

# Never-Realized Capital Gains

Lucy Msall\*

Ole-Andreas Næss

University of Chicago

NHH & Statistics Norway

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Appreciated assets are subject to capital gains tax when sold by their original owner. Yet under policies of “stepped-up basis at inheritance,” many countries forgive this latent tax obligation if the asset is instead transferred, unsold, to the owner’s heir. In the first part of this paper, we create novel data on capital gains in Norway and show that large fractions of top household wealth are in the form of capital gains with latent (i.e., unrealized) capital gains tax liability. Furthermore, much of this capital gain is never taxed: Norway’s stepped-up basis policy exempted around \$300 million of capital gains in stock and real estate from taxation each year (an amount equal to 19-25% of yearly taxable gains in stock and real estate). In the second part of the paper, we study investor responses to a reform that moved Norway from a system of stepped-up basis to a system in which heirs inherit their predecessor’s latent capital gains tax obligation when they inherit appreciated assets. Using a difference-in-difference empirical strategy exploiting cross-sectional variation in investors’ unrealized capital gains prior to the reform, we estimate that the removal of step-up precipitated large increases in taxable realizations among highly appreciated investors. The removal of step-up also affected the composition of inheritance: inherited assets had a lower ratio of capital gain to value following the reform. Overall, we conclude that stepped-up basis has a large effect on investors’ decision to sell appreciated assets and disproportionately benefits the very wealthy.

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# 1 Introduction

Capital gains are taxed when *realized*: typically, not until the underlying asset is sold.<sup>1</sup> But some capital gains are never realized by their original owner: the asset is instead transferred, unsold, to the original owner’s heir. If a policy of “stepped-up basis” is in place for this transfer, the original owner’s appreciation avoids capital gains taxation entirely. Under stepped-up basis, an heir who sells a previously inherited asset will pay capital gains tax only on appreciation during her own holding period.<sup>2</sup> But no one will ever pay capital gains tax on the appreciation that occurred during her predecessor’s holding period. Twelve OECD countries, including the US and UK, currently apply stepped-up basis to at least some inheritance transfers.<sup>3</sup>

Does the opportunity to avoid tax on inherited capital gains depress taxable realizations? If investors’ only goal is to avoid capital gains taxation, stepped-up basis provides an opportunity to ensure their gains will never be taxed. A long theoretical literature has therefore argued that taxable realizations would be higher in a world without step-up ([Holt and Shelton, 1962](#); [Feldstein and Yitzhaki, 1978](#); [Auerbach, 1989](#); [Kiefer, 1990](#)). But it is not immediately clear how much we should expect investors to respond to a tax break that happens after the wealth has left their possession (and frequently after they themselves are dead and gone). If bequests are motivated primarily by precautionary saving or an egoistic desire for wealth accumulation (as opposed to an altruistic concern for one’s heirs), we would not expect any response to such an incentive. Additionally, removing step-up can only

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<sup>1</sup>Circumstances other than sales can count as “realization events” (and therefore trigger the capital gains tax) depending on local law and administrative practice. Examples usually include company liquidations and certain types of mergers.

<sup>2</sup>Throughout this paper, we use the term “inheritance” to refer to intergenerational transfers regardless of whether they occur during the older generation’s lifetime or at their death. We distinguish the former as “*inter vivos* gifts,” and call the later “testamentary” or “deathtime” transfers.

<sup>3</sup>The majority of OECD countries that levy both inheritance and capital gains taxes step-up unrealized capital gains at death ([OECD, 2021](#)). Specifically: Chile, France, Korea, Lithuania, Portugal, Slovenia, Spain, the United Kingdom, and the United States all apply step-up to most deathtime inheritance transfers; while Denmark, Finland, and Hungary have more complicated regimes in which step-up applies to only some types of inherited assets. Most countries do not apply step-up to capital gains passed as *inter vivos* gifts.

have a large effect on realizations if there is a large outstanding stock of unrealized capital gains which the owners expect to eventually bequest, and we do not currently have sufficient information to assess whether this is so.

Empirical work is therefore needed to determine the magnitude of unrealized and inherited capital gains and the extent to which the tax treatment of inherited capital gains affects taxable realizations. However, two key challenges have inhibited prior empirical study of these questions. The first challenge is that national tax authorities do not produce statistics on unrealized or inherited capital gains. As a result, not much is known about capital gains that may eventually be inherited, or which taxpayers benefit from the stepped-up basis exemption. The second challenge is that, despite many proposals to modify the tax treatment of inherited capital gains, few policy changes have actually been enacted in a way that allows for empirical evaluation of the resulting changes.<sup>4</sup> The United States in 2010, for example, briefly repealed its estate tax and required inheritors of capital assets in testamentary bequests to “carry over” their predecessors’ unrealized capital gains for future taxation, but then reverted back to its original system before the end of the year.<sup>5</sup> In this paper, we study the case of the only other country that has substantially modified its treatment of inherited capital gains in the last four decades: Norway.<sup>6</sup>

This paper overcomes the prior empirical challenges by building new data on unrealized capital gains and introducing a previously unstudied reform that removed stepped-up basis

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<sup>4</sup>Presidents Obama and Biden both proposed making death a deemed realization event in their budget proposals to Congress ([Treasury, 2024](#)). Alternatively, Biden’s 2020 campaign proposed to replace step-up with carryover basis. In the UK, the Institute for Fiscal Studies recently called on the new Labour government to replace the stepped-up basis regime with either carryover basis or deemed realization at death ([Adam et al., 2024](#)).

<sup>5</sup>In the end, estates of Americans who died in 2010 were allowed to choose between paying the estate tax and receiving stepped-up basis, or receiving carryover basis treatment. [Gordon et al. \(2016a,b\)](#) evaluate what may be learned from this brief, “voluntary” tax regime. The US also passed legislation that repealed step-up in favor of carryover basis in 1976, but implementation was delayed and the change was eventually repealed before it came into effect. See [Gutman \(2021\)](#) for a discussion of the administrative issues that motivated the repeal of the 1976 reform.

<sup>6</sup>In Section 5, we describe relevant institutional information, including various elements of taxation in Norway.

in Norway. We combine uniquely rich transaction and valuation data from the Norwegian Tax Authority to estimate a yearly panel of the unrealized capital gains in every Norwegian stock, private business, or real estate holding.<sup>7</sup> We observe whether and when these assets are sold or transferred to heirs, and thus can quantify the amount and distribution of inherited capital gains passing via intergenerational transfers each year.

We begin by documenting five new stylized facts about unrealized and inherited capital gains in Norway during the stepped-up basis regime. First, seventeen to nineteen percent of total household wealth is composed of unrealized capital gains in assets subject to the capital gains tax. Second, unrealized capital gains are concentrated in wealthy households, and wealthy households' portfolios are disproportionately made up of unrealized capital gains. Third, assets transferred in inheritance are much more appreciated than those that are realized. Fourth, the yearly amount of inherited capital gains exempted via step-up is a substantial fraction of the tax base of realized capital gains. Fifth, inheritances that benefit from the stepped-up basis exemption come from disproportionately wealthy households.

In the second part of the paper, we examine how the removal of step-up in Norway affected taxable realizations. Prior to 2006, Norway allowed capital gains to disappear from the tax base when gifted or inherited (a policy of “stepped-up basis” for both *inter vivos* gifts and testamentary bequests). In 2006, Norway began “carrying over” inherited capital gains to recipients of stock (including private business interests and mutual fund shares) transferred as gifts or inheritance. We present a conceptual framework which clarifies that the removal of step-up increases the cost of inheriting appreciated stock. Altruistic investors were differentially exposed to this cost change depending on their portfolio's ratio of unrealized capital gains in stock to total value. Investors with unappreciated stock did not experience any change in the cost of bequeathing their assets. Our empirical strategy exploits this differential exposure to the reform. We estimate difference-in-difference regression models that

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<sup>7</sup>We cannot estimate unrealized capital gains in mutual funds, but we explore the implications of this lack of coverage in detail in Section 3. International equity is primarily held through mutual funds.

compare the effect of the reform between investors who have and do not have unrealized capital gains in stock prior to the reform. The key identifying assumption is that, absent the reform, total realizations (of any asset type) would have evolved similarly across investors who accumulated different unrealized capital gains in their portfolios.

We find that investors whose portfolios were exposed to the removal of step-up increased their yearly taxable realizations by an average of \$2,023 — a 59% increase. Total government revenues from the capital gains tax were 24% higher following step-up’s removal than they would have been otherwise. We investigate heterogeneity in responses to the reform and find that the increase in taxable realizations was largest among the investors with the most highly appreciated stock portfolios.

Step-up policy is currently subject to debate in both the US and UK. Our results emphasize that the continuation of step-up is hard to justify on grounds of either equity or pure efficiency. Using a “Marginal Value of Public Funds” framework, we estimate that step-up provides only \$0.43 in benefits for each \$1 of foregone tax revenue. Although this level of efficiency loss could be justified for programs explicitly focused on redistribution, step-up is incurring these efficiency losses in order to transfer benefits to wealthy capital gains owners. Furthermore, this efficiency loss is unnecessary: less revenue from taxation is usually associated with efficiency gains. We discuss the opportunity for a budget-neutral and efficiency-enhancing reform that would remove step-up and, assuming the policymaker wanted to continue to give benefits to capital gains owners, would use the resulting revenue to simply lower the capital gains tax rate.

The paper proceeds as follows: Section 1.1 locates our paper’s contribution in the context of the prior literature. Section 2 provides background on capital gains as a concept and on how capital gains are taxed. Section 3 describes our data, including how we create our novel measure of unrealized capital gains. Section 4 uses our novel data to document several new facts about unrealized and inherited capital gains in Norway under the stepped-up

basis regime. Section 6 provides a conceptual framework for understanding how the tax treatment of capital gains in inheritance (e.g., stepped-up basis) affects investors’ realization decisions. Section 5 provides background on Norway’s policy change from stepped-up basis to a carryover basis regime. Section 7 examines how the removal of step-up affected taxable realizations and the composition of inheritance. Section 8 discusses policy implications and the generalizability of our results.

## 1.1 Connection to Prior Literature

### 1.1.1 The Measurement of Inherited and Unrealized Capital Gains

Prior attempts to estimate the magnitude of inherited capital gains faced notable data limitations. Early work (Steger, 1957; Okun, 1967; Brannon et al., 1967) looked to US estate tax records, which capture the value of wealth transfers subject to the estate tax, but not the amount of capital gains within the transferred wealth. These papers back out a measure of inherited capital gains by assuming that the ratio of capital gains to value is the same for inherited assets and realized assets. We show in Section 4 that this assumption does not hold in practice: inherited assets under step-up are much more highly appreciated than realized assets. More recent attempts (Poterba and Weisbenner, 2001; Office of Tax Analysis, 2014; Avery et al., 2015) estimate inherited capital gains by applying mortality tables to the household-level measure of unrealized capital gains in the US Survey of Consumer Finance: they measure inherited capital gains as equal to unrealized capital gains for households predicted to die in the next year. Office of Tax Analysis (2014) and Gordon et al. (2016a,b) observe the inherited capital gains of US estates that chose carryover treatment in 2010 (the single year in which the US allowed estates to choose between carryover or step-up treatment). Since estates with large amounts of inherited capital gains were incentivized to choose step-up treatment, the amount of inherited capital gains they observe in their sample is almost surely an underestimate. A key contribution of our paper is that it is the first to combine comprehensive data on inheritance transfers with the amount of capital gains in the

transferred assets. We are also the first to measure inherited capital gains in a panel setting, which allows us to examine behavioral responses to changes in tax policy.

In our paper, we measure the outstanding stock of unrealized capital gains in Norway. We believe we are the first to measure this stock in non-survey data.<sup>8</sup> However, our effort is related to prior work that creates measures of the yearly flow of accruing capital gains. Several recent papers use Norwegian administrative data to directly measure a flow of accruing capital gains (Eika et al., 2020; Fagereng et al., 2024).<sup>9</sup> In the US, prior work has measured capital gains accruals using yearly changes in house price values, rates of return on stocks and changes in the yearly values of wealth reported in the *Forbes 400* (Larrimore et al., 2021; Yagan, 2023). Other related papers allocate flows of firm profits or retained earnings to shareholders to proxy for capital gains accruals (Thoresen et al., 2012; Wolfson et al., 2016; Fairfield and Luis, 2016; Alstadsæter et al., 2023). These papers either do not or cannot link individuals’ initial purchase price (i.e., “basis”) to contemporary asset holdings, so they cannot measure the total stock of accumulated unrealized gains, only the year-to-year change in unrealized gains as they accrue. Our measure of basis and unrealized capital gains is necessary to consider the implications of capital gains policy changes within existing realization-based systems.

### 1.1.2 Responses to Capital Gains, Step-Up, and Inheritance Tax Policy

Our work follows a long empirical literature on behavioral responses to the capital gains tax rate (Feldstein and Yitzhaki, 1978). Although this literature agrees that taxable realizations are sensitive to the capital gains tax rate, the magnitude of that sensitivity over the long

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<sup>8</sup>The US Survey of Consumer Finance (SCF) measures unrealized capital gains — see Looney and Moore (2016). Unfortunately, the SCF, by design, excludes the wealthiest US households, preventing a complete characterization of the distribution of unrealized capital gains. The SCF’s cross-sectional structure also makes it difficult to use to analyze behavioral changes over time.

<sup>9</sup>Eika et al. (2020) compute their measure of households’ yearly accrued capital gains using the same transactions data we use in this paper. However, we are the first to use this (or any similar data) to measure basis and unrealized capital gains, or to measure capital gains passing via intergenerational transfers.

term remains highly disputed.<sup>10</sup> In contrast with the prior empirical literature’s focus on the capital gains tax rate,<sup>11</sup> our paper focuses on behavioral responses to changes in the capital gains tax base: we provide the first empirical study of how taxable realizations are affected by the exclusion of inherited capital gains from the tax base.

Behavioral responses to the tax rate, however, are not structural parameters (Slemrod and Kopczuk, 2002). Responsiveness depends on institutional features of the tax base, including the treatment of inherited capital gains. Accordingly, stepped-up basis is typically discussed in the capital gains literature as a policy that likely makes realization behavior more sensitive to the tax rate (Holt and Shelton, 1962; Feldstein and Yitzhaki, 1978; Auerbach, 1989; Kiefer, 1990; Slemrod and Chen, 2023). Revenue estimates from academic researchers and think-tanks increasingly assume that if step-up was removed in tandem with an increase in capital gains tax rates, the behavioral distortions from the higher rates would be lower than if rates were raised without changing step-up (Ricco, 2019; Mermin et al., 2020; Sarin et al., 2022). Our empirical work isolates the realizations effect of removing step-up, without any concurrent change in the capital gains tax rate. But the theoretical section of our paper confirms the prior intuition about step-up’s amplifying effect on the capital gains tax rate. We show theoretically that when step-up is in place, taxable realizations will be more responsive (i.e., more highly elastic) to a given capital gains tax rate.

Our work also relates to studies that examine responses to inheritance and gift taxation (see Kopczuk (2013) for a comprehensive survey). An important takeaway from this literature is that givers appear to forgo a large amount of tax savings in order to keep their wealth in their own possession as long as possible. That is, although *inter vivos* gifts do increase

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<sup>10</sup>See Gravelle (2021) for an excellent summary of the available long-run estimates. Methodological and data differences lead the two most recent studies in this literature, Dowd et al. (2015) and Agersnap and Zidar (2021), to differ sharply in their conclusions about the long-run elasticity of taxable income despite both studying the US over overlapping time periods. Short-term responses, on the other hand, are clearly very large: the literature persistently finds that realizations spike upwards in advance of pre-announced capital gains tax increases (Burman et al., 1994; Goolsbee, 2000; Department of the Treasury, 2016; Auten et al., 2016; Saez, 2017).

<sup>11</sup>Kopczuk (2005) is a notable exception.



in response to tax incentives (Joulfaian, 2004; Ohlsson, 2011), they do not respond as much as they would if the giver chose the timing of his transfer (lifetime vs deathtime) with only tax considerations in mind (Kopczuk, 2007). Our finding in Section 7.2 that many owners of unrealized capital gains forwent the opportunity to benefit from step-up before the law was changed parallels these findings.

Finally, our work is closest to a small number of papers that analyze the interaction of inheritance and capital gains taxation. As our conceptual framework in Section 6 demonstrates, the trade-off between capital gains realizations and bequests is affected by three policy levers: the capital gains tax rate, the inheritance tax rate, and step-up (but only for assets with unrealized capital gains). Closely related prior work illustrates two of these channels: Auten and Joulfaian (2001) show that higher estate tax rates encourage more capital gains realizations by the original owner. Poterba (2001) provides evidence that larger unrealized capital gains push owners towards the utilization of stepped-up basis. We are the first paper to show empirically that changing stepped-up basis affects taxable realizations.

## 2 Background on Capital Gains Taxation

### 2.1 What are Capital Gains?

Capital gains refer to the appreciation of an asset (such as stocks, real estate, or other investments) during the asset owner’s holding period. When the current price of an asset exceeds the owner’s original purchase price (which is called the owner’s “basis” in the asset)<sup>12</sup>, that owner has capital gains:

$$\text{Capital Gains} = \text{Current Price} - \text{Basis}$$

The above formula holds even if the asset has fallen in value since the owner’s initial purchase, in which case the owner is said to have a capital loss in the asset. For sake of brevity we

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<sup>12</sup>The owner’s basis in the asset would also include any costs associated with his acquisition of the asset, such as commissions or fees.

will use the term “capital gains” to include net capital gains and losses throughout this paper. Note that our definition of capital gains includes all gains accumulated during an investor’s holding period, whether or not that gain is recognized for tax purposes upon sale or another realization event. Throughout this paper, we will therefore need to distinguish between “realized capital gains” and “unrealized capital gains,” depending on whether the underlying asset experiences a taxable realization event. We will also refer to those not-yet-realized capital gains that pass in gift or inheritance transactions as “inherited capital gains.”

Capital gains are a form of income tied to asset ownership. This is not to say that all capital gains are “capital income,” as is usually distinguished from labor income in economic theory. Many capital gains, such as those built up in a business by an entrepreneur, or by renovating real estate, are clearly a return to the owner’s human capital and labor effort. Mapping optimal tax theory of capital and labor income onto the legal category of capital gains income is outside the scope of this paper.<sup>13</sup> We take the existence of capital gains as a distinct tax base with a positive tax rate as given and consider changes to that capital gains tax base.

## 2.2 Taxation of Capital Gains

### 2.2.1 A Realization-based Tax

Although capital gains accrue continuously over time, they are typically only taxed when *realized* through the sale of the underlying asset.<sup>14</sup> Therefore, an individual may own a stock for many years and accrue a large amount of *unrealized* capital gains in the stock. But until

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<sup>13</sup>Several seminal results in the theoretical tax literature contend that the optimal tax rate on capital income is zero (Atkinson and Stiglitz, 1976; Chamley, 1986; Judd, 1985), although this view has also been widely challenged.

<sup>14</sup>Although we are not aware of any country with a broad accrual-based system for individual capital gains taxation, accrual-based taxation is sometimes available in limited form. For example, Section 475 of the US Tax Code requires mark-to-market accounting for securities dealers and offers an election into mark-to-market treatment for commodities dealers and traders.

he sells the stock (or until another realization event specified by the tax authority occurs), he will not owe tax on that capital gain.

The realization requirement is widely seen as a concession to the administrative burdens of, and political opposition to, taxing capital gains as they accrue.<sup>15</sup> Taxing capital gains at the time of sale sidesteps the need for the government to value unsold assets and aligns the timing of the tax with when the investor has liquid wealth to pay the tax bill. Despite the near-consensus<sup>16</sup> in the academic literature in favor of accrual-based taxation (at least in theory), policymakers and the public seem to favor a realization requirement, as evidenced both by the lack of global policy experimentation (no country has implemented a broad accrual system), and recent survey evidence in the US ([Liscow and Fox, 2022](#)).

### 2.2.2 Possible Tax Treatments of Never-Realized Capital Gains

As long as the capital gains tax remains a realization-based tax, a choice will need to be made as to how to treat capital gains that are never realized by the original owner, and instead pass to that owner’s heirs as gifts or inheritances. There are three broad alternatives:

#### 1. Stepped-up Basis

Under a system of stepped-up basis, inherited capital gains disappear from the capital gains tax base. No capital gains taxes are due at the time of the inheritance transfer, and if the heir subsequently realizes the asset, she pays capital gains tax only on appreciation that took place during her own holding period. Formally, this result is accomplished by deeming the heir’s basis in the asset to be the market value at the time of the inheritance transfer.

#### 2. Carryover Basis

Under a system of carryover basis, the heir inherits the original owner’s unrealized capital

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<sup>15</sup>Descriptions of the realization rule as a “concession [...] to the exigencies of a given situation” date at least as far back as [Haig \(1921\)](#).

<sup>16</sup>[Aguiar et al. \(2024\)](#) is a notable recent exception. They argue that when some capital gains accrue due to changes in the discount rate, an optimal tax base would have elements of both an accrual-based and realization-based system.

gains when she inherits the associated asset. No capital gains taxes are due at the time of the inheritance transfer, but if the heir subsequently realizes the asset, she pays capital gains tax on all appreciation since the acquisition by the original owner. Formally, this result is accomplished by setting the heir's basis in the asset equal to her predecessor's basis.

### 3. Forced Realization

If the inheritance transfer is deemed to be a realization event, capital gains that the original owner has not yet realized will be realized and taxed at the time of inheritance. If the heir subsequently realizes the asset, she will then pay capital gains tax only on appreciation that took place during her own holding period. Formally, this result is accomplished by acting as if the asset was sold by the original owner to the heir for market value at the time of transfer. The heir's basis in the asset going forward is therefore the market value at the time of the transfer.

Each of these alternatives is currently in use in different countries around the globe. Canada, for example, imposes forced realization events to tax as-yet-unrealized capital gains that are transferred as gifts or inheritance. The UK also imposes forced realization, but only for *inter vivos* gifts. In Australia and Mexico, inheritors of capital assets carry over their predecessor's unrealized capital gains, which are taxed when the asset is next realized ([Joint Committee on Taxation, 2008](#)). Carryover basis is also in place in the US for *inter vivos* transfers. Deathtime transfers, on the other hand, are subject to stepped-up basis in the US, the UK, and 10 other OECD countries ([OECD, 2021](#)).

#### 2.2.3 Interaction with an Inheritance or Estate Tax

Although repealing stepped-up basis and inheritance taxes are frequently considered in tandem, an inheritance tax is not a perfect substitute for exempting inherited capital gains from the capital gains tax base. Inheritance transfer taxes apply to the market value of the bequest, regardless of any unrealized capital gains. Under stepped-up basis, an investor

who sells a highly appreciated asset the day before death and leaves the resulting cash as inheritance is subject to both the capital gains tax and the inheritance tax, whereas a dying investor who bequests the unrealized asset itself pays only the inheritance tax (if any). In Section 6, we clarify formally how the inheritance tax rate and the tax treatment of inherited capital gains each affects the cost of inheritance.

### 3 Data

Our paper uses data and policy variation from Norway, a country of 5.4 million people which consistently ranks among the wealthiest nations globally.<sup>17</sup> Norway is a small, open economy with a well-educated population, a sizable middle class, and a significant public sector. Levels of wealth inequality are relatively high, and top wealth is concentrated in real estate and private business interests (see Appendix D).

We combine several administrative data sources collected by the Norwegian government. We begin with detailed information about each Norwegian resident’s yearly income and wealth, captured in tax return data from 1992 to 2018. We link these tax data to records of sales, purchases, and transfers of individual assets. The data on asset transactions allow us to calculate a novel measure of unrealized capital gains at the individual asset level, and then aggregate that measure to each Norwegian resident and to the entire Norwegian economy.

#### 3.1 Data on Yearly Wealth & Income

In Norway, the tax authority collects detailed information on components of wealth and income. Much of these data (nearly all components of income and of financial wealth) are third-party reported from employers, banks, and financial intermediaries. The income data include information on (taxable) realized capital gains at the individual-year level.

The Norwegian wealth data are perceived to be high quality, and we are confident that it

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<sup>17</sup>In 2023, GDP per capita in Norway was \$87,961, versus \$81,695 in the United States ([World Bank, 2023](#)).

captures market values well for most components of financial wealth, such as bank deposits, liabilities, and listed securities. Some caveats and data supplementation, however, are necessary when measuring wealth in real estate and unlisted companies. Although the Norwegian tax authority assesses the value of all domestic real property each year, the quality of the assessment methodology prior to a substantial revision in 2010 is thought to be poor, and the 2010 reform did not improve the quality of the assessments for non-residential property. We therefore replace the tax-assessed value of real estate wealth with alternative property-level values computed by [Eika et al. \(2020\)](#). These alternative values use sales prices from the real estate transaction data (described below), and then interpolate and extrapolate those sale values using house price indices in years when that property does not sell. This procedure is validated and discussed in extensive detail in [Eika et al. \(2020\)](#). Unlisted stock are valued for the purposes of the Norwegian tax system by the book value of the firm’s underlying assets. This is likely to be a substantial underestimate of market value, and some types of firm assets, such as goodwill and other intangible assets, are not valued at all. We will therefore replace this measure with an alternative measure of unlisted stock wealth, discussed further below.

A few categories of wealth are missing. We do not observe wealth in defined contribution pension plans. Defined contribution plans were not permissible in Norway until 2001 and only begin to have market share during our period of study.<sup>18</sup> Although Norwegians are legally required to report wealth abroad, and we observe these reported values, we will not capture international wealth that Norwegians fail to report to the tax authority. It has been established that offshoring forms of tax evasion are substantial among the wealthy citizens of Norway ([Alstadsæter et al., 2019a](#)).

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<sup>18</sup>Even in 2017, the average wealth in individual and private contribution plans was only around \$24,000 ([Statistics Norway, 2017](#)).

## 3.2 Transactions Data in Real Estate and Stock

Transactions data from the Norwegian Land Register allow us to observe sales and other transfers of real estate. For nearly all properties in Norway, the data contain information on the last transaction prior to 1993, and all subsequent transactions from 1993 to 2018. Detailed information is recorded for each transaction, including the type of transfer (e.g., an arms-length sale or an inheritance transfer).

In addition to the data on real estate transactions, we have transaction data for listed and unlisted stocks over the period 2003 to 2014. These data contain similarly detailed information on the type of transfer, the identity of the buyer or seller, and the transaction price. The data contain information on the last transaction prior to 2003, and all subsequent transactions from 2003 to 2018. The data on transactions in stock have two key limitations: stock transactions are not observed before 2003, and we do not observe transactions in mutual funds. Mutual funds are an important component of many Norwegians' portfolios, with a higher average participation rate than directly held stock (See Appendix Figure A5). However, they are a much smaller fraction of overall wealth for the richest Norwegians (See Appendix Figures A6, A7). Since we cannot calculate unrealized capital gains in mutual funds, we will bound our estimates of total unrealized capital gains by making the alternative assumptions that (1) Norwegian households do not have any unrealized capital gains in mutual funds and (2) Norwegian households' mutual fund wealth is 100% unrealized capital gains (i.e., all owners of mutual funds have zero basis in their mutual fund holding).

## 3.3 A New Measure of Unrealized Capital Gains

To construct our measure of unrealized capital gains, we first convert the transactions data into a ledger, tracking each individual's asset holdings as the individual buys and sells. Our initial measure of an individual's basis in a held asset is the original purchase price which that individual paid for the asset. We calculate unrealized capital gains each year by subtracting

the individual's basis in the asset from the contemporary value of the asset at the end of the year.

We ignore unrealized capital gains in asset classes other than Norwegian stock (including unlisted stock), real estate, and mutual funds. Although capital gains from other asset types, including directly held international stock, directly held business assets, artwork, etc., are subject to the capital gains tax, the aggregate amount of wealth in these categories (and thus, the upper bound for the possible amount of unrealized capital gains) is small.<sup>19</sup> See Appendix Figures [A6](#) and [A7](#).

### 3.3.1 Tracking Basis and Current Holdings

We create a ledger at the individual-asset level. When an individual buys a new asset, we open a ledger for that individual-asset pair. We record the number of shares initially owned in the asset (or fractional ownership share for real estate), and then we update the number of shares held (or fractional ownership held) as the individual makes subsequent transactions in the asset. We account for stock splits, consolidations and mergers when applicable.

We measure an individual's initial basis in an asset as the asset's original purchase cost, or carryover basis if applicable. To properly account for carryover basis, it is necessary to trace shares moving across ledgers in non-taxable transactions. Basis may be carried over between ledgers due to mergers, changes to share classes, or gift/inheritance transactions after the removal of step-up ([The Norwegian Tax Administration, n.d.](#)). As the individual buys and sells, we increase and decrease his basis under a first-in-first-out assumption, in keeping with the accounting methods required by Norwegian law.

For capital gains that are eventually realized, we can validate our measure of basis by using it to calculate realized capital gains (as the recorded value of the sale minus basis), and then comparing that calculation to the realized capital gains reported in each individual's

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<sup>19</sup>Most Norwegians participate in international equity markets via mutual funds, and this wealth would therefore be included in our mutual fund numbers.



tax return. The match is extremely good — over 98% of person-years agree (within rounding error) on the amount of capital gains in stock realized between our transaction-based calculation and the tax returns.

### 3.3.2 Measuring Yearly Value

Our ability to measure unrealized capital gains requires us to obtain a yearly measure of each asset’s market value, even when that asset is not sold. For listed stock, we obtain the stock’s end-of-year closing price from Thomson-Reuters Datastream.

For unlisted stock, we begin with the book value measure used by the Norwegian government to value each unlisted company for wealth and inheritance tax purposes. When stepped-up basis was in place, this valuation also served as the heir’s new basis for unlisted stock received in inheritance. This measure almost certainly undervalues the value of these companies. We therefore create our own measure of unlisted company value by scaling up the company’s sales, income, and asset book values with multipliers computed for a sample of listed firms in the same industry, and then applying a 10% liquidity discount to those values. This procedure follows [Smith et al. \(2023\)](#) and is described in greater detail in Appendix B. When a firm’s estimated value is negative, we replace that value with zero, in keeping with the limited liability of the firms considered. When unlisted firm value is directly attributable to firm ownership in listed equity, we value that portion of the firm at the listed equity value.

### 3.3.3 Inheritance Values and Never-Realized Gains

Until 2014, the (tax-assessed) values of gifts and inheritances were reported to the Norwegian tax authority.<sup>20</sup> However, the inheritance data never included information about the amount of unrealized capital gains passing in inheritance. We construct this measure using the transactions data (described above) for stock and real estate. We observe gift and in-

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<sup>20</sup>Gifts and inheritances were not reported if they are below the lowest tax threshold (see Appendix Table A1) or if the estate is administered through the public probate process. Our transaction-based measure of inherited stock and real estate does not suffer from these limitations.

inheritance transactions of stock and real estate with information about the particular asset transferred and the quantity (i.e., number of shares) transferred. Since these transactions do not usually include a recorded value, we calculate the amount of capital gains in an inheritance transaction as the value of the asset at the beginning of the year minus the basis associated with the transferred asset.

Throughout this paper, we convert all currency amounts to 2018 USD using yearly average consumer price indices from Statistics Norway and the NOK-USD exchange rate on December 31, 2018.

## 4 New Descriptive Facts on Unrealized Capital Gains

In this section, we use our data to document new facts about unrealized and inherited capital gains. Because we are interested in learning about the state of unrealized capital gains under step-up (i.e., prior to the Norwegian policy reforms), we will focus on capital gains in Norway as of end-of-year 2004. As will be described in more detail in Section 5, 2004 was the last year before the removal of step-up was announced.

We focus on capital gains in what we call *taxable asset categories*—that is, asset categories that are usually subject to the capital gains tax.<sup>21</sup> Taxable asset categories in our data include listed and unlisted stock, mutual funds, and taxable real estate.<sup>22</sup> Primary residences and certain other forms of real estate, although present in our data, are exempt from capital gains tax if the owner meets certain holding period requirements (see Section 3). These categories of *non-taxable real estate* do not typically benefit from stepped-up basis, and we separate out their capital gains in the analysis that follows.

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<sup>21</sup>The use of the term “taxable asset categories” is not meant to imply that the capital gains within these assets will necessarily be subject to the capital gains tax, only that they would be so subject if realized. Capital gains from retained earnings might instead be paid out as dividends, and thus subject to a dividend tax (if any). And, in accordance with the focus of this paper, capital gains passed in inheritance under step-up are exempted from the capital gains tax base.

<sup>22</sup>Wealth in other possibly taxable asset categories is a very small share of household wealth (see Appendix Figure A6).

**Fact 1.** *Seventeen to nineteen percent of total household wealth is composed of unrealized capital gains in taxable asset categories.*

See Table 1 Panel (a). At the end of 2004, \$68.2–\$78.5 billion of unrealized capital gains were outstanding in asset categories subject to the capital gains tax: listed and unlisted stock, mutual funds, and taxable real estate. This amount equals 17–19% of aggregate net wealth held by Norwegian households in 2004 (\$412 billion).

We present our measures of total unrealized capital gains in taxable assets as a range to acknowledge our uncertainty regarding the amount of unrealized capital gains in mutual funds. We do not observe mutual funds in our transaction data and are therefore unable to measure the amount of unrealized or inherited capital gains in mutual funds. However, we know that an individual’s unrealized capital gains in mutual funds cannot exceed his total wealth in mutual funds, which we observe in our wealth data. We can therefore present a range for the value of unrealized gains including mutual funds: the upper bound of this range assumes that all mutual fund holdings are 100% appreciated. The lower bound of this range assumes zero unrealized capital gains in all mutual fund holdings.

Much of household wealth, naturally, is comprised of assets such as cash and primary residences, which are not (or not usually) subject to the capital gains tax. Of the \$123.4 billion of wealth in the taxable asset categories of stock, mutual funds, and taxable real estate, 55–64% of this amount was unrealized capital gains. Within these categories, real estate wealth was less appreciated than wealth in listed or unlisted stock. On average, 29% of wealth in taxable real estate was unrealized gains (similar to 28% in non-taxable real estate). Forty-two percent of wealth in listed stocks was composed of unrealized capital gains and 79% of wealth in unlisted stock was unrealized capital gains.

Of assets subject to the capital gains tax, unrealized capital gains are largely found in private business holdings (Table 1 Panel (a)). \$53.2 billion of unrealized capital gains were

present in unlisted shares at the end of 2004. In Norway, top wealth is very concentrated in private business holdings (see Appendix Figure A7). So it is perhaps unsurprising that we also find unrealized capital gains to be concentrated in this type of asset. But this compositional effect is amplified by the fact that private business holdings are much more appreciated on average (79%) than holdings of listed stock or taxable real estate (which are on average 42% and 29% appreciated, respectively).

**Fact 2.** *Unrealized capital gains are concentrated in wealthy households, and wealthy households’ portfolios are disproportionately made up of unrealized capital gains in taxable asset categories.*

Figure 1 Panel (a) shows that ownership of unrealized capital gains in 2004 was concentrated among the wealthiest Norwegian households. The bottom 90% of households owned around 30% of the stock of taxable unrealized capital gains in Norway in 2004. The next 9% of households owned 26–27%, and the top 1% of households owned 41–44% of the stock of unrealized capital gains.<sup>23</sup> In contrast, Panel (b) shows that the distribution of unrealized capital gains in real estate categories not subject to the capital gains tax is much more evenly distributed across the wealth distribution.

The importance of unrealized capital gains within household portfolios also varies across the wealth distribution. Figure 1 Panel (c) shows that taxable unrealized capital gains are less than 10% of wealth for the bottom 80% of households in 2004. The ratio of taxable unrealized capital gains to total household wealth increases sharply at the top of the wealth distribution, reaching a value of over 40% for the wealthiest households.

The skewed distribution of taxable unrealized capital gains is mostly driven by differences in household portfolio composition across the wealth distribution. Wealthy households hold large fractions of their wealth in assets subject to the capital gains tax — holdings of unlisted

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<sup>23</sup>As before, we present ranges to incorporate alternative assumptions regarding the amount of unrealized capital gains within mutual funds.

stock are particularly important for the wealthiest households (see Appendix Figure A7). For example, households in the top 0.01% of net wealth in 2004 own 22% of the total wealth in stock and taxable real estate. These top households own a similar share of unrealized capital gains in these asset categories. Less wealthy households own more of their wealth in cash and primary residences, which are not subject to the capital gains tax. Because the fraction of wealth in primary residences is decreasing across the wealth distribution, Figure 1 Panel (d) shows that the fraction of household wealth attributable to unrealized capital gains in non-taxable assets is also decreasing in wealth.

**Fact 3.** *Assets transferred in inheritance are much more appreciated than those that are realized.*

Inherited assets are highly appreciated: the ratio of (taxable) capital gains to value in inherited assets subject to the capital gains tax is 57% (Table 1 Panel (b)). Realized assets are much less appreciated: the ratio of capital gains to value in realized assets subject to the capital gains tax is 8% (Table 1 Panel (c)). Listed and unlisted stock show a particularly large difference in appreciation between inherited and realized assets: 65% versus 1% in listed stock, and 71% versus 7% in unlisted. Real estate, whether taxable or non-taxable, does not show a similar pattern.

**Fact 4.** *The yearly amount of inherited capital gains exempted via step-up is a substantial fraction of the tax base of realized capital gains.*

Although 38 times as much *value* is realized as is inherited in 2004, the large differences in appreciation within those assets (Fact 3) mean that only about five times as much *capital gains* are realized than are inherited in 2004 (Table 1 Panels (b) and (c)). Specifically, \$310 million of inherited capital gains are exempted via step-up in 2004, which is 19% of the amount of aggregate realized capital gains from stock and taxable real estate in 2004 (\$1.65 billion). Numbers in 2003 are similar — \$274 million of inherited capital gains is equivalent

to 25% of that year’s amount of realized capital gains from stock and taxable real estate (\$1.06 billion).

**Fact 5.** *Inheritances that benefit from the stepped-up basis exemption come from disproportionately wealthy households.*

Although Fact 2 (Figure 1) established that unrealized capital gains are disproportionately concentrated at the top of the wealth distribution, wealthy households own an even larger share of capital gains that are passed in inheritance. Figure 2 Panel (a) shows that the bottom 90% of households are the source of only 14% of inherited capital gains in taxable assets in 2004. The next 9% of households are responsible for 20% of inherited capital gains, while the top 1% is the source of the remaining 66%. The top 0.01% alone is responsible for 34% of inherited capital gains in taxable assets.

The households that transfer large amounts of capital gains in inheritance are the mechanical beneficiaries of stepped-up basis policy: the capital gains they transfer are exempted from the capital gains tax under step-up. Figure 2, therefore, paints an portrait of step-up as a tax break that goes to households that are wealthy even relative to the skewed distribution of capital gains ownership (Figure 1). In the next part of the paper, we explore how investor behavior changes when the stepped-up basis exemption is removed.

## 5 Norway’s Removal of Step-Up for Stock (2005-2006)

The remainder of this paper studies the removal of stepped-up basis for stock in Norway (including listed and unlisted stock, and equity-based mutual fund shares). This change was announced in 2005 and implemented in 2006. Capital gains and inheritance tax rates did not change during the same period. Further detail on later policy changes, including the removal of step-up for non-stock asset classes (concurrent with the removal of the inheritance tax in 2014), can be found in Appendix A.

During our period of study, capital gains realized by their original owner were taxed at a 28% rate.<sup>24</sup> Heirs were subject to an inheritance tax on the market value of received inheritance (of any type), but, until 2006, were not subject to capital gains tax on unrealized capital gains from their predecessor’s holding period. The top inheritance tax rate for transfers between close relatives was 20% from 1999 to 2008.<sup>25</sup> We end our baseline difference-in-difference results in 2008 to isolate the removal of step-up for stock from the subsequent 2009 change in the inheritance tax rates.

The 2006 removal of step-up for stock was passed as an afterthought to a wider reform of capital taxation (see Appendix Section A.1.4 for more detail). Although the main components of the 2006 tax reform were formally announced in March 2004 and approved in June of that year, the removal of step-up was not part of the June legislation and was not definitively decided until later in the year (Norwegian Ministry of Finance, 2004). Since we do not find any press coverage regarding the impending removal of step-up until early 2005, we take 2005 to be the relevant announcement year when considering anticipatory responses in our empirical analysis.<sup>26</sup>

The removal of step-up for stock meant that, from January 1, 2006, inheritance transfers of appreciated stock (including unlisted stock and equity-based mutual funds) received

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<sup>24</sup>The capital gains tax rate was 28% from 1992 to 2013 and has never depended on individual income (i.e., there is no progressive rate structure). The same rate was also applied to other forms of capital income, such as interest income. Capital losses can be used to fully offset capital gains. Net losses can be used to offset ordinary income: \$1 of capital losses offsets only \$0.72 of ordinary income, and cannot be applied against social security contributions or top marginal tax rates.

<sup>25</sup>Norway’s inheritance tax had a rate structure that depended on the cumulative amount of the inheritance received, and the relationship between the giver and the recipient. Other than a small yearly gift exemption, no distinction was made between *inter vivos* gifts and bequests at the time of death. Appendix Table A1 provides details on the rates and brackets over time.

<sup>26</sup>The removal of step-up for stock was formally introduced on December 10, 2004 (Stortinget, 2004). However, this change did not receive immediate media attention. A search through the Norwegian media library (Nasjonalbiblioteket) for the terms “kontinuitetsprinsippet” and “diskontinuitet” (which are the Norwegian terms corresponding to carryover and stepped-up basis, respectively) shows that the first mention of the impending change appeared in the newspaper *Finansavisen* on January 8, 2005, under the headline “One Year Left” (Amundsen, 2005). A second mention appeared in *Levanger-Avisa* on February 19, 2005 (Vigdal, 2005). Both articles featured lawyers advocating that Norwegians transfer stock (especially stock of family businesses) to the younger generation before the new carryover basis regime came into effect. Media coverage of the upcoming change grew more intense during the spring and summer of 2005.

carryover basis treatment.<sup>27</sup> That is, heirs who inherited appreciated stock continued to be subject to inheritance tax on the value of the stock they received, but now were also subject, if and when they sold the stock, to capital gains tax on the amount of appreciation during the original owner’s holding period.<sup>28</sup> Losses, however, were not permitted to be carried over in the 2006 reform, so stocks with losses continued to be subject to a “step-down” in basis at the time of inheritance. Step-up also continued for non-stock assets (such as real estate) until 2014.<sup>29</sup>

Our empirical analysis focuses on how owners of appreciated stock reacted to the 2005 announcement of step-up’s impending removal, rather than the later implementation of that removal. The announcement date is important because the capital gains tax treatment of the original owner is not changing. The original owner faces the same cost of realizing his capital gains before or after step-up is removed. But the announcement of step-up’s removal informs the original owner that the inheritance he may give in the future will be more expensive, which will cause him to reassess his trade-off between present realizations and future bequests. We formalize this understanding of step-up’s effects on owners of unrealized gains in the next section of the paper.

## 6 Conceptual Framework

This section presents a conceptual framework to understand the effects of step-up. Step-up makes it less costly for heirs to realize appreciated assets which they received as inher-

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<sup>27</sup>In Norway, mutual fund investors are not taxed when fund managers buy and sell stocks or reinvest dividends. Capital gains taxes are only triggered when the investor sells their mutual fund units. Mutual funds are classified as stock funds and taxed identically to stock if more than 80% of the fund is in equities; otherwise, they are treated as combination funds, with stock income taxed at a higher rate (currently 38%) and bond income taxed at 22%. Exemptions that are available to offset capital gains from stock are also applicable to capital gains from stock in mutual funds.

<sup>28</sup>From 2006 until the removal of the inheritance tax in 2014, recipients of gifted or inherited stock were given a deduction on their inheritance tax bill equal to 20% of the carried-over capital gains tax liability, to lessen the “double taxation” from being subject to both an inheritance tax and carried over capital gains. We abstract from this deduction in our explanation of the policy changes, but fully account for it in all our figures and empirical analyses.

<sup>29</sup>See Appendix A for detail on the removal of step-up for non-stock assets, which is not the focus of our empirical analysis.



itance. Under the assumption that givers of inheritance have altruistic bequest motives (i.e., that they care about their heirs' after-tax value of the bequest), we show that step-up will disincentivize realizations by the original owners of appreciated assets and amplify the distortionary effects of the capital gains tax rate.

Only some of the large literature on bequest motivations (see [Kopczuk \(2013\)](#) for a review) agree with the altruistic motivation assumed in this model. We assume here that the giver cares about the post-tax amount received by the heir, but alternative assumptions would hold that givers leave bequests only accidentally, or that they value the pre-tax amounts of their bequest transfers.<sup>30</sup> In their pure form, these alternative assumptions would imply that givers do not respond to changes in inheritance tax rates or step-up policy, which would be inconsistent with our main empirical findings in Section 7. Our focus in this section is therefore on the altruistic motivation. However, we revisit the possibility that givers may have more complicated bequest motives in Section 7.2.

## 6.1 A Model of Altruistic Bequests

Consider an individual with wealth of value  $W$ , some fraction  $\gamma$  of which is unrealized capital gains. The individual may either choose to realize this wealth, in which case he uses the proceeds of that realization for his own current consumption  $C$ , or the individual may pass the unrealized wealth to his heirs, who will realize it for their own consumption. The individual is assumed to be altruistic and thus values the after-tax amount  $B$  received by his heirs. The individual chooses after-tax consumption ( $C$ ) and bequests ( $B$ ), subject to a budget constraint that depends on two costs: his own cost of realization ( $c_R$ ) and his heir's

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<sup>30</sup>Givers might care about the pre-tax value of their bequests if they care more about being known to the world as a wealthy and generous individual than about how their bequests are valued by the recipients.

cost of inheriting and then realizing ( $c_I$ ):<sup>31</sup>

$$\max_{C,B} \quad U(C, B) \quad \text{subject to} \quad W = \frac{C}{(1 - c_R)} + \frac{B}{(1 - c_I)}$$

## 6.2 The Cost of Realizing and Inheriting

We define a “per-dollar cost of realization” and a “per-dollar cost of inheritance” to illustrate how the capital gains tax, inheritance tax, and tax treatment of inherited capital gains together affect the trade-off between consumption and bequests.

We first define a “per-dollar cost of realization” as the cost to extract 1 unit of value from wealth with fraction  $\gamma$  of unrealized capital gains:

$$c_R \equiv c_R(\gamma) = \tau_c \cdot \gamma$$

where  $\tau_c$  is the statutory capital gains tax rate and  $\gamma$  is the ratio of capital gains to total value in the realized wealth. All realizations face the same tax rate ( $\tau_c$ ) on realized capital gains. But the fact that the capital gains tax is levied on capital gains, rather than total value, means that  $c_R$  will vary across realized assets, because it is cheaper to extract the same amount of value from less-appreciated assets.

As an illustration, suppose two individuals own different stocks with the same current value. Suppose Stock 1 was originally purchased for \$99 and is now worth \$100 (Unrealized Capital Gains = \$1). Suppose Stock 2 is also currently worth \$100 but was originally purchased for only \$50 (Unrealized Capital Gains = \$50). If the first individual realizes the full \$100 value from Stock 1, it will cost  $\tau_c \times \$1$ . If the second individual realizes the full \$100 value from Stock 2, it will cost  $\tau_c \times \$50$ . In per-dollar terms, the cost of realization is

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<sup>31</sup>Although this is a static model, if we want to allow for the possibility that wealth grows at rate  $r$  between the time of consumption and the time of bequests, we can modify the budget constraint (using the cost variables defined in the next section) to  $W = \frac{C}{1 - c_R} + \frac{B}{(1+r)[1 - c_I - \tau_c r(1-\gamma)/(1+r)]}$ . Doing so complicates the notation and does not change any of our conclusions, so we set  $r = 0$  outside of this footnote.

thus  $\tau_c$  times the amount of unrealized capital gains divided by the total value, precisely as shown in the equation for  $c_R$  above.

The “per-dollar cost of inheritance” is the heirs’ cost of inheriting \$1 of wealth and then immediately realizing the accompanying capital gains (if any).<sup>32</sup>

$$c_I \equiv c_I(\gamma) = \begin{cases} \tau_I & \text{under stepped-up basis} \\ \tau_I + \tau_c \gamma & \text{under carryover basis} \end{cases}$$

where  $\tau_I$  is the statutory inheritance tax rate,  $\tau_c$  is the statutory capital gains tax rate, and  $\gamma$  is the fraction of capital gains to total value in the inherited wealth. For notational convenience, we will also define the indicator  $\iota$  to equal 0 when a step-up regime is in place and equal 1 when in a carryover basis regime is in place. We can then write the per-dollar cost of inheritance as  $c_I = \tau_I + \iota \tau_c \gamma$ .

Figure 3 depicts how the per-dollar cost of inheritance,  $c_I$ , is affected by the removal of stepped-up basis, depending on the fraction  $\gamma$  of unrealized capital gains to total value. The cost of inheritance  $c_I$  increases when step-up is removed, and the magnitude of the change is increasing in the ratio of unrealized capital gains to value ( $\gamma$ ). In a stepped-up basis regime, the heir did not have to pay capital gains tax on inherited capital gains. The cost of inheritance was therefore equal to the inheritance tax rate  $\tau_I$  (the flat dashed line in Figure 3 Panel (a)). When step-up is removed, the heir now has to pay capital gains taxes when he realizes the inherited asset. The total cost of inheritance is thus the sum of the inheritance tax and the heir’s capital gains tax obligation, and depends sharply on the fraction of unrealized capital gains in the asset (the solid light blue line in Figure 3 Panel (a)). In contrast, the cost of realizations for the original owner’s consumption,  $c_R$  is

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<sup>32</sup>Alternatively, if we assume that the heir realizes the inherited wealth  $T$  periods after the inheritance is received, we will need to modify the formula for the carryover basis case to account for the distance in time between the payment of inheritance and capital gains taxes:  $c_I = \tau_I + \beta^T \cdot \iota \cdot \tau_c \cdot \gamma$

unaffected by the removal of step-up.

In practice, the capital gains tax rate was 28% in Norway from 1992 until 2013. Therefore the original owner's cost  $c_R$  of realizing (for an asset with a fixed ratio  $\gamma$  of unrealized capital gains to value) stayed constant across these years. The cost  $c_I$  of leaving the asset for the heir to realize, on the other hand, was affected by the removal of step-up for stock (and later, by reductions in the inheritance tax rate, see Appendix A). Figure 4 illustrates how the cost  $c_I$  changed with the 2006 the removal of step-up for stock. In the step-up regime, the cost of bequests does not depend on the fraction of value that is taxable capital gains — the cost equals the inheritance tax rate  $\tau_I$  regardless of the type of asset inherited or the amount of unrealized capital gains in that asset. Once a carryover basis regime is established for stock, the price of bequests becomes heterogeneous across portfolios and depends steeply on the fraction of total wealth that is capital gains from stock.

### 6.3 Effects of Step-Up Policy on Realizations

Returning to the consumption model of Section 6.1, we can rewrite the budget constraint by plugging in our definitions for costs  $c_R$  and  $c_I$ :

$$W = \frac{C}{1 - c_R} + \frac{B}{1 - c_I} = \frac{C}{1 - \tau_c \gamma} + \frac{B}{1 - \tau_I - \iota \tau_c \gamma}$$

To maximize utility subject to this budget constraint, our individual will, naturally, choose consumption and bequests such that the ratio of his marginal utilities is set equal to the relative price:  $u_B/u_C = (1 - c_R)/(1 - c_I)$ . Changes to step-up policy (i.e.,  $\Delta \iota$ ), which affect the per-dollar cost of inheritance  $c_I$ , will therefore give rise to income and substitution responses, discussed further below:

**Proposition 1** (Step-Up Depresses Realizations). *If the substitution effect dominates the income effect, then replacing stepped-up basis with carryover basis (i.e., a change from  $\iota =$*

0 to  $\iota = 1$ ) will weakly increase the amount  $C$  realized for present consumption.

See Appendix B for formal proof. Briefly: the change in  $\iota$  weakly raises the cost of bequests relative to present consumption ( $\frac{c_I}{c_R} \uparrow$ ). If the substitution effect dominates the income effect, this price change causes consumers to reallocate their wealth toward current consumption and away from bequests, leading to a net increase in  $C$ .

**Corollary 1** (Differential Exposure to the Removal of Step-Up). *Given the conditions in Proposition 1, the magnitude of the increase in realizations for present consumption ( $C$ ) that follows the removal of step-up ( $\Delta\iota = 1$ ) will depend on the ratio  $\gamma$  of unrealized gains to value within an individual’s portfolio. In particular:*

- a. Individuals whose portfolios have some amount of unrealized capital gains ( $\gamma > 0$ ) will strictly increase the amount  $C$  realized for present consumption.*
- b. Individuals whose portfolios do not have any unrealized capital gains ( $\gamma = 0$ ) will not change their realization behavior.*
- c. Individuals whose portfolios have relatively larger fractions  $\gamma$  of unrealized capital gains will have relatively larger increases in realizations.*

Since  $\iota$  only enters the budget constraint in the individual’s maximization problem when multiplied by  $\gamma$ , this corollary follows directly from Proposition 1. In our analysis of the removal of step-up for stock in Norway in Section 7, Corollary 1 guides our empirical strategy. We consider individuals with some amount of unrealized capital gains in stock to be “treated” by the removal of step-up for stock, while individuals without any unrealized gains in stock are “untreated.” We also explore heterogeneous treatment effects by  $\gamma$  and confirm that individuals with the most-appreciated stock portfolios have the largest responses to the reform.

**Proposition 2** (Step-Up Affects the Relationship Between Realizations and the Capital

Gains Tax Rate). *If the substitution effect dominates the income effect, then the elasticity of realizations with respect to the capital gains tax rate  $\tau_c$  is more negative under stepped-up basis ( $\iota = 0$ ) than under carryover basis ( $\iota = 1$ ).*

See Appendix B for formal proof. When step-up is in place, the capital gains tax rate  $\tau_c$  only affects the original owner’s cost of realization. Thus every increase in  $\tau_c$  increases the price of realizations relative to bequests, leading to fewer taxable realizations. When carryover basis is in place, increases to  $\tau_c$  increase both the original owner’s cost of realization and the heir’s cost of bequests, and so changes to  $\tau_c$  have less of an effect on the relative price. This result is related to prior work by Slemrod and Kopczuk (2002) and Kopczuk (2005), which shows that broader tax bases lead to less-elastic taxable income elasticities. The removal of step-up, as a base-broadening reform, dampens the distortions from the capital gains tax rate, thereby reducing the marginal efficiency cost of taxation.

In the next section, we begin our empirical analysis of the removal of step-up, guided by the framework and the propositions above.

## 7 Observed Responses to the Removal of Step-Up

In 2005, following thirteen years without substantial changes to capital gains and inheritance tax rates,<sup>33</sup> it was announced that step-up would be removed for stock (including private business interests and equity-based mutual funds). Stock gifted or inherited after January 1, 2006, would be subject to capital gains tax on the original owner’s gains when the heir next realized the asset.

In this section, we document responses to the 2005-2006 removal of step-up for stock.<sup>34</sup>

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<sup>33</sup>See Appendix Table A1 for detail on minor modifications to the inheritance tax brackets during this time.

<sup>34</sup>Although step-up was eventually removed for non-stock asset classes in 2014 (see Appendix A), evaluation of that removal is confounded by the 2014 removal of the inheritance tax, which had a simultaneous but opposite effect on the relative price of bequests versus realizations. We therefore choose to focus our analysis only on the earlier reform, which removed step-up for stock while holding inheritance tax rates fixed.

First, we focus on realization responses and document large increases in taxable realizations. We show that this increase was driven by individuals whose portfolios were most affected by the removal of step-up. Second, we document that this increase in realizations occurred despite the opportunity, throughout 2005, to make early bequests that would still benefit from stepped-up basis treatment. Third, we examine how increased realizations and anticipatory behavior affected aggregate trends for inheritance transfers.

## 7.1 Capital Gains Realization Responses

For investors with altruistic bequest motives, the removal of step-up made it relatively cheaper to realize appreciated stock relative to the outside option of leaving that stock to their heirs (Section 6.2). Our Proposition 1 demonstrated that, in a very simple model of realizations and bequests, the removal of step-up should trigger an increase in realizations, particularly for investors whose portfolios have large fractions of unrealized capital gains in stock. In this section, we seek to learn whether the removal of step-up actually caused such an increase in taxable realizations.

### 7.1.1 Aggregate Increase in Realizations

As an initial naive examination, we look to the aggregate amount of net capital gains realized each year. Capital gains realizations surged following the announcement of the removal of step-up — aggregate realized capital gains more than tripled in 2005 compared to the previous year, and remained high until 2008’s financial crisis. Figure 5 documents this change, which corresponded to a 205% increase in tax revenue from the capital gains tax between 2004 and 2005.

However, as evidenced by the other fluctuations on display in Figure 5, aggregate capital gains realizations frequently exhibit large year-to-year variation. Large losses tend to be realized during economic downturns, and more gains are realized in periods of economic boom.

We are therefore unwilling to attribute the 2004-to-2005 increase in realizations to the removal of step-up without accounting for other time-specific factors such as contemporaneous macroeconomic shocks.

### 7.1.2 Defining the Target Parameter

Not all stock owners were equally exposed to the removal of step-up in 2006. As explained in our conceptual framework (Section 6, Corollary 1), individuals are more or less affected by the inheritance cost shock from the removal of step-up for stock depending on the ratio of unrealized capital gains in stock to value ( $\gamma$ ) in their portfolio. The intensity of the realizations response to the removal of step-up should be mechanically increasing for  $\gamma \in (0, 1]$ , and we do not expect any realization response for individuals with  $\gamma \leq 0$  (no unrealized capital gains in stock).<sup>35</sup> The average effect<sup>36</sup> of the removal of step-up on taxable realizations in year  $t$  for individuals with a fixed level of exposure  $\gamma$  can be written:

$$ATT_t(\gamma) = E[Y_{it}^\gamma - Y_{it}^0 | \Gamma_i = \gamma]$$

where  $Y_{i,t}^\gamma$  denotes the potential outcome (taxable realizations) of an individual  $i$  if she experiences treatment exposure of magnitude  $\gamma$ , and  $Y_{i,t}^0$  denotes the potential outcome if the individual is not exposed to the removal of step-up.  $\Gamma_i = \gamma$  denotes individual  $i$ 's actual exposure level  $\gamma$  (because the individual's portfolio had a ratio  $\gamma$  of unrealized capital gains in stock to value in the year before removal).

Although these  $\gamma$ -specific treatment effects reveal important heterogeneity in responses to the removal of step-up, we are primarily interested in the overall effect on total realizations

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<sup>35</sup>Loss positions were not exposed to the 2006 reform because, as discussed in Section 5, the 2006 reform removed step-up for stock but not step-down. That is to say, a carryover basis regime was implemented for inheritance transfers of appreciated stock, but capital losses were not carried over until the subsequent reform in 2014.

<sup>36</sup>We seek to document the extent to which the removal of step-up increased capital gains realizations for those individuals who were exposed to the removal of step-up. Our target parameter is thus an average treatment effect for the treated (an “ATT”).



and total tax revenue. The average effect of the removal of step-up for all individuals affected by the removal is:

$$ATT_t = E[Y_{it} - Y_{it}^0 | \Gamma_i > 0]$$

where  $Y_{i,t}$  represents individual  $i$ 's observed amount of taxable realizations in year  $t$ . This overall  $ATT_t$  is a weighted average over all the  $ATT_t(\gamma)$  with  $\gamma > 0$ , and can be transformed into a measure of the total increase in taxable realization engendered by the removal of step-up by simply multiplying the  $ATT_t$  by the number of individuals with  $\Gamma_i > 0$ .

### 7.1.3 Comparing Realization Responses for Differently Exposed Individuals

To account for the concern about confounding time effects, we require a control group that is not exposed to the removal of step-up but whose observed response to macroeconomic shocks and other time effects will allow us to construct a counterfactual for the realization behavior of individuals exposed to step up's removal. Guided by Corollary 1, we use individuals with  $\gamma \leq 0$  (negative or zero unrealized capital gains in stock in the year before the removal of step-up) as our control group. Our first empirical strategy is therefore the following: We compare the average taxable realizations of shareholders before and after the removal of step-up, contrasting those individuals who had a positive amount of unrealized capital gains in their stock portfolio (i.e., the treatment group) and individuals with no or negative unrealized capital gains in their stock portfolio (i.e., the control group). To be included in the analysis, an individual must own stock at the beginning of 2005. We then sort these individuals into the treatment or control group depending on whether they have positive appreciation ( $\gamma > 0$ ) in their stock portfolios at the beginning of 2005. Figure 6 displays the average change in the per-dollar cost of inheritance in 2006 for this treatment and control group. Our outcome variable is the individual's net realized capital gains, as reported on his or her yearly income tax return, which includes realized capital gains from stock and from all other taxable asset categories. Secondly, we separate the treatment group into groups based on treatment exposure: we group individuals based on their portfolios' fraction

of unrealized capital gains in stock.

These comparisons are only useful if observed realizations by the control group are informative of what realizations by the treatment group(s) would have been if step-up had not been removed. To identify our treatment effects, we assume that realizations for these groups would have trended proportionally. That is, we assume that, if step-up had not been removed, the groups' average realizations would experience the same percent changes over time. Assumption 1 describes this assumption formally:

**Assumption 1** (Parallel Trends in Percent Changes). *The average outcome for the group of individuals with treatment exposure  $\gamma$  would have, in the absence of treatment, evolved proportionally to the average outcome of the untreated group.*<sup>37</sup>

$$\frac{E[Y_{it}^0|\Gamma_i=\gamma, Post_t=1]-E[Y_{it}^0|\Gamma_i=\gamma, Post_t=0]}{E[Y_{it}^0|\Gamma_i=\gamma, Post_t=0]} = \frac{E[Y_{it}^0|\Gamma_i=0, Post_t=1]-E[Y_{it}^0|\Gamma_i=0, Post_t=0]}{E[Y_{it}^0|\Gamma_i=0, Post_t=0]}$$

where  $Post_t$  is an indicator that equals one if the year is greater than or equal to 2005 (the announcement year).

We also require a “no anticipation” assumption for the years we consider to be our pre-period:

**Assumption 2** (No Anticipation Before 2005).

$$E[Y_{it}^0|\Gamma_i = \gamma, Post_t = 0] = E[Y_{it}^\gamma|\Gamma_i = \gamma, Post_t = 0] \quad \forall t, \gamma$$

Under Assumptions 1 and 2, we can employ a difference-in-difference estimator to identify

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<sup>37</sup>An assumption of parallel trends in percent changes is commonly made by assuming parallel trends in a logged variable — but zeros in our outcome variable make a log transformation particularly inappropriate to our setting (Chen and Roth, 2024). Furthermore, estimating a diff-in-diff using OLS on a log transformation of the dependent variable only approximates the proportional difference in growth rates between treated and untreated groups. Such approximations ignore Jensen’s inequality and thus may deliver biased estimates of the true multiplicative effect (Ciani and Fisher, 2018). Our estimator avoids this bias and can be estimated with Poisson Pseudo Maximum Likelihood (PPML) regression. PPML consistently estimates the multiplicative effect as long as the mean function is correctly specified as multiplicative (Wooldridge, 2023).

an  $ATT_t(\gamma)$  for each level of treatment exposure  $\gamma$ , from which we can aggregate to our summary parameter of interest for all treated individuals:

$$ATT_t = E[ATT_t(\gamma)|\Gamma_i > 0]$$

We are primarily interested in the  $ATT_t$  in levels, because it translates readily into the aggregate increase in capital gains tax revenue. However, we can also identify the effect of the removal of step-up in terms of percent changes from the counterfactual.

#### 7.1.4 Adding Covariates

Our baseline specification, as laid out above, does not include covariates. However, our identification strategy may be more plausible if we modify our parallel trends assumption (Assumption 1) so that it only needs to hold after conditioning on covariates. For example, under the assumptions that (1) individuals realize to consume in accordance with the permanent income hypothesis and (2) wealth shocks affect portfolios proportionally to their ex-ante capital gains, we can microfound parallel trends in percent changes for individuals of the same age. We therefore present results that condition on individuals' age and features of their stock portfolio. To include these time-invariant covariates (which we will call  $X_i$ ), we need to modify our two previous assumptions to depend on  $X_i$ :

**Assumption 1'** (Conditional Parallel Trends in Percent Changes).

$$\frac{E[Y_{it}^0|X_i = x, \Gamma_i = \gamma, Post_t = 1] - E[Y_{it}^0|X_i = x, \Gamma_i = \gamma, Post_t = 0]}{E[Y_{it}^0|X_i = x, \Gamma_i = \gamma, Post_t = 0]} =$$

$$\frac{E[Y_{it}^0|X_i = x, \Gamma_i = 0, Post_t = 1] - E[Y_{it}^0|X_i = x, \Gamma_i = 0, Post_t = 0]}{E[Y_{it}^0|X_i = x, \Gamma_i = 0, Post_t = 0]}$$

**Assumption 2'** (Conditional No Anticipation Before 2005).

$$E[Y_{it}^0|X_i = x, \Gamma_i = \gamma, Post_t = 0] = E[Y_{it}^\gamma|X_i = x, \Gamma_i = \gamma, Post_t = 0] \quad \forall \gamma, t$$

and then add an overlap condition:

**Assumption 3** (Overlap in Each Period).

$$P(\Gamma_i \leq 0|X_i = x) > 0 \quad \forall x$$

The overlap assumption implies that a covariate match can be found for all persons with  $\Gamma_i > 0$ . If there are regions where the support of  $X$  does not overlap for  $\Gamma_i \leq 0$  and  $\Gamma_i > 0$ , then we can only estimate a treatment effect for participants whose covariates lie within the common support region. Under Assumptions 1', 2' and 3, we can identify a treatment effect for each  $(\gamma, x)$  pair, and aggregate to  $ATT_t = E[ATT_t(\gamma, x)|\Gamma_i > 0]$ .

### 7.1.5 Estimation

We recover the  $ATT_t$  from the parameters of the following regressions using Poisson Quasi-Maximum Likelihood (Correia et al., 2020). In the case without covariates, we estimate the following conditional mean function:

$$E[Y_{it}|Treat_i, Post_t] = \exp\left(\beta_0 + (Treat_i \times Post_t)\beta_1 + Treat_i\beta_2 + Post_t\beta_3\right)\epsilon_{it} \quad (1)$$

with  $E[\epsilon_{it}|Treat_i, Post_t] = 1$ . In our main analysis we compare all treated individuals to the untreated control group, and so we define  $Treat_i \equiv \mathbb{1}\{\Gamma_i > 0\}$ . In our analyses that instead break out treatment effects by the intensity of treatment exposure, we run regressions that each compare a bin of treatment intensity (e.g.  $\gamma \in [\gamma^{low}, \gamma^{high}]$ ) to the control group ( $\gamma \leq 0$ ). For each of these analyses, we define treatment as  $Treat_i \equiv \mathbb{1}\{\Gamma_i \in [\gamma^{low}, \gamma^{high}]\}$ .

The exponentiated coefficient  $\exp(\beta_1) - 1$  can be interpreted as the percentage change in realizations due to the policy change, and all the coefficients together allow us to construct:

$$ATT = \exp(\beta_0 + \beta_1 + \beta_2 + \beta_3) - \exp(\beta_0 + \beta_2 + \beta_3) \quad (2)$$

In the case with saturated, time-invariant covariates, we can estimate the following conditional mean function:

$$\begin{aligned} E[Y_{it}|Treat_i, X_i, Post_t] = & \exp\left(\beta_0 + (Treat_i \times Post_t)\beta_1 + Treat_i\beta_2 + Post_t\beta_3 + \right. \\ & X_i\beta_4 + (Treat_i \times X_i)\beta_5 + (Post_t \times X_i)\beta_6 + \\ & \left. (Treat_i \times Post_t \times \dot{X}_i)\beta_7\right) \epsilon_{it} \end{aligned} \quad (3)$$

Where  $\dot{X}_i$  implies that the covariates in the final interaction have been demeaned. Again,  $\exp(\beta_1) - 1$  has a percentage-change interpretation, and the parameters allow us to recover the ATT:

$$ATT(x) = \exp(\beta_0 + \beta_1 + \beta_2 + \beta_3 + x(\beta_4 + \beta_5 + \beta_6) + \dot{x}\beta_7) - \exp(\beta_0 + \beta_2 + \beta_3x(\beta_4 + \beta_5 + \beta_6))$$

We also estimate year-by-year event study estimates by replacing the  $Post_t$  variable in the equations above with an indicator variable for each specific year.

### 7.1.6 Results

Column 1 of Table 2 reports our baseline estimates: individuals exposed to the removal of step-up increased their taxable capital gains realizations by around \$2,023 (2018 USD) per year. This is a very large behavioral response—in terms of percentage change, these individuals' realizations are 59% higher than their counterfactual level. Figure 7 displays

year-by-year event study estimates of the ATT. These year-by-year estimates allow us to visually examine trends in the variable prior to 2005 and the time pattern of the response after 2005. The pattern (in terms of percent changes) of average realizations for the treatment and control group appear similar in the pre-period. A large increase in realizations for the treatment group began as soon as the repeal of step-up was announced (2005), and higher levels of realizations are sustained throughout the post-period.

Given the one-time nature of the removal of step-up, it is not possible to fully separate transitory and permanent responses to the removal of step-up in our data. Theoretically, we expect a short-run increase in realizations as investors rearrange their portfolios in response to the change, but also (as predicted by Proposition 1) a sustained higher level of realizations in the new equilibrium. Our main difference-in-difference results (Table 2) concentrate on the years immediately following the removal of step-up, and these results might therefore combine both short-run and long-run increases. However, when we look to the year-by-year responses (Figure 7) we see sustained higher levels of realizations even thirteen years after step-up’s removal.<sup>38</sup> Furthermore, we believe that the combined (short-run and long-run) response is policy relevant: countries are currently considering changes to step-up policy because they are interested in keeping the current stock of unrealized capital gains in the tax base, not only because it will change the accumulation of capital gains in the future.<sup>39</sup>

As shown at the bottom of Table 2, our ATT estimates can be converted into estimates of increased tax revenues simply by multiplying the ATT by the number of treated individuals and the capital gains tax rate. Since 344,538 individuals were in the treated group, our estimates imply that the removal of step-up triggered \$697 million of additional capital

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<sup>38</sup>The early years (2005-2008) appear to display slightly larger effects in Figure 7, but this difference is not statistically significant, and the later year coefficients may also be biased downwards due to inheritance tax rate cuts in 2009 and 2014.

<sup>39</sup>The short-run response may be particularly interesting due to generational differences in wealth accumulation. Baby boomers and the silent generation (individuals born between 1928 and 1964) in western countries have benefited from a historic run-up in asset prices during their adult lifetime. Some public debate has focused on a need to reform inheritance taxation prior to the “great wealth transfer” expected as these generations begin to die in larger numbers (Smith, May 14, 2023).

gains realizations, implying \$195.16 million of increased tax revenue (relative to the counterfactual). This implies that 24% of the (notably high) level of collected capital gains tax revenue in 2005 was attributable to the removal of step-up.

Our baseline results consider all treated individuals as a group, but Figure 8 shows that responses to the removal of step-up were heterogeneous depending on individuals' level of exposure. The size of the average response increases monotonically in the degree of exposure to the reform. We find no evidence of statistically-significant responses among investors with low levels of appreciation in their stock portfolios. Results appear to be driven by extremely large responses among the most-appreciated investors.

Table 2 also examines how our estimates are affected by the inclusion of time-invariant covariates. These covariates are included by saturating the regression with indicator variables for each covariate level. In column (2), we add an indicator for whether an individual owns any unlisted stock (as is common at the top of the Norwegian wealth distribution). In column (3) we further add indicators for the decade bin of an individual's age. As these covariates are added, our estimates grow slightly in magnitude but remain qualitatively very similar.

## 7.2 Anticipatory Bequest Responses

We find large realization responses to the removal of step-up despite the fact that Norwegians had a full year (all of 2005) in which to make anticipatory inheritance transfers that would still fall under the stepped-up basis regime. As discussed in Section 5, legislation to remove step-up for stock was passed on December 10, 2004, but only implemented for inheritance transfers beginning on January 1, 2006. In the interim period, Norwegians were able to make *inter vivos* transfers that would still benefit from stepped-up basis. Several news articles during 2005 urged Norwegians, especially private business owners, to consider early inheritance transfers (Amundsen, 2005; Vigdal, 2005).

Consistent with this advice, an unprecedented number of stock-based gift transactions

took place in the later months of 2005. In particular, Figure 9 documents that inheritance transfers in late 2005 contained an outlier amount of capital gains in stock.

These anticipatory responses have two important implications for interpreting our realization results in Section 7.1. First, without these anticipatory responses, we would expect weakly larger (short-run) realization responses than what we document in Section 7.2.<sup>40</sup> Second, the fact that we find realization responses beginning in the announcement year, 2005, (Figure 7) means that many Norwegians passed up the opportunity to benefit from step-up by making anticipatory transfers. The fact that we see an increase in immediate realizations reveals that early inheritance transfers were an imperfect substitute for the previously available option of benefiting from step-up via later inheritance transfers.

Reasoning why early inheritance transfers may be costly relative to later transfers returns us to the question of bequest motives. An altruistic giver (like the one in our conceptual framework in Section 6), if he knew exactly how much stock he planned to leave in inheritance, should respond to the impending removal of step-up by making an earlier-than-planned inheritance transfer. Ignoring this opportunity despite the tax consequences suggests that some portion of the bequest motive must either come from precautionary saving or a wealth-in-utility motive. The giver must want to maintain lifetime control over the planned bequest, either due to uncertainty over his own consumption needs, or because he values control of his stockpiled wealth directly. Yet some portion of the bequest motive must also be altruistic (i.e., valuing the post-tax amount received by the heir) else there should be no behavioral response to the removal of step-up. All together, our results imply that individuals value the post-tax amounts received by their heirs, but are willing to forgo some tax benefits to maintain longer control over their wealth.

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<sup>40</sup>The anticipatory responses were only possible because of the lag between the announcement and implementation of step-up's removal and the fact that step-up was available for *inter vivos* gifts.



### 7.3 Aggregate Inherited Capital Gains in the Post-Period

Above, we documented an increase in realizations of highly-appreciated stock by the original owners. This should presumably imply less capital gains in stock transferred in inheritance after 2006. Indeed, although the total value of all forms of inheritance has grown in every year for which there is data, the composition of inheritance appears to shift away from stock and perhaps away from highly appreciated stock in particular following the 2006 reform. Figure 10 Panel (a) shows that the value of inherited stock is flat over time, even as the value of all types of inheritance continues to grow. Figure 10 Panel (b) shows that inherited stock had a somewhat smaller fraction of unrealized capital gains to value after 2006. Together, these two panels imply that the ratio of capital gains in stock to total inheritance value has fallen over time.

## 8 Discussion and Implications

We have shown in this paper that stepped-up basis, relative to carryover basis, involves a substantial expenditure of government funds and that the benefits of step-up accrued to the wealthiest households in the Norwegian economy. Step-up policy costs the government money both through the mechanical effect of exempting inherited capital gains and by depressing overall taxable realizations. Continuing a policy of step-up, then, should be thought of as a deliberate fiscal policy choice: it involves a cost (both directly and in terms of distortionary effects), and it provides a benefit to a small number of individuals (mechanically, the heirs who receive and realize inherited capital gains, and indirectly, the original owners of those inherited assets). How should the government think about step-up as a deliberate fiscal policy? In this section, we examine the efficacy of step-up compared to other possible policies. We demonstrate that even if policymakers wish to maintain the same level of tax benefits for capital gains owners, step-up is an unusually inefficient way to give such a benefit.

## 8.1 Marginal Value of Public Funds

To compare the effectiveness of step-up to other potential policies, we use our estimates from Section 7 to calculate a marginal value of public funds (MVPF) for step-up. The MVPF is the ratio of a policy’s benefits to its recipients divided by the policy’s net cost to the government, inclusive of the behavioral effects engendered by the policy (Wildasin, 1984; Mayshar, 1990; Hendren, 2016). The MVPF quantifies the “leakiness” of Okun’s famous bucket metaphor for redistributive government policies: “The money must be carried from the rich to the poor in a leaky bucket. Some of it will simply disappear in transit, so the poor will not receive all the money that is taken from the rich” (Okun, 1975). Lower MVPFs imply that, as the particular benefit is transferred to the beneficiaries, more government revenue than usual leaks out due to behavioral responses. We calculate an MVPF of 0.43, which implies that, accounting for behavioral distortions, each \$0.43 of tax benefits (given to those who inherit appreciated assets) costs the government \$1 of foregone tax revenue.

### 8.1.1 Calculation of the MVPF for Step-Up

Step-up’s mechanical beneficiaries are the heirs whose later realizations are more lightly taxed because of step-up, and the envelope theorem implies that, to a first order, they value \$1 of additional tax savings from step-up at \$1. The total benefits from step-up (numerator of the MVPF) is thus the mechanical tax savings for the heirs: the amount of inherited capital gains that experience a realization event in the hands of the heir, times the capital gains tax rate. The key to capturing the mechanical cost is to hold heirs’ realizations constant at the level and timing observed under step-up. The denominator (government costs) are the effects of the reform on government revenue, including behavioral effects and any spillovers across tax bases. If we assume that step-up only affects government revenue through earlier

capital gains realizations<sup>41</sup>, then we can write:

$$MVPF_{SU} = \frac{\tau_c \times RICG_{SU}}{\tau_c(1 - \tau_I) \times ATT \times N_{TREAT}}$$

where  $RICG_{SU}$  is the amount of previously inherited capital gains that were realized in a given year,  $ATT$  is our causal estimate of the average change in yearly capital gains realizations among the treated when step-up is removed, and  $N_{TREAT}$  is the number of individuals in our treatment group. The denominator,  $\tau_c(1 - \tau_I) \times ATT \times N_{TREAT}$ , is the total change in tax revenue from the removal of step-up: each dollar of increased realizations is taxed at  $\tau_c$ , but the early capital gains tax payment mechanically lowers inheritance tax revenues by  $-\tau_I\tau_c$ .

To calculate the benefit to the heirs of their exempted capital gains, we need to know not only the historical amounts of inherited capital gains that experienced step-up, but also whether and when those capital gains would have been realized in taxable transactions under a counterfactual carryover basis regime.  $RICG_{SU}$  should include all previously inherited capital gains that are realized in a given year, whether the inheritance transaction took place earlier that year or 10 years prior. Due to data limitations (our transactions data in stock begin only in 2003), we need to make a few assumptions to create this yearly estimate. First, we assume that the ratio of inherited capital gains in stock to total inheritance value was constant during the step-up regime, and set this ratio at the observed value of 0.073 for inherited capital gains in 2003-2004. We therefore estimate the amount of inherited capital gains in 1995-2002 as the observed aggregate value transferred in inheritance, multiplied by 0.073. Second, we assume that the speed at which heirs realized their capital gains in those years followed a constant hazard rate (i.e., that the heirs' time to realization followed an

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<sup>41</sup>Our formula assumes that step-up only affects inheritance tax revenue mechanically: when assets are realized earlier, then the earlier-paid taxes are subtracted from the inheritance tax base. It is possible that step-up also increases the amount left in inheritance, in which case our MVPF estimate would be an underestimate. Although we present evidence in Section 7 that step-up affects the composition of inherited assets, we do not find clear evidence that it affected the level of inheritance (which is rising rapidly over time, both before and after step-up).

exponential distribution). We estimate this constant hazard rate using Maximum Likelihood Estimation on the observed pattern of realizations for inherited capital gains that were inherited in 2003-2004. Our estimate of the constant hazard rate is 0.20.

Under these assumptions, we estimate that the amount of previously inherited capital gains that were realized by heirs in 2005 was \$239 million. We take our estimate of the total change in tax revenue ( $ATT \times N_{TREAT}$ ) from Table 2. Combining these numbers, we calculate a MVPF of  $\frac{\$239 \text{ million}}{(1-\tau_I)\$697 \text{ million}} = 0.43$ .

### 8.1.2 Step-Up as an Unusually Inefficient Tax Break

Comparing our MVPF estimate with estimates of MVPFs for other government programs (Hendren and Sprung-Keyser, 2020) reveals step-up to be a particularly inefficient tax policy. An MVPF of 0.43 is only slightly smaller than standard for spending programs targeted at adults, in which the government trades off a desire to redistribute money or other goods with the program’s distortionary effect on labor income. Compared with other tax breaks, however, step-up is shockingly inefficient: MVPF estimates for tax rate cuts exceed 1, implying that each dollar of benefit to taxpayers costs the government less than a dollar of foregone revenue.<sup>42</sup> This is because most tax rate cuts reduce distortions, which encourages (taxable) economic activity. Step-up, in contrast, reduces tax collections from inheritors of appreciated assets (who notably come from extremely wealthy backgrounds, see Section 4) while increasing overall distortions to the capital gains tax system.

If the government wished to improve efficiency while continuing to give a tax benefit to owners of capital gains, repealing step-up could be paired with a reduction in capital gains tax rates.<sup>43</sup> Such a policy change would be distortion-reducing and could be accomplished

<sup>42</sup>The MVPF for a reduction in the capital gains tax rate is  $\frac{1}{1+\epsilon_\tau}$ , where  $\epsilon_\tau$  is the (usually negative) elasticity of taxable capital gains realizations with respect to the capital gains tax rate.

<sup>43</sup>Although both policies would benefit capital gains owners, the beneficiaries of a tax rate cut would be owners of capital gains who choose to realize, while step-up’s gives tax benefits to owners of never-realized capital gains. In our data (see Appendix Figure A1), the former population is larger and somewhat less wealthy, which could be seen as an additional reason to favor rate cuts over step-up.

in a budget-neutral manner.<sup>44</sup> Given the existence of this budget-neutral reform and the fact that step-up’s beneficiaries are so disproportionately wealthy, it is hard to justify the continuation of step-up on either equity or efficiency grounds.

## 8.2 Implications for Other Countries

Although our data and policy changes take place in Norway, we believe our findings are relevant to ongoing policy debates about the taxation of inherited capital gains in other countries. We find a large increase in taxable realizations when step-up is removed, which persists throughout our post-period, even after the inheritance tax is fully repealed in Norway. This finding contrasts with the US Joint Committee on Taxation’s model of step-up removal, which concludes that the magnitude of increased realizations expected from removing step-up would not be as large as the expected decrease in realizations from removing the estate tax ([Joint Committee on Taxation, 2012](#)). Although we expect the effects of the removal of step-up to differ across institutional contexts, we believe policymakers should update their priors in the direction of large behavioral effects.

There is arguably less incentive to defer capital gains in Norway, relative to countries such as the US and UK. This smaller incentive is due to the imposition of a yearly wealth tax, which penalizes deferral relative to immediate consumption, and due to the fact that inter-corporate dividends are fully tax exempt, which allows Norwegians to build up holding companies in which they can reallocate their portfolios without triggering the capital gains tax. Furthermore, Norway paired its stepped-up basis regime with a broad-based inheritance tax, which imposed a cost that needed to be paid to benefit from step-up. In contrast, the estate tax regimes currently in place in the US and UK exempt many inheritances from transfer tax while still granting them stepped-up basis. It is hard to know exactly how to

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<sup>44</sup>The exact rate reduction that could be financed by the repeal of step-up depends on the elasticity of capital gains relations with respect to the tax rate *within a carryover basis regime*. We are not aware of existing estimates within the Norwegian context but expect the elasticity to be lower than it was during the stepped-up basis regime (See Proposition 2, Section 6).

adjust our estimates upwards for these institutional factors, but the main point is that there is nothing obvious about our empirical setting that would lead us to expect smaller effects elsewhere. Our hope is that future research will be able to study the removal of step-up in other countries, and therefore directly test the external validity of our findings. In the meantime, the conclusion of our policy comparison in Section 8.1 applies as long as our empirical results are *directionally* true. We have shown that step-up is a tax break that amplifies behavioral distortions. Reducing tax rates, in contrast, gives a tax break while simultaneously reducing tax-induced behavioral distortions. It is therefore hard to justify the continuation of step-up policies, even if the goal is to provide a tax break to certain capital-gains-rich individuals.

## 9 Conclusion

Under policies of “stepped-up basis,” many countries exempt inherited assets from previously accumulated capital gains tax liability. A lack of data and policy variation has limited prior empirical work on the distribution and distortionary consequences of this type of policy. To overcome those challenges, this paper builds novel data on unrealized capital gains in Norway. We use this data to document several empirical facts about unrealized and inherited capital gains in a stepped-up basis regime. We show that a large share of average and, particularly, top household wealth is unrealized capital gains, and that the amount of capital gains exempted from tax under step-up is a sizable fraction of the total capital gains tax base.

The second part of this paper presents the first empirical estimates of how the tax treatment of inherited capital gains affects inheritance and taxable capital gains realizations. Stepped-up basis distorts investor behavior, both in terms of reduced taxable capital gains realizations and an altered composition of assets transferred in inheritance. Removing step-up corrects this distortion, dampens the distortionary effects of the capital gains tax overall, and frees up public funds from a tax exemption that disproportionately benefits the

wealthiest people in the economy.

Table 1: Unrealized, Realized, and Inherited Capital Gains in 2004 (billions of 2018 USD)

*(a) Asset Value & Unrealized Capital Gains*

Asset Type	Total Value	UCG	UCG/Value
Taxable Assets including Mutual Funds	123.4	78.48 <sup>†</sup>	0.64 <sup>†</sup>
Mutual Funds	10.2	-	-
Taxable Assets excluding Mutual Funds	113.2	68.28	0.60
Taxable Real Estate	32.4	9.24	0.29
Listed Shares	13.8	5.84	0.42
Unlisted Shares	67.0	53.20	0.79
Nontaxable Real Estate	164.0	46.40	0.28

*(b) Realizations & Realized Capital Gains*

Asset Type	Amount Realized	RCG	RCG/Amount Realized
Taxable Assets excluding Mutual Funds	20.42	1.65	0.08
Taxable Real Estate	2.31	1.29	0.56
Listed Shares	16.20	0.22	0.01
Unlisted Shares	1.91	0.13	0.07
Nontaxable Real Estate	6.29	2.90	0.46

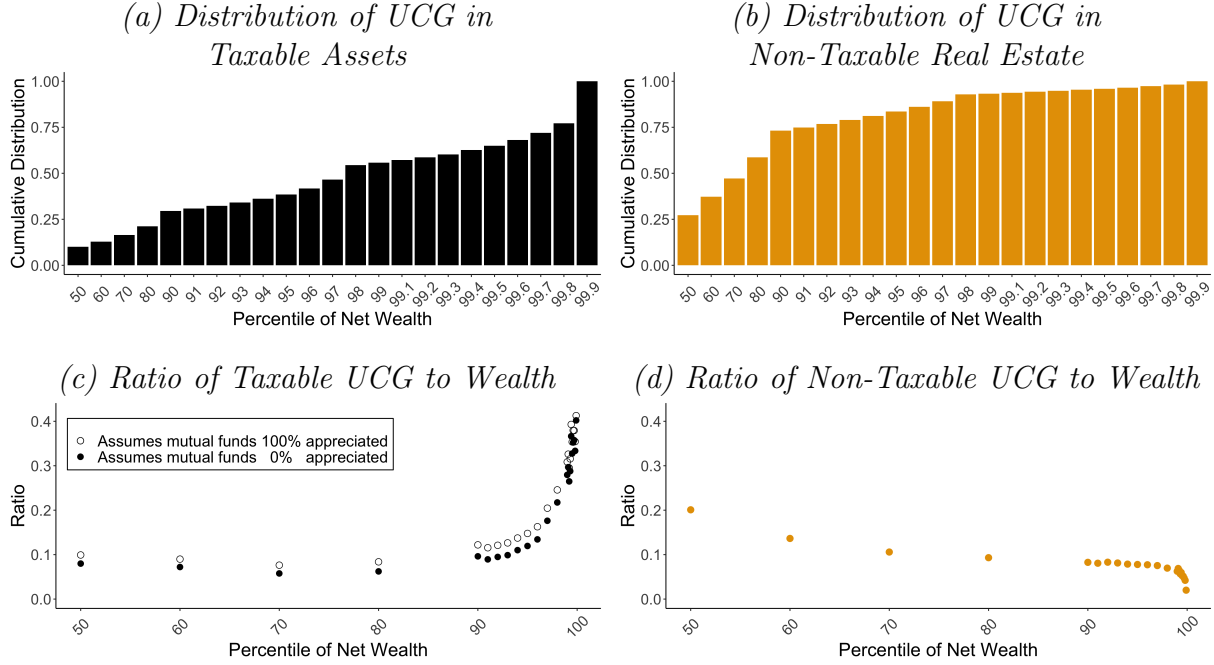
*(c) Inheritances & Inherited Capital Gains*

Asset Type	Amount Inherited	ICG	ICG/Amount Inherited
Taxable Assets excluding Mutual Funds	0.54	0.31	0.57
Taxable Real Estate	0.17	0.05	0.30
Listed Shares	0.10	0.07	0.65
Unlisted Shares	0.27	0.19	0.71
Nontaxable Real Estate	0.51	0.16	0.31

*Note:* This table presents aggregate numbers on the value of wealth and capital gains in certain asset categories in Norway at the end of 2004. Panel (a) presents the total amount of wealth (“Total Value”) in each category, along with the amount of Unrealized Capital Gains (“UCG”). The amount of UCG when mutual funds are included assumes that mutual funds are 100% appreciated (estimates affected by this assumption are marked with a dagger †). Panel (b) displays the value of assets that are realized in 2004 (“Amount Realized”), along with the Realized Capital Gains (“RCG”). Panel (c) displays the value of assets that are inherited in 2004 (“Amount Inherited”), along with the Inherited Capital Gains (“ICG”).

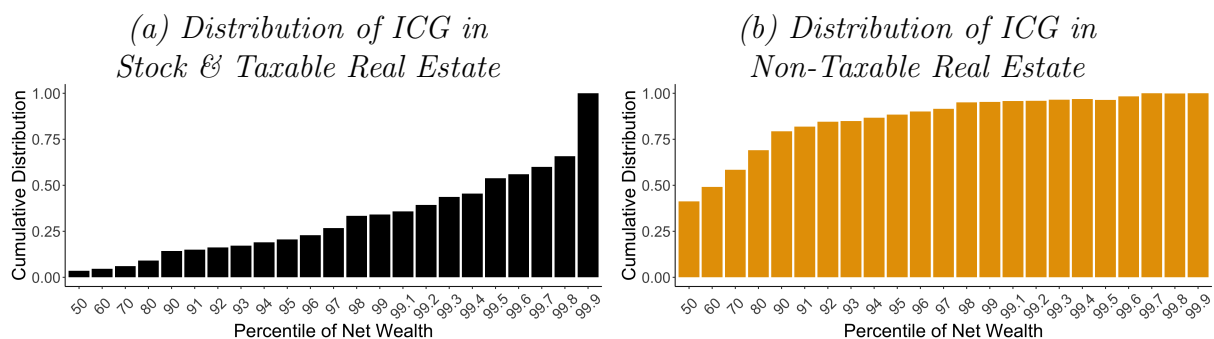


Figure 1: Unrealized Capital Gains Across the Wealth Distribution, 2004



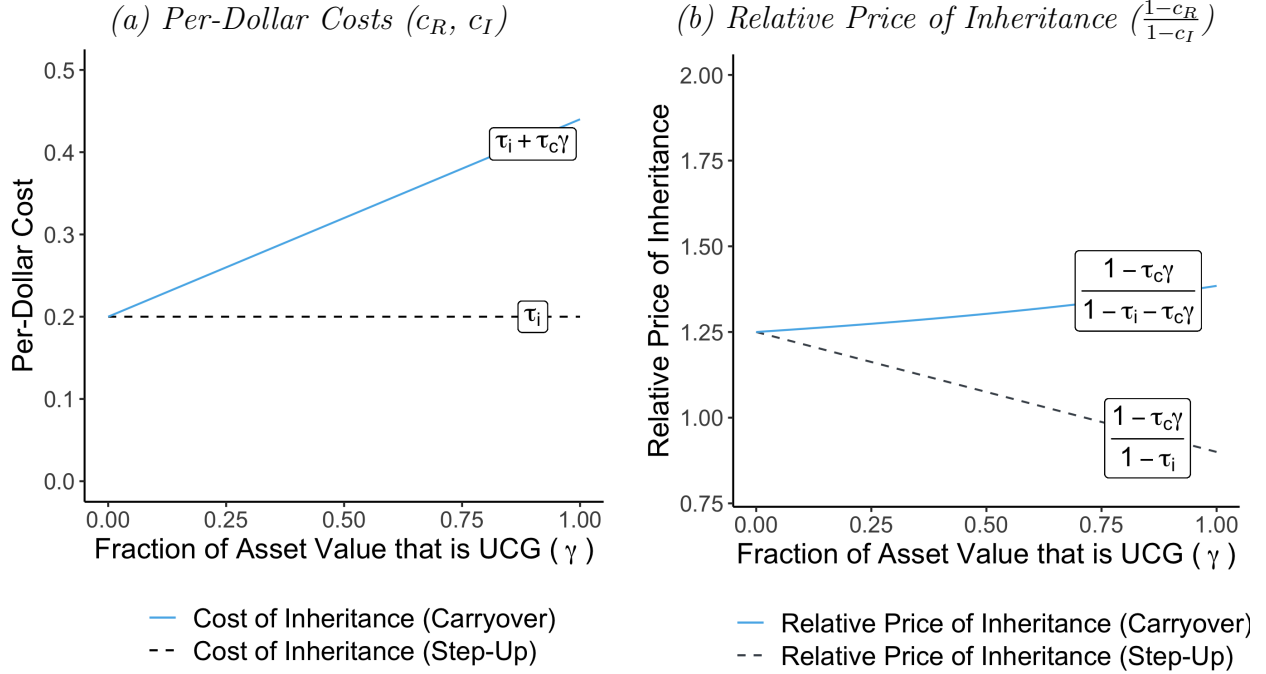
*Note:* This figure displays the cumulative distribution of unrealized capital gains and the average ratio of unrealized capital gains to total net wealth, for household net wealth percentiles in 2004. Panel (a) depicts the distribution of unrealized capital gains in assets subject to the capital gains tax (mutual funds, listed and unlisted stock and taxable real estate). Because we do not observe unrealized capital gains in mutual funds, we bind our estimates for taxable UCG under the alternative assumptions that mutual fund wealth is either 0% or 100% appreciated. Panel (b) depicts the distribution of unrealized capital gains in non-taxable real estate. Unrealized capital gains in taxable assets are concentrated at the very top of the wealth distribution. In contrast, unrealized capital gains in non-taxable real estate (the largest category of which is primary residences) are much more evenly distributed throughout the wealth distribution. Appendix Figure A1 compares these distributions to the distributions of realized and inherited capital gains. Panel (c) depicts the ratio of unrealized capital gains in taxable assets to total household net worth, which increases sharply at the top of the wealth distribution. Panel (d) shows a corresponding figure for the ratio of unrealized capital gains in non-taxable real estate to net wealth. Since household wealth at lower percentiles of net wealth is disproportionately in the form of (non-taxable) primary residences, this ratio is actually declining across the wealth distribution.

Figure 2: Inherited Capital Gains Across the Wealth Distribution, 2004



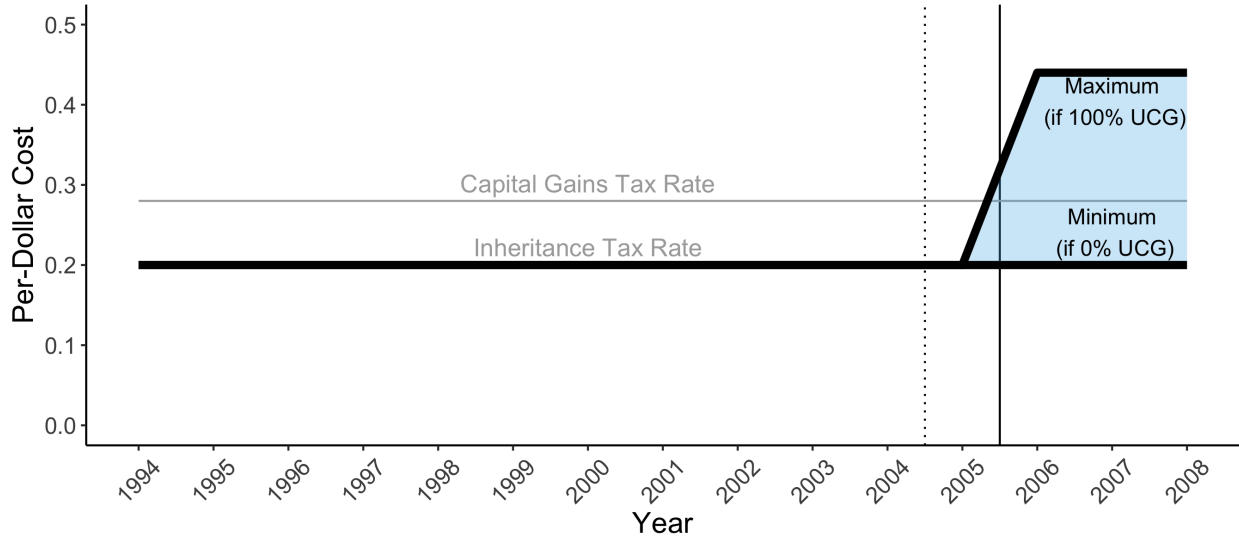
*Note:* This figure displays the cumulative distribution of inherited capital gains during 2004 with respect to households' percentile of net worth. Panel (a) displays this distribution for taxable assets—listed and unlisted stock and taxable real estate. Note that we are unable to observe inherited capital gains for mutual funds. Panel (b) shows a corresponding figure for the distribution of non-taxable real estate. The distribution of inherited capital gains in taxable assets is very concentrated at the top of the wealth distribution, even more so than the distribution of unrealized or realized capital gains (see Figure 1 and Appendix Figure A1). In contrast, inherited capital gains in non-taxable real estate (the largest category of which is primary residences) are much more evenly distributed throughout the wealth distribution.

Figure 3: How the Removal of Step-Up Affects the Relative Price of Inheritance



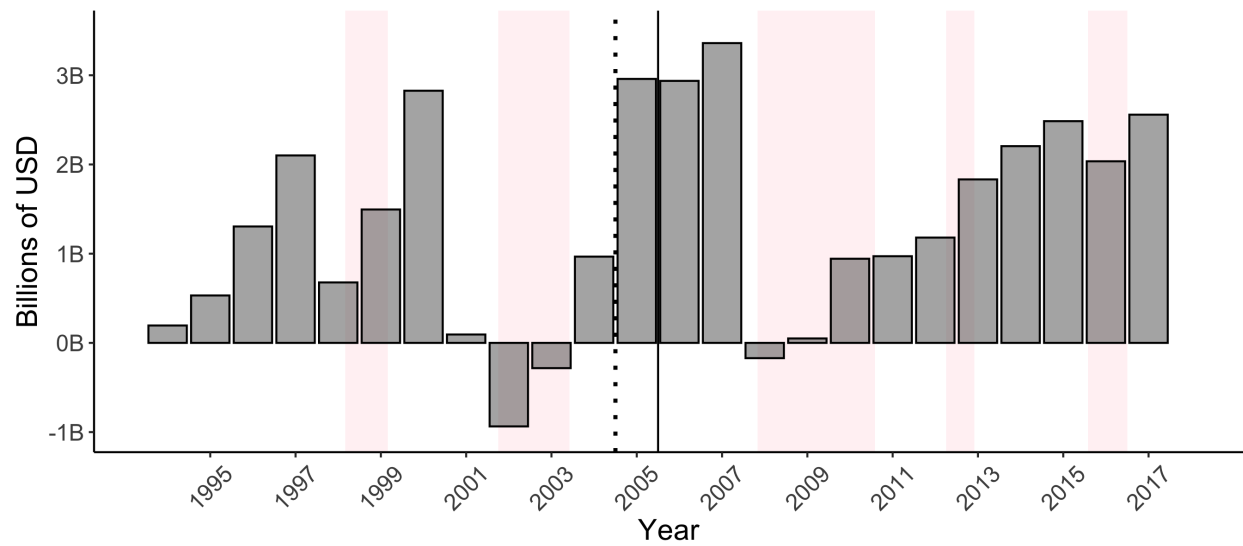
*Note:* This figure demonstrates how the change from a policy of stepped-up basis to a policy of carryover basis increases the cost of inheritance (defined in Section 6.2 as  $c_I = \tau_I + \tau_c \gamma$ ), and thus how it affects the price of inheritance relative to present consumption ( $\frac{1-c_R}{1-c_I}$ ). Panel (a) depicts how a change from step-up to carryover basis changes the relationship between the fraction of asset value that is unrealized capital gains ( $\gamma$ ) and the cost of inheritance  $c_I$ : the flat line equal to the statutory inheritance tax rate (the dashed line  $\tau_I$ ) rotates to now depend steeply on  $\gamma$  (the solid lightblue line  $\tau_I + \tau_c \gamma$ ). Panel (b) depicts how this change in the cost of inheritance affects the relative price of inheritance in terms of consumption:  $(1 - c_R)/(1 - c_I)$ . The magnitude of the relative price change depends on the fraction of asset value that is unrealized capital gains: portfolios with no unrealized capital gains ( $\gamma = 0$ ) experience no change in relative prices, while portfolios with large amounts of  $\gamma$  experience the largest price change. The figure is parameterized with the values  $\tau_i = 20\%$  and  $\tau_c = 28\%$ , which were the top tax rates in place in Norway from 1994 to 2008.

Figure 4: Per-Dollar Inheritance Costs for Stock, 1994–2008



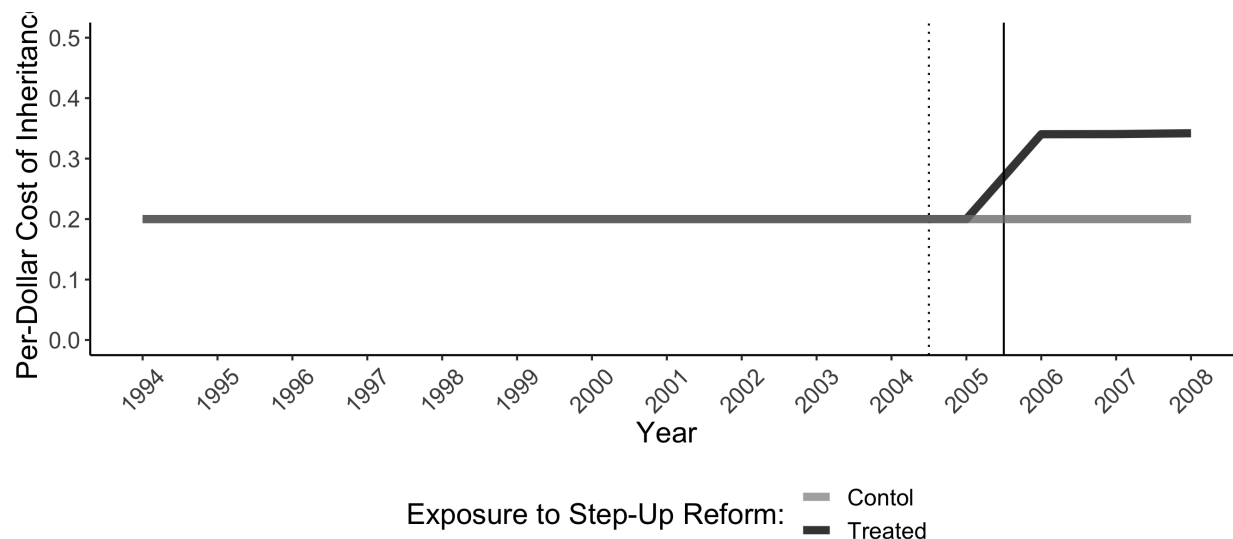
*Note:* This figure depicts the range of per-dollar costs of inheritance  $c_I = \tau_I + \iota\tau_c\gamma$  for stock in a given year. Prior to 2006, Norway had a stepped-up basis regime ( $\iota = 0$ ), so all assets had a inheritance cost equal to the statutory inheritance tax rate ( $\tau_i = 20\%$  in the highest bracket, for inheritance between close relatives). Carryover basis ( $\iota = 1$ ) is introduced for stock in 2006, which widens the range of inheritance costs for appreciated stock to cover the area shaded in blue. When carryover basis is in place, stock with 0% unrealized capital gains still face only the statutory inheritance tax, but the cost of inheritance for stock with positive unrealized capital gains includes both the statutory inheritance tax and a capital gains tax. At the maximum, stock with 100% unrealized capital gains in a carryover basis regime have a per-dollar inheritance cost equal to the sum of the capital gains and inheritance tax rates. The dotted black line before 2005 indicates the announcement of step-up's impending removal for stock. The solid black line before 2006 indicates the implementation of step-up's removal for stock. We end our baseline analysis in 2008 because inheritance tax rates change in 2009, but Appendix Figure A3 depicts  $c_I$  over a longer time horizon, for both stock and non-stock assets.

Figure 5: Aggregate Net Capital Gains Realizations, 1994-2018



*Note:* This figure depicts the total amount of net capital gains (i.e., capital gains minus capital loss) realized in Norway from 1994 to 2018, in terms of 2018 USD. The light pink shading denotes recessionary periods, as classified by the OECD. The dotted black line before 2005 indicates the announcement of step-up's impending removal for stock. The solid black line before 2006 indicates the implementation of step-up's removal for stock. Net capital gains realizations tripled between 2004 and 2005: from \$0.97 billion in 2004 (6.24 billion nominal NOK) to \$2.96 billion in 2005 (19.4 billion nominal NOK).

Figure 6: Average Per-Dollar Inheritance Costs ( $c_I$ ), for Treated and Control Group



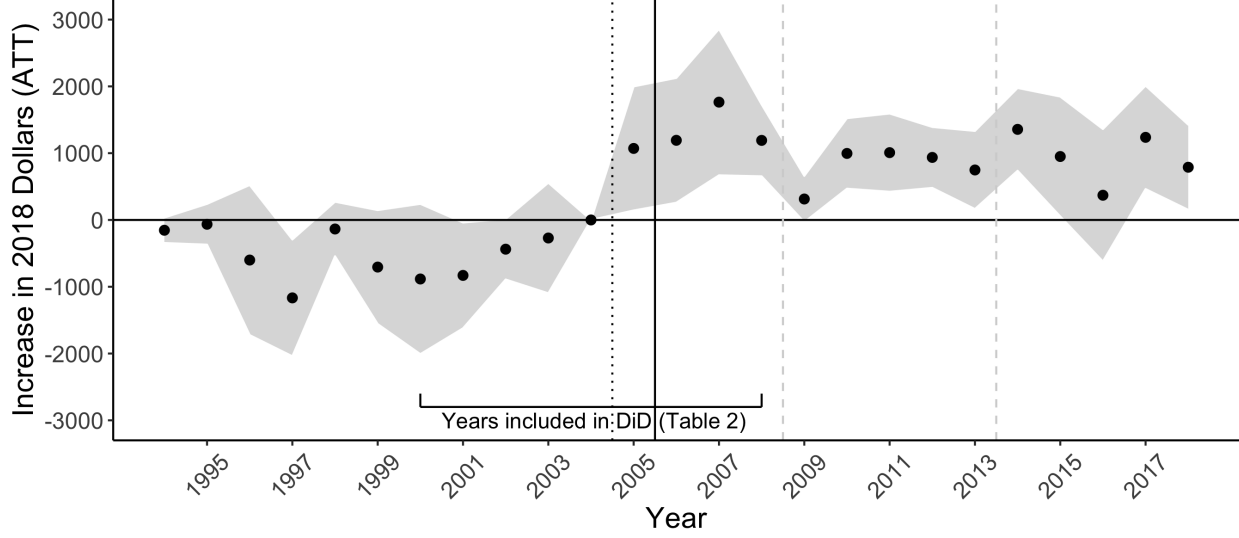
*Note:* This figure depicts the empirical average of our measure of the “per-dollar cost of inheritance” for the treatment and control groups in our analysis of the removal of step-up for stock. The per-dollar cost of inheritance is defined as  $c_I = \tau_I + \iota_t \tau_c \gamma$  in Section 6.2. Before 2006, step-up is in place ( $\iota = 0$ ), so the total cost is simply the statutory inheritance tax rate ( $\tau_I$ ). Once step-up is removed ( $\iota = 1$ ), costs begin to depend on the amount of appreciation in each individual portfolio. The dotted black line before 2005 indicates the announcement of step-up’s impending removal for stock. The solid black line before 2006 indicates the implementation of step-up’s removal for stock. We end our baseline analysis in 2008 because inheritance tax rates change in 2009, but Appendix Figure A4 depicts  $c_I$  over a longer time horizon.

Table 2: Realization Responses to the Removal of Step-Up for Stock, 2000-2008

<i>Outcome:</i> Total Realized Capital Gains	(1)	(2)	(3)
TREAT $\times$ POST ( $\beta_1$ )	0.461*** (0.109)	0.483*** (0.094)	0.492*** (0.073)
<i>Covariates:</i>			
Indicator for any unlisted holdings		X	X
Decade Age Bin			X
Number of Observations	4,124,605	4,124,605	4,011,557
<i>Implied Treatment Effects:</i>			
$\exp(\beta_1) - 1$	.59	.62	.64
Average Increase in Realizations (ATT)	\$2,023	\$2,163	\$2,152
Total Increased Realizations ( $\text{ATT} \times N_{TREAT}$ )	\$697.02 mil	\$745.23 mil	\$741.43 mil

*Note:* This table shows our baseline difference-in-difference estimates, which estimate Equations 1 and 3 using Poisson Pseudo Maximum Likelihood. Observations are at the individual-year level. Individuals are included in these regressions if they owned stock at the beginning of 2005. The outcome variable is net realized capital gains, as reported yearly on each individual's tax return. The indicator "TREAT" equals 1 if the individual is exposed to the removal of step-up (i.e., has positive appreciation in his or her stock portfolio at the beginning of 2005). The indicator "POST" equals 1 for years after 2004, and 0 before then. The first row of the table presents the coefficient from the Poisson regression. To interpret this coefficient in terms of percent changes in the outcome variable, we need to exponentiate the coefficient and subtract by one. We form an estimate of the ATT from regression parameters as described in Equation 2. We can calculate the total increase in taxable realizations (relative to counterfactual) by multiplying the ATT by the number of individuals in the treatment group ( $N_{TREAT}$ ). Values are in 2018 USD. Column (1) includes no covariates. Column (2) includes an indicator for whether a portfolio includes any unlisted stock (including holding companies). Column (3) includes additional indicators for an individual's 10-year age bin. Covariates are included in the regressions as fully saturated indicators. We end our baseline analysis in 2008, before the 2009 decrease in inheritance tax rates. Figure 7 displays year-specific event study estimates over a longer time horizon.

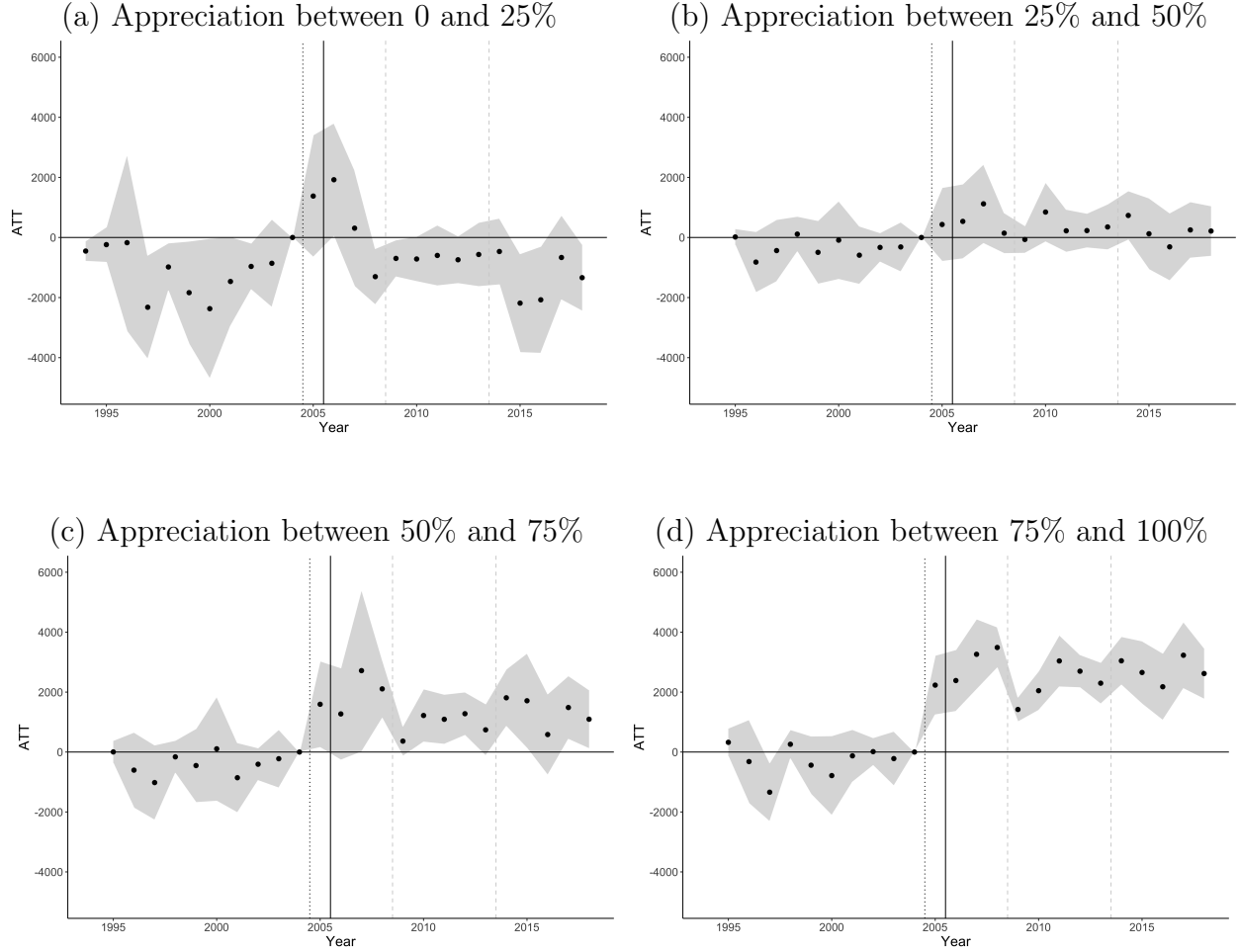
Figure 7: Average Yearly Increase in Realized Capital Gains (Event Study)



*Note:* This figure shows the average increase in realized capital gains among all treated individuals, in response to the removal of stepped-up basis for stock. Treated individuals are defined as those with any positive amount of unrealized capital gains in their stock portfolio at the beginning of 2005. The control group is individuals with zero capital gains, or net capital losses, in their stock portfolio at the beginning of 2005. The y-axis presents the level of the estimated treatment effect in 2018 USD. The dotted black line before 2005 indicates the announcement of step-up's impending removal for stock. The solid black line before 2006 indicates the implementation of step-up's removal for stock. In contrast to other figures in the main text of this document (and to the baseline difference-in-difference estimates presented in Table 2), this figure extends beyond 2008, and thus includes multiple reforms to the inheritance tax rate. The dashed gray line before 2009 indicates a fall (by half) of the statutory inheritance tax rate. The dashed gray line before 2014 indicates the full removal of the inheritance tax, and the beginning of a period of increasing capital gains tax rates. See Appendix A for more detail on these later policy changes. Our baseline difference-in-difference estimates (Table 2) only include data from 2000 to 2008, in order to end the analysis before the 2009 inheritance tax rate change.

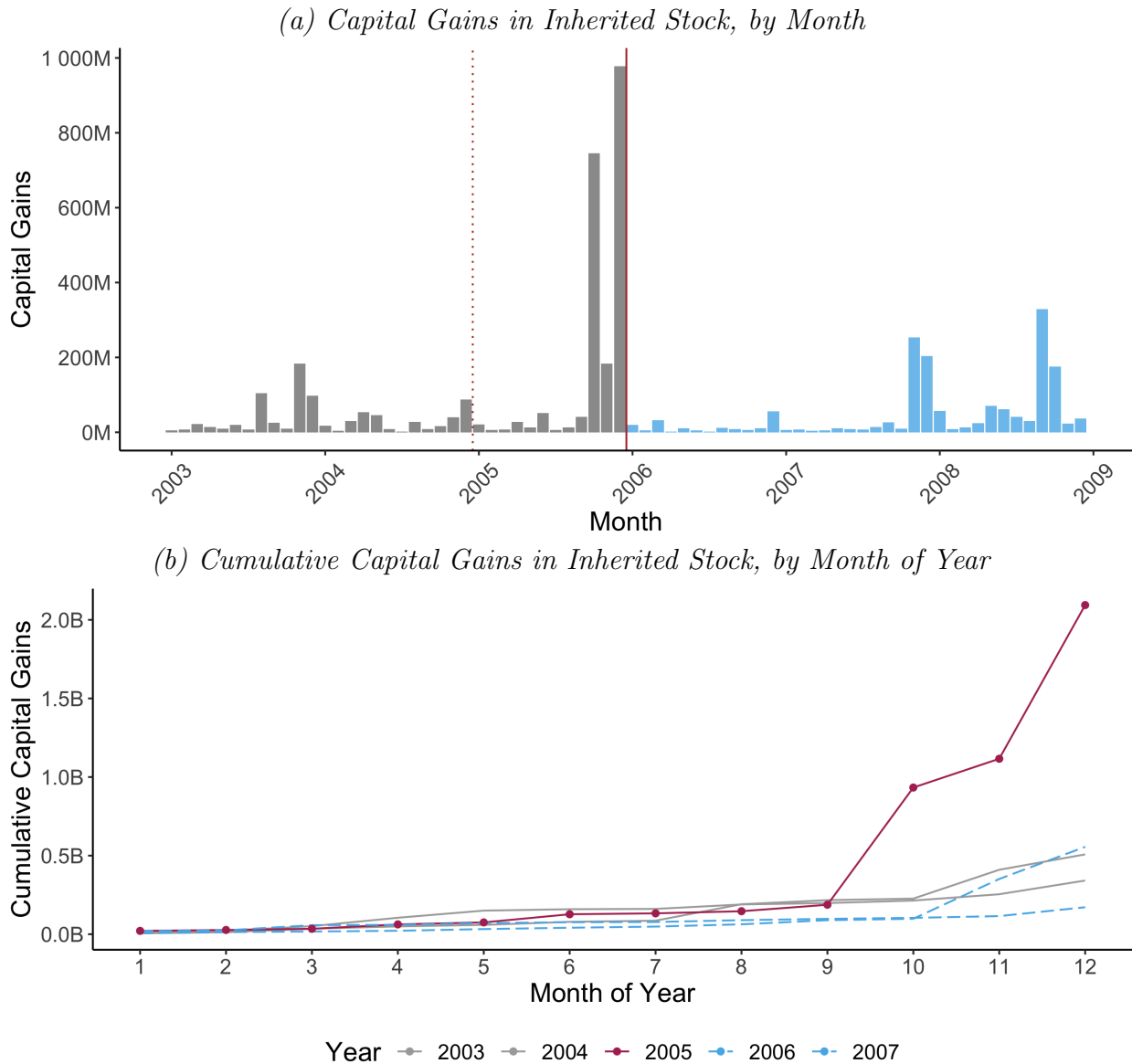


Figure 8: Average Yearly Treatment Effect (Event Study), by Bin of Treatment Intensity



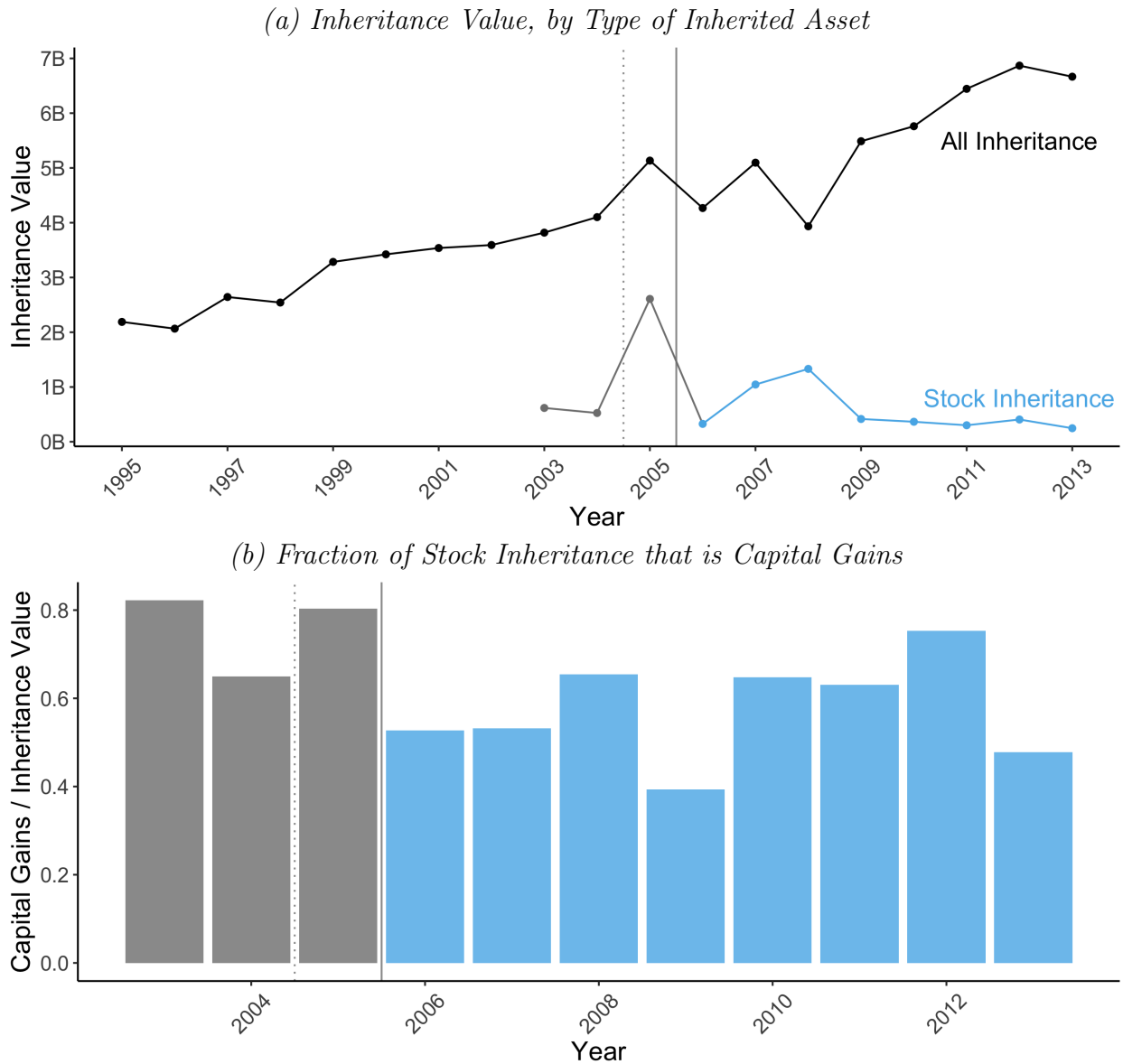
*Note:* This figure shows heterogeneity in the average responses to the removal of stepped-up basis for inherited stock. The y-axes present the level of the estimated treatment effect in 2018 USD. Panel (a) depicts the response for individuals whose stock holdings, at the beginning of 2005, have a ratio of unrealized capital gains to value ( $\gamma$ ) between zero and 0.25. Panel (b) shows the corresponding figure for individuals with 2005 stock holdings with  $\gamma$  between 0.25 and 0.5. Panel (c) is the corresponding figure for those with  $\gamma$  between 0.5 and 0.75. Panel (d) is the corresponding figure for those with  $\gamma$  between 0.75 and 1. In all panels, the control group is individuals whose stock portfolios in 2005 had zero capital gains or net capital losses. The dotted black line before 2005 indicates the announcement of step-up's impending removal for stock. The solid black line before 2006 indicates the implementation of step-up's removal for stock. The dashed gray line before 2009 indicates a fall (by half) of the statutory inheritance tax rate. The dashed gray line before 2014 indicates the full removal of the inheritance tax, and the beginning of a period of increasing capital gains tax rates.

Figure 9: Anticipatory Inheritance Transfers in Late 2005



*Note:* This figure demonstrates the anticipatory transfers that occurred in late 2005, which were triggered by the announcement that step-up would be removed for stock on January 1, 2006. Transfers made prior to January 2006 would still be subject to stepped-up basis treatment. Panel (a) shows that the amounts of capital gains transferred in inheritance in the later months of 2005 were large outlier values compared to monthly values before or since. The dotted red line before 2005 indicates the announcement of step-up's impending removal for stock. The solid red line before 2006 indicates the implementation of step-up's removal for stock. Panel (b) displays the cumulative value transferred over each year — the amount of capital gains transferred in inheritance in 2005 was much more than the prior or immediately subsequent years. Values are in 2018 USD.

Figure 10: Aggregate Inheritance Trends Following the Removal of Step-Up for Stock



*Note:* Panel (a) shows that the value of all inheritance (i.e., of cash or of any other asset) is growing over time, from \$2.19 billion in 1995 to \$6.67 billion in 2013, the last year prior to the abolition of the inheritance tax. The value of stock transferred in inheritance, on the other hand, does not show consistent growth after step-up is removed in 2006. Values are in 2018 USD. Furthermore, Panel (b) shows that the fraction of inherited stock value that is capital gains falls somewhat following the removal of step-up for stock. Combined, these two panels suggest that although the total value of inheritance is growing in Norway over time, an increasingly small fraction of that inherited value is composed of capital gains in stock. The dotted gray line before 2005 indicates the announcement of step-up's impending removal for stock. The solid gray line before 2006 indicates the implementation of step-up's removal for stock.

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# Appendix

## A Background on Norway

### A.1 Taxation in Norway, 1992-2018

Norwegians pay taxes on their worldwide labor income, capital income, and wealth. Labor income is subject to progressive taxation with a top marginal rate of 53.2–54.3% (including social security contributions) during our period of study. Net wealth in excess of an exemption amount faces a yearly tax of 0.85–1.30% during our period.<sup>45</sup>

#### A.1.1 Capital Gains and Inheritance Taxation

Norway has a flat capital gains tax on realized capital gains. From 1992 to 2013, all (net) realized capital gains were taxed at a rate of 28%.<sup>46</sup> Since 2014, there have been several rate changes, including the introduction of separate rates for the realization of capital gains from stock and non-stock assets. These rate changes are depicted in Figure A2. Throughout our study period, the capital gains tax has had a flat rate structure, so that capital gains tax rates do not depend on individual income.

Prior to its abolition in 2014, Norway’s integrated gift and inheritance transfer tax taxed the receipt of gifted or inherited assets through a rate structure that depended on the cumulative amount of the gifts/inheritance received, and the relationship between the giver and the recipient. Other than a small yearly gift exemption, no distinction was made between *inter vivos* gifts and bequests at the time of death. Appendix Table A1 provides

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<sup>45</sup>The wealth tax exemption has ranged from \$19,555 to \$162,800 (2018 USD) during our period of study. In general, exemptions have grown more generous and wealth tax rates have fallen over our period of study. See Thoresen et al. (2022) for a detailed description of Norway’s wealth tax. Interestingly, Norway collects a smaller share of total tax revenue from property/wealth taxation than is typical among OECD countries (OECD, 2018).

<sup>46</sup>This rate is also applied to other forms of capital income, such as interest income. Capital losses can be used to fully offset capital gains. Net losses can be used to offset ordinary income: \$1 of capital losses offsets only \$0.72 of ordinary income, and cannot be applied against social security contributions or top marginal tax rates.

details on the rates and brackets over time. Figure A2 depicts the top rate for gifts and inheritances between close relatives: a rate that fell from 20% to 10% in 2009.<sup>47</sup> In 2014, the gift and inheritance tax was abolished, so all rates for subsequent years are set to 0%.

### A.1.2 Stepped-Up Basis Policy

During our period of study, Norway moved from a system of stepped-up basis for inherited capital gains to a system of carryover basis. This change was accomplished in two steps. In 2006, carryover basis was introduced for appreciated gifted or inherited stock (including equity-based mutual funds).<sup>48</sup> Recipients of gifted or inherited stock from 2006–2013 continued to be subject to inheritance tax on value of the stock they received,<sup>49</sup> but now were also subject, if and when they sold the stock, to capital gains tax on the amount of appreciation during the original owner’s holding period. Losses, however, were not permitted to be carried over in the 2006 reform – so stocks with losses continued to be subject to a “step-down” in basis. In 2014, concurrent with the abolition of the gift and inheritance tax, carryover basis was introduced for other assets, including stocks with losses. Therefore, since 2014, recipients of gifted and inherited assets do not pay inheritance tax at the time of the receipt, but are subject to capital gains tax on appreciation from the original owner’s holding period when they sell the inherited asset.

Certain types of real estate are exempt from capital gains taxation in Norway if the owner’s use of the property and length of ownership meets certain requirements. Most

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<sup>47</sup>The definition of close relatives includes parents and children of the giver. Transfers between spouses were not taxed. Transfers between individuals who are not close relatives were subject to a higher top rate in every year: 30% before 2009, and 15% afterwards.

<sup>48</sup>In Norway, mutual fund investors are not taxed when fund managers buy and sell stocks or reinvest dividends. Capital gains taxes are only triggered when the investor sells their mutual fund units. Mutual funds are classified as stock funds and taxed identically to stock if more than 80 of the fund is in equities; otherwise, they are treated as combination funds, with stock income taxed at a higher rate (currently 38%) and bond income taxed at 22%. Exemptions (such as the risk-free return allowance) that are available to offset capital gains from stock are also applicable to capital gains from stock in mutual funds.

<sup>49</sup>Recipients of gifted or inherited stock from 2006–2013 were given a deduction on their inheritance tax bill equal to 20% of the carried-over capital gains tax liability, to lessen the “double taxation” from being subject to both an inheritance tax and carried over capital gains. We abstract from this deduction in our explanation of the policy changes, but fully account for it in all our figures and empirical analyses.

prominently, residential property is not subject to capital gains tax if the seller has owned and lived in the property as his primary residence for 12 of the last 24 months. Vacation homes can be similarly exempt if the seller has used it as his own vacation home for five of the last eight years. Buildings on a farm may be exempt if the farm has been lived on for over ten years. In these cases in which the original owner could have sold the property without capital gains tax, the heir's basis continues to be stepped up to the assumed sales value at the time of acquisition, even after 2014.

### **A.1.3 Legislative History & Anticipation of Step-Up's Removal**

Norway's policy of stepped-up basis for gifted and inherited assets was first established by Norwegian Supreme Court rulings in the 1920s. Various government committees sporadically proposed moving to a system of carryover basis (proposals were made in 1975, 1981 (for gifts only), 1989 and 2000), but no changes were enacted until 2006 ([Zimmer, 2014](#)).

In 2005, it was announced that step-up would be removed for stock (including equity-based mutual funds). The 2006 removal of stepped-up basis at death for inherited stock was passed as an afterthought to a wider reform of capital taxation. The 2006 tax reform changed the exemption rules for dividend and capital gains taxes in a way that made these exemptions more dependent on owners' cost basis (see Section [A.1.4](#)). Because of concern that owners might transfer shares as gifts to their relatives to get the increased dividend exemptions that would accompany stepped-up-basis, subsequent legislation was passed that abolished stepped-up-basis for shares and parts of companies starting in 2006. Although the main components of the 2006 tax reform were formally announced in March 2004 and approved in June of that year, the removal of step-up was not part of the June legislation and was not definitively decided until later in the year ([Norwegian Ministry of Finance, 2004](#)). In a search through the Norwegian media library (Nasjonalbiblioteket) for the terms "kontinuitetsprinsippet" and "diskontinuitet" (which are the Norwegian terms corresponding to carryover and stepped-up basis, respectively), we do not find any press coverage regarding

the impending removal of step-up until early 2005.

The 2014 removal of step-up for other assets was closely tied to the abolition of the inheritance tax. Right-wing parties campaigned on abolishing the inheritance tax during the 2013 election, which they won in September 2013. Therefore from September 2013, it was reasonably certain that the inheritance tax would be repealed, although the exact timing of the repeal initially remained uncertain. The rules accompanying that repeal, which included the removal of step-up for non-stock assets, were announced as part of the government's yearly budget in October 2013.

#### **A.1.4 Other Aspects of the 2006 Reform**

As mentioned above, the removal of step-up for stock came about due to a larger overhaul of exemptions for capital gains and dividend taxation. The overall reform was primarily motivated by a need to prevent private business owners from relabelling labor income as dividends, which had become endemic to the old system. Under the old system, both capital gains and dividends were given generous exemptions that corresponded to the amount of retained earnings held in the underlying firm. The goal of this exemption was to avoid double-taxation on corporate earnings which would have already been subject to the corporate tax. Furthermore, dividend distributions were subject to a yearly limit that corresponded to the amount of retained earnings in the firm at the beginning of the year. Because the exemption amount and dividend cap were thus linked, the effect was that almost no dividends were taxed prior to 2006. From 2006, the same dividend cap remained in place, but the exemption calculations for dividends and capital gains were made less generous going forward. Henceforth, investors would accumulate exemptions based on how their costs basis would grow with the normal rate of return.

Previous work has documented that the 2006 reform led to a large fall in dividend distributions ([Alstadsæter et al., 2014, 2019b](#)). However, we do not think that this aspect of

the reform is likely to be linked to the increase in capital gains realizations we document later in this paper (Section 7). First of all, our results in Section 7 show a response starting in the announcement year of 2005, before the exemption calculations changed. Secondly, the old exemption amounts remained usable after 2006 – only the accumulation of future exemption amounts changed. Therefore, there was no immediate change to the tax calculation of realizing a capital gains in 2005 vs. early 2006 – the same exemption amounts would be available both times. Finally, we do not think there is any incentive for investors to shift from dividend distributions to capital gains realizations. Both before and after the reform, dividends and capital gains were subject to the same tax rate and granted the same exemption amounts. Investors should therefore be “neutral” between the two methods of extracting money from the firm both before and after the reform (Sørensen, 2005).<sup>50</sup> We therefore do not expect any of our documented increase in capital gains realizations (Section 7) to be a shift from dividends to capital gains realizations.

## B Model Proofs

**Proof of Proposition 1** (Step-Up Depresses Realizations) *If substitution effect dominates the income effect, replacing stepped-up basis with carryover basis (i.e., a change from  $\iota = 0$  to  $\iota = 1$ ) will weakly increase the amount  $C$  realized for present consumption.*

*Set-Up:* Call  $p$  the relative “take-home rate” of bequests:  $p \equiv \frac{1-c_R}{1-c_I} = \frac{1-\tau_c\gamma}{1-\tau_I-\iota\tau_c\gamma}$  so that the budget constraint can be rewritten:  $C + pB = W(1 - \tau_c\gamma)$ . In this reformulation, it is clear that the effect of the removal of step-up (increasing  $\iota$  from 0 to 1) is to weakly increase  $p$ , the relative price of bequests. This increase is “weak” because a change in  $\iota$  has no effect if  $\gamma = 0$ . We want to show that the uncompensated cross-price elasticity between  $C$  and  $B$  is weakly positive, as long as the income effect is not too large relative to the substitution effect.

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<sup>50</sup>See Bjerk Sund and Schjelderup (2021a,b) for discussions of how exemptions and loss limitations affect the capital gains realization decision in Norway.



*Proof.* The law of demand gives us that the Hicksian own-price elasticity of demand is negative ( $e_{cc}^H \leq 0$ ). Since Hicksian demand is homogeneous of degree zero in prices, the sum of all Hicksian cross price elasticities is zero. Therefore, in a 2 good model, the sole Hicksian cross-price elasticity is positive. By the Slutsky equation, the total (Marshallian) elasticity of demand equals the Hicksian elasticity of demand minus the budget share times the income elasticity of demand:  $e_{cb}^M = e_{cb}^H - s_b \eta_c$ . We know  $s_b \geq 0$  and, if realizations are a normal good, then  $\eta_c > 0$ . Therefore  $e_{cb}^M$  is positive as long as  $s_b \eta_c < e_{cb}^H$ .  $\square$

**Proof of Proposition 2** (Step-Up Affects the Relationship Between Realizations and the Capital Gains Tax Rate) *If the substitution effect dominates the income effect, then the elasticity of realizations with respect to the capital gains tax rate  $\tau_c$  is more negative under stepped-up basis ( $\iota = 0$ ) than under carry-over basis ( $\iota = 1$ ).*

*Set-Up:* As in the previous proof, define  $p \equiv \frac{1-\tau_c\gamma}{1-\tau_I-\iota\tau_c\gamma}$ . We can then express the (Marshallian) elasticity of realizations  $C$  with respect to the capital gains tax rate  $\tau_c$  as

$$\epsilon_{C,\tau_c} = \frac{\partial C}{\partial p} \cdot \frac{\partial p}{\partial \tau_c} \cdot \frac{\tau_c}{C}.$$

We have shown in Proposition 1 that  $\frac{\partial C}{\partial p} \geq 0$  if the substitution effect dominates the income effect and we know that  $\frac{\tau_c}{C} \geq 0$ . Therefore our objective in this proof is simply to show that  $\frac{\partial p}{\partial \tau_c}$  is more negative under stepped-up basis ( $\iota = 0$ ) than under carryover basis ( $\iota = 1$ ).

*Proof.* We can decompose  $p$ , the relative take-home rate of bequests, into a part that does and does not depend on  $\iota$ :

$$p = \frac{1 - \tau_c\gamma}{1 - \tau_I} + \iota \left( \frac{(1 - \tau_c\gamma)\tau_c\gamma}{(1 - \tau_I - \tau_c\gamma)(1 - \tau_I)} \right)$$

And then take the derivative:

$$\frac{\partial p}{\partial \tau_c} = -\frac{\gamma}{1 - \tau_I} + \iota \gamma \left( \frac{(1 - \tau_c \gamma)^2 - \tau_I(1 - 2\tau_c \gamma)}{(1 - \tau_I)(1 - \tau_I - \tau_c \gamma)^2} \right)$$

Given that  $\gamma$ ,  $\tau_I$ , and  $\tau_c$  are all bounded between zero and one, the first term in this equation is negative and the second term is positive. Therefore the derivative  $\frac{\partial p}{\partial \tau_c}$  is more negative under step-up (when  $\iota = 0$ ) than under carryover (when  $\iota = 1$ ).  $\square$

*Comment:* Note that in the case where the inheritance tax is fully removed ( $\tau_I = 0$ ), the derivative simplifies to  $\frac{\partial p}{\partial \tau_c} = -\gamma + \iota \gamma$ , illustrating that under carryover basis, changes to the capital gains tax rate have no effect on the relative take-home rate of bequests vs. current realizations (since the realization cost for the original owner will be the same as the heir's cost of inheriting and then realizing).

## C Valuing Unlisted Firms in the Norwegian Data

### C.1 Procedure

Our preferred estimate of unlisted firm value follows the procedure of [Smith et al. \(2023\)](#) to compute a liquidity-adjusted, equal-weighted average of capitalized pro rata sales, assets, and EBITDA. Specifically, we apply a 10% liquidity discount to an equal-weighted average of three measures of the firm's capitalized value using (1) sales (2) assets and (3) EBITDA, respectively.

To capitalize each factor, we define valuation multiples for each NACE three-digit industry using Worldscope data on listed firms in the European Union, European Economic Area, and Switzerland<sup>51</sup>. We regress a ratio of the listed firm's equity value (i.e., market price times common shares outstanding) relative to the factor ( $X \in \{sale, asset, ebitda\}$ )

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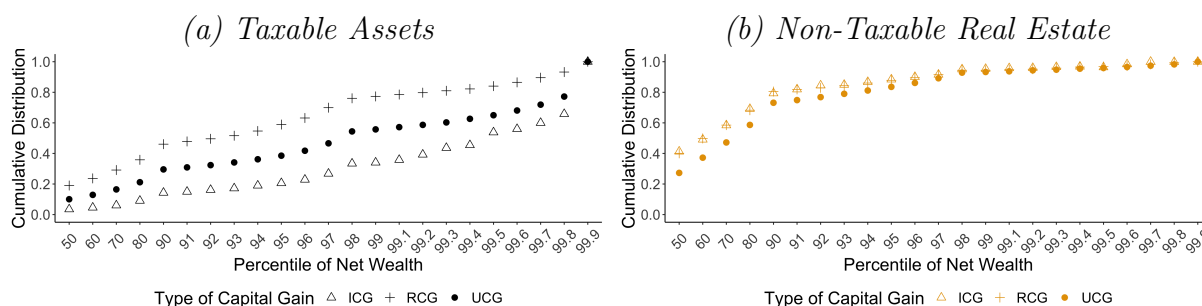
<sup>51</sup>Norwegian firms alone do not have sufficient industry variation to estimate multipliers for all the industries of unlisted firms.

on year-specific fixed effects for the firm’s industry and country. We then employ the fitted values for Norway as our multiple for the given industry in the given year.

We assign unlisted firms in industries with insufficient data (less than 5 listed firms in the Worldscope data that year) a multiplier computed at a higher level in the industry classification (e.g., NACE 2, or the overall market average). We winsorize outlier multipliers at the 95th percentile. For firms that own other firms, we capitalize the firm value at the lowest level possible, and then sum over those valuations to value the parent firm. Since liquid financial assets are valued in the firm’s book at market value, we value unlisted firms with substantial financial assets and little inherent value (holding companies) simply using the book values of assets minus liabilities.

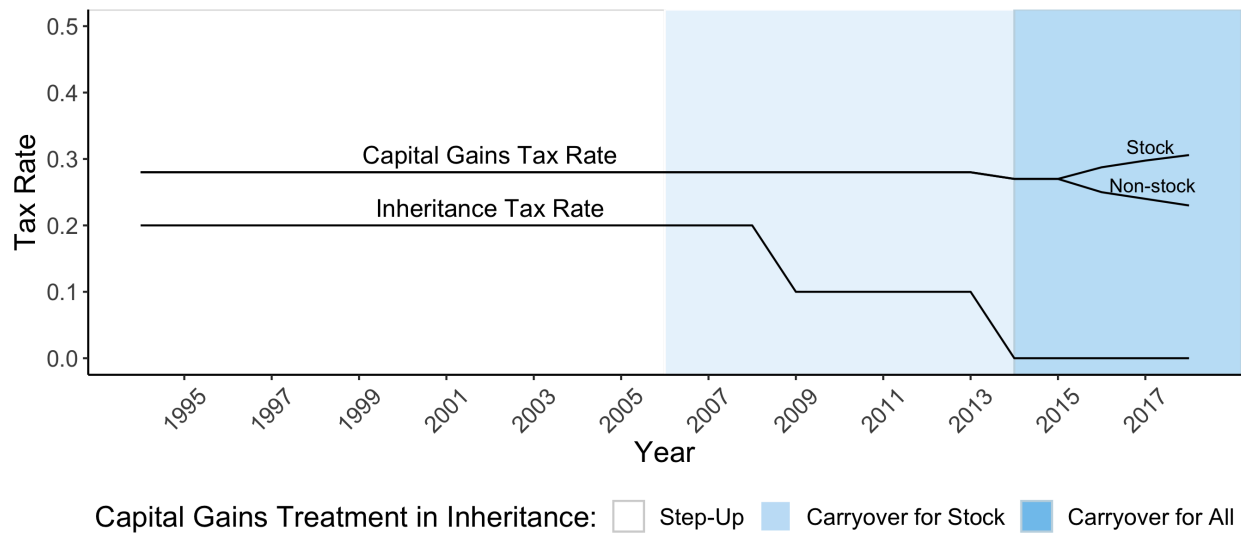
## **D Appendix Tables & Figures**

Figure A1: Comparison of Unrealized, Realized & Inherited Capital Gains, 2004



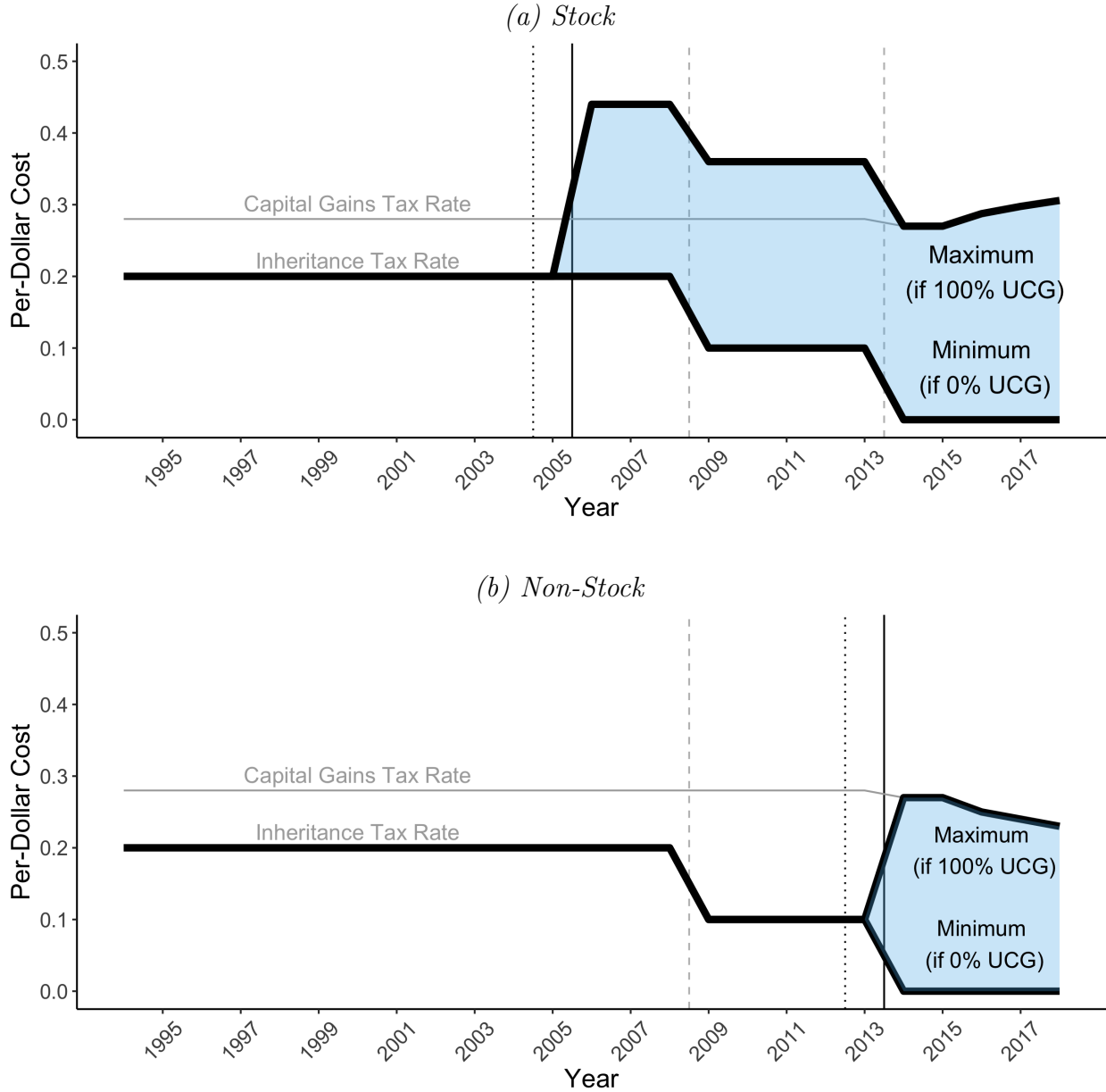
*Note:* This figure compares the cumulative distributions of unrealized capital gains, realized capital gains, and inherited capital gains, for household net wealth percentiles in 2004. Panel (a) displays these distributions for taxable assets (listed and unlisted stock and taxable real estate). Compared to realized capital gains, unrealized capital gains are more concentrated in wealthy households. Inherited capital gains are more concentrated in wealthy households than either realized or unrealized capital gains. Note that for comparability, these distributions all exclude possible capital gains from mutual funds. Panel (b) shows a corresponding figure for the distributions in non-taxable real estate. In contrast to the comparison for taxable assets, the distributions of realized, unrealized, and inherited capital gains in non-taxable real estate (the largest category of which is primary residences) are similarly distributed throughout the wealth distribution. For a presentation of the distribution of only unrealized capital gains (including mutual funds) or only inherited capital gains, see Figures 1 and 2, respectively.

Figure A2: Capital Gains and Inheritance Policy in Norway, 1994–2018



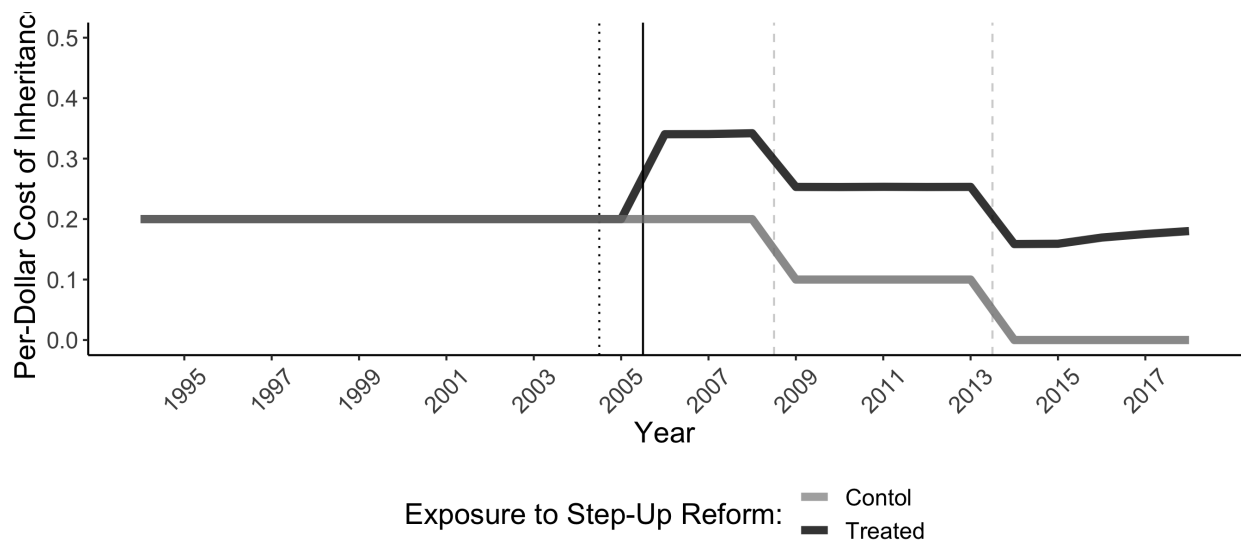
*Note:* This figure summarizes the changes to capital gains and inheritance taxation that took place during our study period. The statutory capital gains tax rate on all taxable assets was steady at 28% until 2014. In 2015, separate capital gains tax rates were introduced for stock and non-stock assets. Throughout our period, capital gains taxation in Norway has had a flat rate structure, although the rate was made to depend on the asset type (stock or non-stock) in later years. In contrast, inheritance tax rates (prior to their abolition) were progressive in the cumulative amount of the inheritance received, and depended on the relationship between giver and recipient. This graph depicts the top statutory inheritance tax rate for closely related family members, which fell from 20% to 10% in 2009 and to 0% with the abolition of the inheritance tax in 2014. See Appendix Table A1 for more information on inheritance tax rates and brackets. The shading of the graph depicts changes to the treatment of inherited capital gains. Prior to 2006, all gifted and inherited assets benefited from stepped-up basis. From 2006, gifted and inherited stock were switched to a system of carryover basis. From 2014, all gifted and inherited assets carried their basis over to the recipient, unless the asset would not have been subject to capital gains taxation in the hands of the original owner.

Figure A3: Per-Dollar Inheritance Costs, by Year & Asset Class



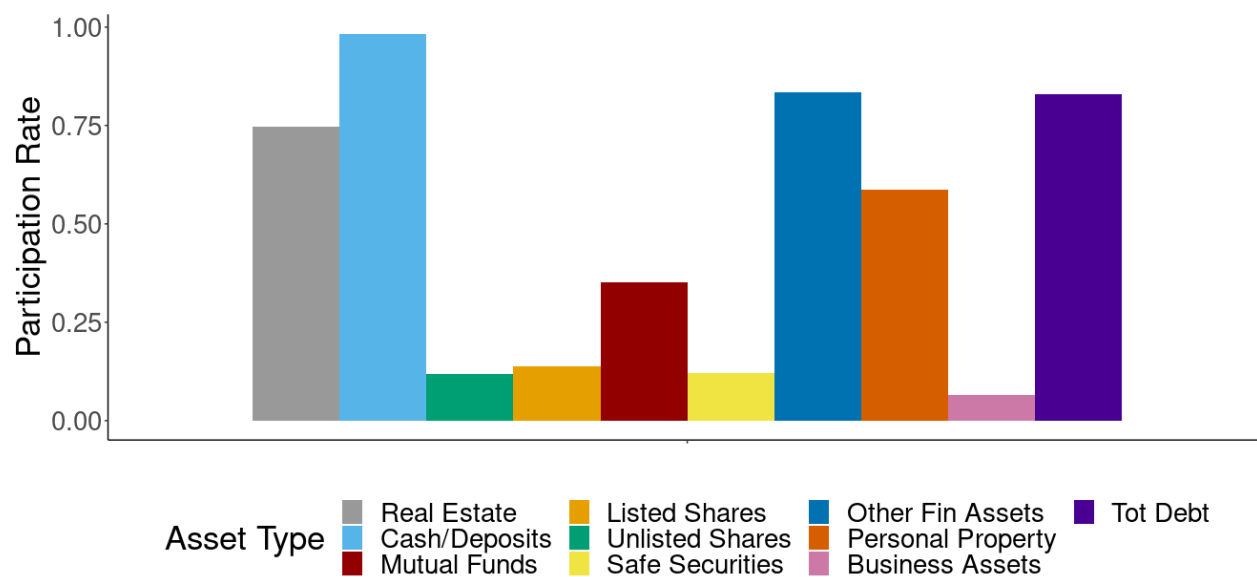
*Note:* As an extension of Figure 4, this figure depicts the range of per-dollar costs of inheritance  $c_I = \tau_I + \iota \tau_c \gamma$  for assets of a given class (stock or non-stock) from 1994–2018. Prior to 2006, Norway had a stepped-up basis regime ( $\iota = 0$ ), so all assets had a inheritance cost equal to the statutory inheritance tax rate ( $\tau_i = 20\%$  in the highest bracket, for inheritance between relatives). Carryover basis ( $\iota = 1$ ) is introduced for stock in 2006 (Panel a) and other assets in 2014 (Panel b), which widens the range of effective tax rates on inherited assets. When carryover basis is in place, assets with 0% unrealized capital gains still face only the statutory inheritance tax, but assets with positive unrealized capital gains face both the statutory inheritance tax and a capital gains tax. At the maximum, assets with 100% unrealized capital gains in a carryover basis regime have an effective tax rate equal to the sum of the capital gains and inheritance tax rates. The dotted black lines (before 2005 or 2013) indicates the announcement of step-up's impending removal for the given asset class. The solid black lines (before 2006 or 2014) indicates the implementation of step-up's removal for that asset class. The dashed grey line before 2009 indicates a fall (by half) of the statutory inheritance tax rate. The dashed grey line before 2014 indicates the full removal of the inheritance tax, and the beginning of a period of increasing capital gains tax rates.

Figure A4: Average Per-Dollar Inheritance Costs ( $c_I$ ), for Treated and Control Group



*Note:* As an extension of Figure 6, this figure depicts the empirical average of our measure of the “per-dollar cost of inheritance” from 1994 to 2018 for the treatment and control groups in our analysis of the removal of step-up for stock. The per-dollar cost of inheritance is defined as  $c_I = \tau_I + \iota_t \tau_c \gamma$  in Section 6.2. Before 2006, step-up is in place ( $\iota = 0$ ), so the total cost is simply the statutory inheritance tax rate ( $\tau_i$ ). Once step-up is removed ( $\iota = 1$ ), costs begin to depend on the amount of appreciation in each individual portfolio. The dotted black line before 2005 indicates the announcement of step-up’s impending removal for stock. The solid black line before 2006 indicates the implementation of step-up’s removal for stock. The dashed grey line before 2009 indicates a fall (by half) in the statutory inheritance tax rate. The dashed grey line before 2014 indicates the full removal of the inheritance tax, and the beginning of a period of increasing capital gains tax rates.

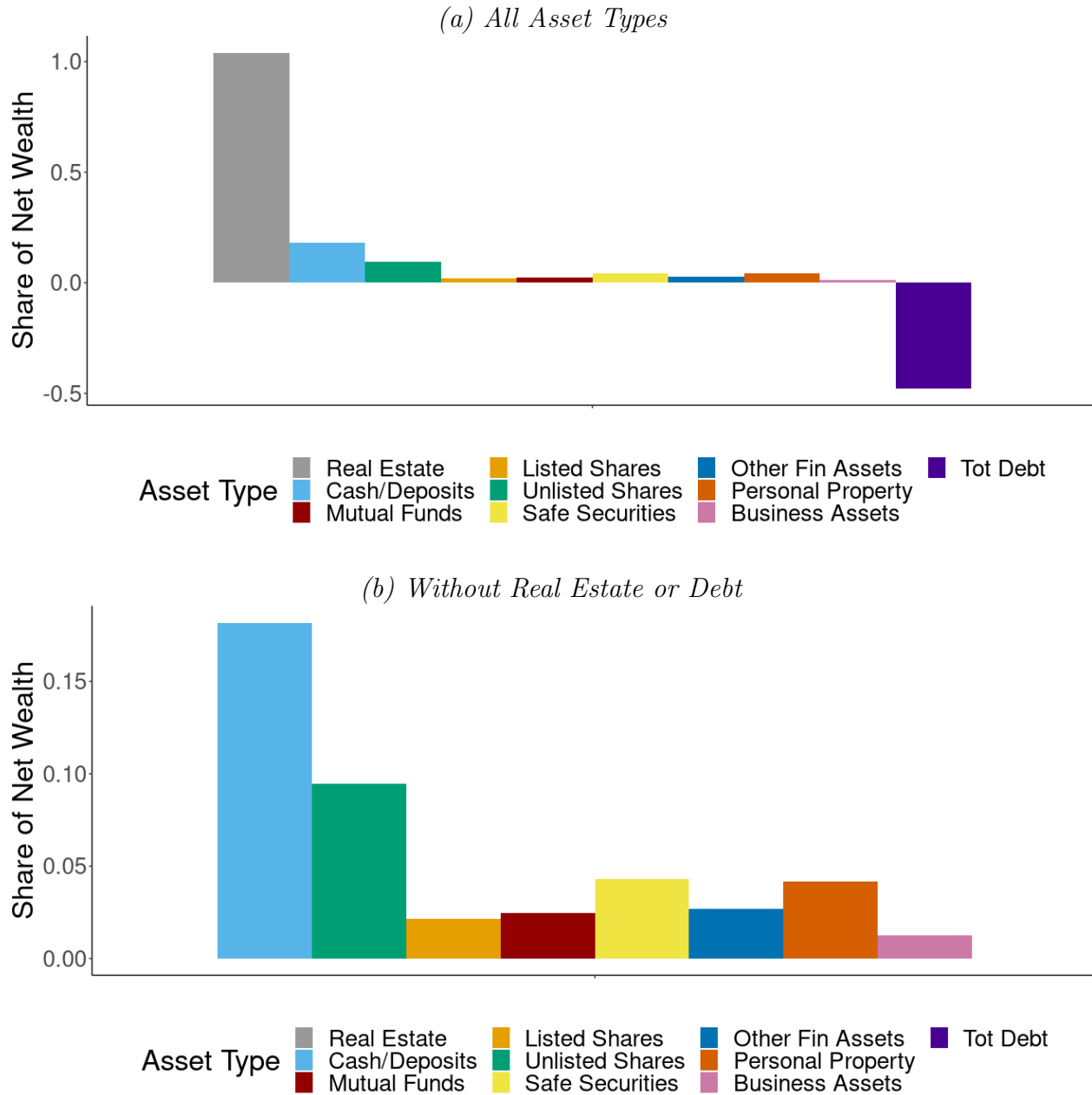
Figure A5: Ownership Rates by Asset Category in 2004



*Note:* This figure depicts the percentage of Norwegian households that hold each asset type at the end of 2004. 14% of Norwegian households owned listed stock and 12% of Norwegian households owned unlisted stock in 2004.

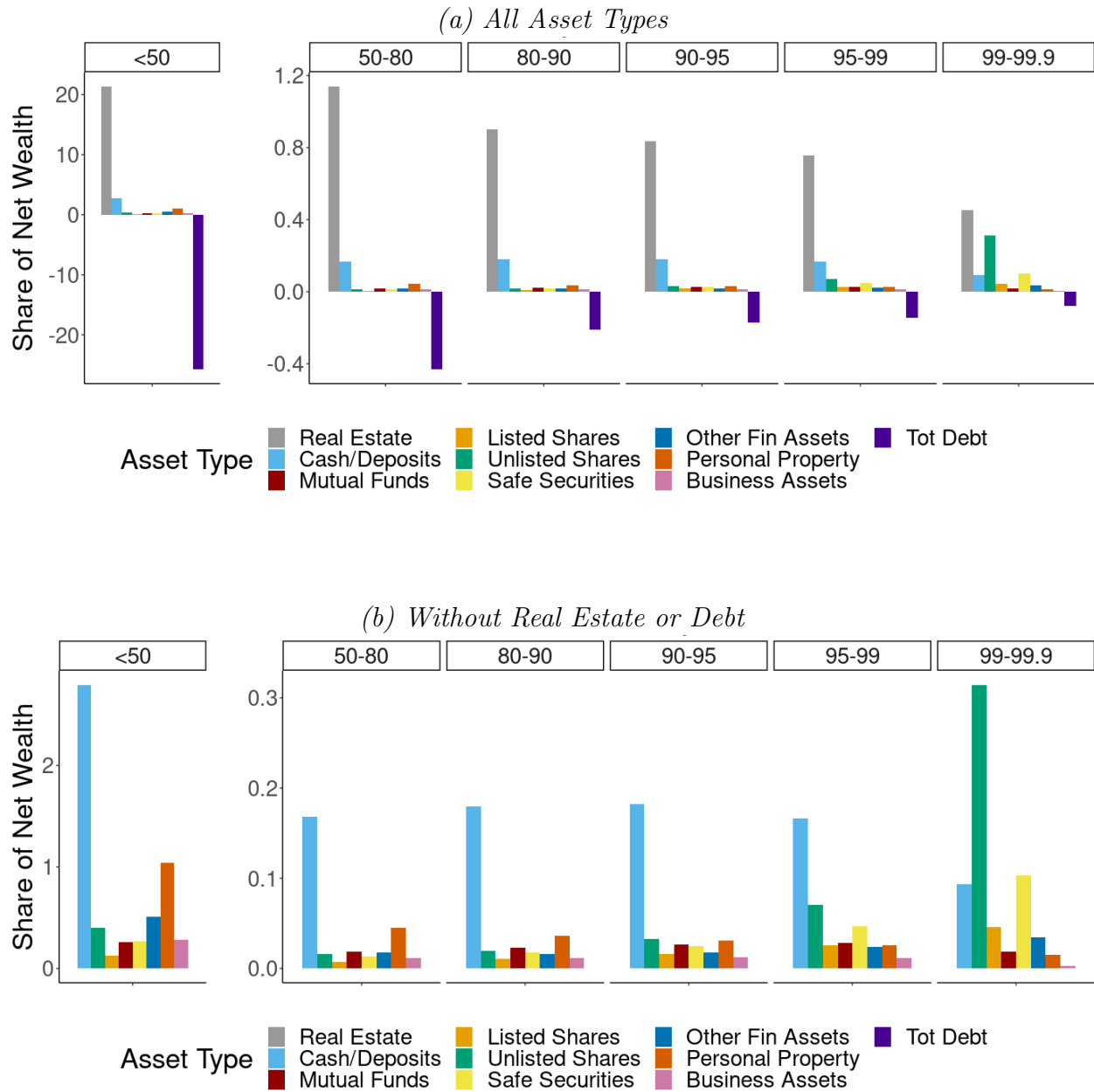


Figure A6: Average Portfolio Shares in 2004



*Note:* This figure depicts portfolio shares for the average Norwegian household at the end of 2004. Panel (a) presents all asset types. Panel (b) is a zoomed in version for those asset types other than real estate and debt.

Figure A7: Average Portfolio Shares in 2004, by Net Worth Percentile



*Note:* This figure depicts portfolio shares for Norwegian household broken out by percentile of net worth at the end of 2004. Panel (a) presents all asset types. Panel (b) is a zoomed in version for those asset types other than real estate and debt. Note that averages below the 50th percentile include people with negative net worth (lots of debt), implying portfolio shares greater than 1. Unlisted stock is a disproportionately important part of very rich people's portfolios – people between the 99th and 99.99th percentile of net wealth in 2004 had an average holding of \$1.3 million (31% of net wealth).

Table A1: Inheritance Tax Rates, 1985-2013

Years	Amount Received (NOK)	Tax Rate		
		Spouses	Close Relatives	Other Recipients
1985-1998	0 - 100,000	0	0	0
1985-1998	100,000 - 400,000	0	0.08	0.10
1985-1998	400,000 +	0	0.20	0.30
1999-2002	0 - 200,000	0	0	0
1999-2002	200,000 - 500,000	0	0.08	0.10
1999-2002	500,000 +	0	0.20	0.30
2003-2008	0 - 250,000	0	0	0
2003-2008	250,000 - 550,000	0	0.08	0.10
2003-2008	550,000 +	0	0.20	0.30
2009-2013	0 - 470,000	0	0	0
2009-2013	470,000 - 800,000	0	0.06	0.08
2009-2013	800,000 +	0	0.10	0.15

*Note:* This table depicts the Norwegian inheritance tax scheme from 1985 until the inheritance tax was abolished in 2014. Inheritance tax was levied without distinction between *inter vivos* gifts and bequests at the time of death. The rate structure depended on the cumulative amount of the gift/inheritance received from the individual giver, and the relationship between the giver and the recipient. The definition of close relatives includes parents and children of the giver. Transfers between spouses were not taxed. Transfers between individuals who are not close relatives were subject to a higher top rate in every year. In 2014, the gift and inheritance tax was abolished, so all rates for subsequent years are set to 0%.