges rate is accounted for. To separate between face and market value, we will us the subscript fv to denote when the financial capital is valued at face value.

Using the definitions above we fill the missing cells in Table F.6 by calculation the following expressions in the following order:

1. Calculate the financial savings ($S_{f,t}$). We calculate this separately for the different price groups.

   $S_{f,t} = F_t^{fv} - (1 + e_{f,t+1}) F_{t-1}^{fv}$

2. Finding the saving in fixed assets.

   $S_{r,t} = S_t - S_{f,t}$

3. Finding the financial capital stock in time t.

   $R_t = \frac{R_{t+1} - S_{r,t+1}}{(1 + c_{r,t+1})}$

4. Finding the fixed capital stock in time t.[41]:

   $F_t = \frac{F_{t+1} - S_{f,t+1}}{(1 + c_{f,t+1})}$

5. Finding the total wealth in time t.

   $W_t = F_t + R_t = \frac{F_{t+1} - S_{f,t+1}}{(1 + c_{f,t+1})} + \frac{R_{t+1} - S_{r,t}}{(1 + c_{r,t+1})}$

When we calculate from 1939, we also have to iterate (12) forwards. We can use the same equations for savings in financial assets, $S_{f,t}$ and $S_{r,t}$, as when we iterate backwards in time, but

[40]The timing of when the different stocks, prices and flows is measured is important when constructing the definitions and relationships needed. The financial wealth stock, stock prices and exchange rates at the end of the calendar year.

[41]This step is only needed for stocks. For the rest of the financial assets types c_{t+1} is equal to 0, so we can use the numbers directly from the financial market statistics.

replace the expression for fixed capital, R_t, and wealth, W_t, to the following:
Fixed assets in time t:
$R_t = (1 + c_{r,t}) * R_{t-1} + S_{r,t}$
Wealth in time t:
$W_t = F_t + R_t = (1 + c_{f,t}) * F_{t-1} + S_{f,t} + (1 + c_{r,t}) * R_{t-1} + S_{r,t}$

F.3.2 Lack of annual capital accumulation numbers (S_t) during World War 2

For the World War 2 years estimates are missing for private capital accumulation, S_t. This makes it impossible to calculate the private wealth during the war. This is not an a problem in itself, since we have no distributional tables for the years during the war. However, we need to be able to calculate equation (12) from the year after the war to the year before the invasion. This is possible by using the price indexes and estimates in fixed capital loss during the war from Statistics Norway (1946). We have estimates for the financial capital stock through the whole time period. For the fixed capital stock, we make the following compute the fixed capital stock change through the World War 2.
$R_{1946} = (1 + c_{r,39-46})(R_{1939} + S_{r,39-46})$
and the other way
$R_{1939} = \frac{R_{1946}}{(1+c_{r,39-46})} - S_{r,39-46}$

The reduction in fixed capital is not given for the public and the private sector separately. But using tables for capital reduction by sector or asset types as well as shares of private ownership by sector and asset types, we estimate the reduction in private capital. The two estimates differs with two and half percent lower private capital stock in 1945.

The accuracy of the estimates for the reduction in fixed capital during the war published in Statistics Norway (1946) is questioned by Espeli (2013), who argues that Statistics Norway (1946) exaggerate the loss of capital during the German occupation. The main concern is related to the estimation of public wealth. Espeli (2013) points out that Aukrust and Bjerve (1945) do not include the German installations and equipment that the Norwegian government confiscated after the liberation in their estimates for national wealth after the war, including railway lines, telecommunications, hydroelectric power plants, and airports/bases. This is not a concern in our case, since the German installations and equipment were added to the public wealth, while we focus on total wealth held by the private sector. However, Espeli (2013) also argues that the estimated capital loss in terms of personal chattels is exaggerated, which could potentially affect our results.

Aukrust and Bjerve (1945) presents estimates for capital loss during the war as well. Statistics Norway (1946) gives the most detailed estimates for our purpose. The aggregate numbers are the same in the two publications.

F.3.3 Harmonizing sector definitions

As mentioned in Section 6.1 we assume that the non-household units own the same fraction in other assets as in stocks and deflate all private wealth by one minus the share of stocks in the private sector held by foreign and public investors to find the wealth held by the household sector. Before 1958 the value of all stocks in the private sector is not available. Hence, even though the value of stocks held by the public sector and the foreign sector is available, we are missing the denominator to calculate the share held by these non-household sectors. We assume that the share is constant at the 1958 level in earlier years when deflating all private wealth by one minus the share of stocks in the private sector held by foreign and public investors.

F.3.4 Consolidating estimates from different years

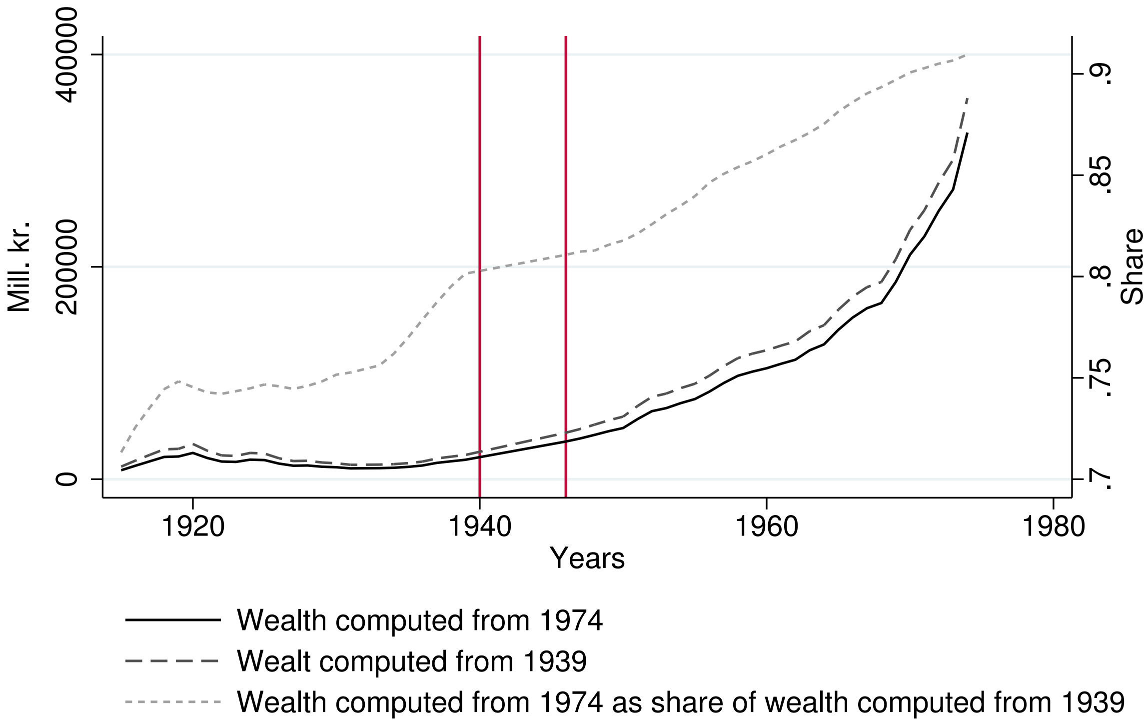
The estimates for total private wealth differ depending on whether we compute equation (12) recursively backwards from 1974 or forwards from 1939. Figure F.2 depicts both the wealth estimates computed from 1974 and the wealth estimates computed from 1939. The estimates from Statistics Norway (1946) are used during the war in the computation of both time series. Figure F.2 shows that the the estimate computed from 1974 is 20 per cent lower than the estimate computed from 1939 in 1939. To obtain identical estimates requires a yearly measurement error for private wealth growth on 0.8 percentage points.[42] This is well within reasonable uncertainty for such measurements. A measurement error of 0.8 percentage point for the growth in private wealth is equivalent to a claim that private capital accumulation is overestimated by 30 per cent or that price growth for fixed capital is overestimated by around 15 per cent yearly in equation (12). For comparison, estimates of the price growth for fixed capital published by Statistics Norway can in some cases differ with as much as 50 per cent. [43]

Whether we adjust private capital accumulation, price growth for fixed capital or a combination to consolidate the two series, affect the wealth estimates. In Figure F.3 we can see that the difference does not surpass 4 percent after the Second World War. However in 1920 the difference is close to 17 percent.

[42]This estimate is computed by finding the average yearly growth rate needed to get from the estimate for wealth in 1946 computed from 1939 and from the estimate for wealth in 1946 computed from 1974 to the wealth estimate for 1974, respectively 0.074 and 0.082, and taking the difference between the two growth rates.

[43]The difference between the estimate of the price growth for fixed capital (the gross investment price index) for the year 1970 is 54% higher in Statistics Norway (1972) than in Statistics Norway (1994a). Figure F.1 shows the difference between the estimates from Statistics Norway (1972)/ Statistics Norway (1981) and Statistics Norway (1994a) for the years 1960-1975. The average difference is 32% of the estimate from Statistics Norway (1994a)

Figure F.2: Differences between computed from 1939 and from 1974 using the capital reduction under WW2 from Statistics Norway (1946)



Notes: For the estimate form the national account:
The old definitions for growth in private capital is used as long as they are avilable, untill 1969, after this unaltered new defenitions are used.

Figure F.3: Adjusted the wealth estimates

(a) Adjusted wealth estimates

(b) Difference between adjusted wealth estimates

Notes: The difference between Adjustment 1-3 is in what variable measurement error is assumed in order to consolidate the series calculated from 1939 and 1974 in 1939 and 1974. Adjustment 1 assumes that all the measurement error is in estimates of private capital accumulation, Adjustment 2 assumes that all the measurement error is in the estimates of price growth for real capital, and Adjustment 3 assumes that there is measurement error in both private capital accumulation and price growth for real capital. Adjustment 3 corresponds to assuming that private savings in official statistics has been overestimated by 13 per cent and price growth for capital by 8 per cent

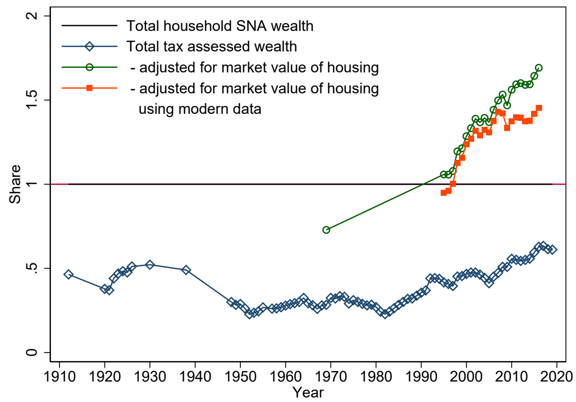
F.4 The evolution of three alternative measures of total household wealth relative to total household SNA wealth

In this paper we have discussed four alternative estimators for total household wealth. Firstly, from 1912 onwards, official tax statistics provide a measure of household tax-assessed wealth, as reported in Section 3.4. Secondly, in Section 5.1 we discuss two series that account for the market values of housing. Finally, in this section we will give a description of total wealth derived from national accounts data.

The relationship between the four alternative wealth totals is displayed in Figure F.4. Each graph shows an estimated total from the tax data relative to total SNA wealth. As discussed in Section 6.1, the tax assessed wealth from Section 3 accounts for around 50 per cent of the SNA wealth until the Second World War. The share decreases to around 25 percent at the beginning of the 1950s before stabilizing at around 30 per cent untill the the early 1980s, when tax assessed wealth accounts for a growing share of the SNA wealth ending at around 60 per cent in 2018.

Figure F.4 presents both the relative totals that include the market value of housing starting from 1995 and the extended series starting in 1969, relying on additional assumptions. When market values of housing are included, estimates of total wealth more than double. As a result, the previous estimate is, with the exception of 1967 and 1995 (and 1996 in one of the series), higher than SNA household wealth. The changes over time, with relative total of wealth estimates from Section 5 growing from around 70 per cent to more than 170 per cent, are mainly due to the fact that the rising housing prices are a result of rising land prices, which are not accounted for in the SNA.

Figure F.4: Evolution of household SNA wealth and the ratio between three alternative wealth totals based on tax records and the SNA wealth total



(a) Ratio between three alternative wealth totals based on tax records and the SNA wealth total

Notes: Panel a) displays the evolution of total household SNA wealth measured in million of 2015 NOK. Panel b) figure shows total wealth for our preferred measure of tax assessed wealth from Section 3 and for two alternative measures of market value of housing as explained in Section 5. All totals are presented as shares of the total private (household) wealth from macro sources as explained in Section 6.1, which does not account for land prices of housing. Due to data limitation in 1969 the longest series that includes market value of housing relies on the assumption that assessed wealth below the common lower threshold (Section 3) is set to zero before assessed values of housing is replaced by market values. However, after 1995, this restriction is not needed. Thus, for the series starting from 1995 negative values wealth is set to zero after including the market value of housing.

F.5 Alternative ways of accounting for excess SNA wealth in measurement of wealth inequality

In the following we explain in detail how the "constant proportionality" and the "constant interaction" method introduced in Section 6.2 is implemented, introduce an alternative assumption about the distribution of pension wealth, and show the results for the full sets of assumptions.

The "constant proportionality" method

In the "constant proportionality" method we consider an allocation where the wealth of each household is scaled to match the wealth total from SNA. Specifically, ratios of asset-class totals from SNA data to asset-class totals from tax data is used to re-scale each household's wealth holding. For each asset-class i for household j, we compute a household-level SNA wealth holding $z_{i,j} = (\mu_{z,i}/\mu_{y,i}) \cdot y_{i,j}$ for each asset class i (j indexes households). Next, we aggregate $z_{i,j}$ across asset classes to obtain household SNA wealth holdings, and estimate the Gini coefficient for this distribution.

This assumption is inspired by the assumption Saez and Zucman (2016) used for the capitalization method (which is also used in other studies, e.g. Piketty et al. (2018) and Garbinti et al. (2020)).Saez and Zucman (2016) define a capitalization factor that is equal to the ratio of aggregate wealth in the balance sheet of households from Financial Accounts (FA) to tax return income for different asset groups. Further they impute individual wealth, which aggregated up matches the FA, by multiplying the capitalization factor for different asset groups with individual capital income. This is equivalent to distributing the wealth in the FA proportionally to capital income. In our setting we do not need to capitalize income to obtain wealth. However, we distribute the wealth in the SNA proportionally to taxable wealth to match the SNA aggregate for each asset group.

The "constant interaction" method

In the "constant interaction" method we assume that association between the wealth of each of the asset-classes and total wealth is the same for the excess SNA wealth as for the taxable wealth. The Rao decomposition of inequality introduced in Section 5 allows the following decomposition of the Gini for taxable wealth by asset classes;

$$G_y = \sum_{i=1}^{5} \frac{\mu_{yi}}{\mu_y} \gamma_{yi}, \tag{C14}$$

where μ_{yi} and μ_y are the means of asset class i and taxable wealth, while γ_{yi} is the interaction coefficient of asset-class i, $i = 1,2,...,5$. Note that the interaction coefficients can be considered as measures of association between the wealth of each of the asset-classes and total taxable wealth. Next, by assuming that the interaction coefficients for the SNA asset-classes are equal to the interaction coefficients for taxable wealth asset classes, G_z can be obtained from equation (C14) by replacing μ_{yi} with μ_{zi}, $i = 1,2,...,5$ and μ_y with μ_z.

Alternative assumption about the allocation pension wealth

In Section 5, the pension wealth from SNA data is allocated proportionally to taxable deposits. We here introduce an alternative assumption where pension wealth from SNA data is allocated proportionally to taxable gross financial wealth (deposits and other gross financial wealth). When we apply this assumption we consider deposits and other gross financial wealth jointly. Hence, when this assumption is combined with the "constant interaction" method we sum over four not five assets classes in equation (C14).

Results for the full sets of assumptions

We have presented two alternative assumptions about the distribution of pensions wealth and two alternative assumptions about how the excess SNA wealth is distributed relative to the taxable wealth within each asset-class. Together these two sets of assumptions result in four different estimates for the Gini coefficient for SNA extended wealth (G_z) and the corresponding allocation parameters (k) for each of the reference years 2000 and 2019.

Table F.7 shows the Gini coefficient for SNA extended wealth (G_z) and the corresponding allocation parameters (k) for the full sets of assumptions. The two first columns indicate

Table F.7: Allocation methods

			2000			2019		
		Asset classes	$\frac{\mu_{yi}}{\mu_y}$	$\frac{\mu_{zi}}{\mu_z}$	γ_{yi}	$\frac{\mu_{yi}}{\mu_y}$	$\frac{\mu_{zi}}{\mu_z}$	γ_{yi}
A		Deposits	0.44	0.44	0.61	0.36	0.52	0.57
A		Other gross financial wealth	0.46	0.32	0.80	0.48	0.37	0.86
A	B	Debt	-0.57	-0.50	-0.05	-0.61	-0.67	-0.04
A	B	Housing	0.40	0.67	0.17	0.66	0.72	0.28
A	B	Other real capital	0.27	0.08	0.35	0.11	0.06	0.29
	B	Deposits + other gross fin. wealth	0.90	0.75	0.71	0.84	0.89	0.74
		Total wealth	$G_y = 0.832$, $\frac{\mu_y}{\mu_z} = 0.468$			$G_y = 0.861$, $\frac{\mu_y}{\mu_z} = 0.608$		
				G_z	k		G_z	k
A		Constant proportionality, 5 groups		0.785	0.107		0.882	-0.062
A		Constant interaction, 5 groups		0.691	0.320		0.863	-0.004
	B	Constant proportionality, 4 groups		0.796	0.081		0.915	-0.157
	B	Constant interaction, 4 groups		0.704	0.291		0.902	-0.122

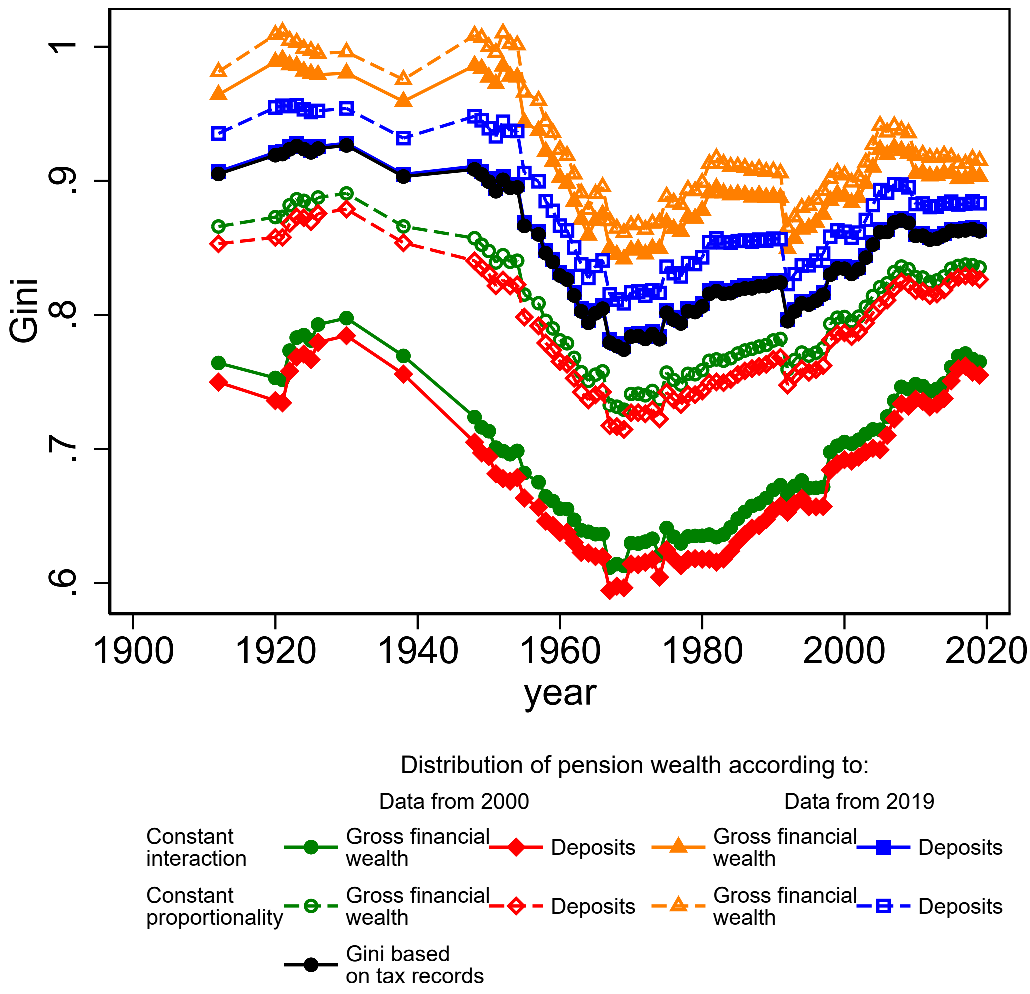
Note: The table displays Gini coefficient for the distribution of SNA extended wealth (G_z), the allocation parameter k, and the parameters used to calculate the two based on data from 2000 and 2019. G, μ, γ denotes Gini coefficient, mean and interaction coefficient. The subscript y and z denotes that the parameter is based on tax data or SNA data, and i denotes that the parameter is asset-class specific.

whether pension is allocated proportionally to deposits (A) or proportionally to gross financial wealth (B). Hence, the rows marked A is equivalent to the results shown in Table 2.

Figure F.5 shows the series of wealth Gini coefficients adjusted for national accounts wealth for the full set of assumptions, in addition to the benchmark series from Section 4. The series labeled "Deposits" are equivalent to the series shown in Figure 10. All estimates associated with allocating pension wealth proportionally to taxable gross financial wealth —instead of solely to deposits— yields higher estimated inequality. Moreover we see that in 2000, when the ratio of SNA wealth to assessed wealth is higher than in 2019, the choice between assuming constant interaction or constant proportionality is the most important, while in 2019 the choice of assumption regarding the distribution of pension wealth is the most important.

However, although the assumptions matters substantially for the estimated level of wealth inequality the trend is less dependent on the allocation assumptions, even though the ratio between taxable wealth and SNA wealth varies significantly across time.

Figure F.5: Evolution of the Gini coefficient when accounting for excess SNA wealth



Notes: The figure shows the distribution of the excess wealth from SNA