

# Never-Realized Capital Gains

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Appreciated assets are subject to capital gains tax if sold by their original owner. Yet under policies of “stepped-up basis in inheritance”, many countries forgive this latent tax obligation if the asset is instead transferred, unsold, to the owner’s heir. We build a novel dataset on unrealized capital gains in Norway and study 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. We document that the stepped-up basis regime in Norway 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 capital gains in stock and real estate). This exemption disproportionately benefited older individuals and the very wealthy. Furthermore, step-up appears to have large distortionary effects on investors’ decisions to sell appreciated assets. Using a difference-in-difference empirical strategy, 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.

## 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: the asset is never sold by the original owner, and is instead transferred to the 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

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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.

stepped-up basis, an heir who sells a previously-inherited asset will pay capital gains tax only on appreciation during her own holding period. 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>2 3</sup>

Does the opportunity to avoid tax on inherited capital gain 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 whether 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). Some theories of bequest motives would not imply any response to such an incentive. Additionally, removing step-up could only have a large effect on realizations if many capital gains are transferred (or built up in preparation for being transferred) in inheritance, and we do not currently have sufficient information to assess whether this is so.

Empirical work is therefore needed to determine the magnitude of inherited capital gains and the extent to which the tax treatment of inherited capital gains affects taxable realizations. But 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 the aggregate amount of

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<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.

inherited capital gains, 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<sup>4</sup>, few policy changes have actually been enacted in a way that allows for empirical evaluation of the resulting changes. 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’ never-realized 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.

This paper overcomes these two empirical challenges by building new data on unrealized capital gains and introducing a previously-unstudied reform that removed stepped-up basis in Norway. We combine uniquely rich transaction data and asset valuations collected by the Norwegian Tax Authority to estimate a yearly snapshot of the unrealized capital gain in every Norwegian stock, private business, or real estate holding<sup>6</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 gain passing via intergenerational transfers each year. We then use this data to evaluate investor responses to the Norwegian policy changes that altered the tax treatment of inherited assets. Prior to 2006, Norway levied an integrated gift and inheritance transfer tax and allowed all inherited capital gains to disappear from the income tax base when gifted or inherited (a policy of “stepped up basis” for both *inter vivos* gifts

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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.

<sup>6</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.

and testamentary bequests). In 2006, Norway began “carrying over” inherited capital gains to recipients of stock and private business interests transferred as gifts or inheritance. The carryover regime was extended to other asset classes in 2014, when the inheritance transfer tax was also abolished.<sup>7</sup>

In the first part of the paper, we document five new stylized facts about unrealized and inherited capital gains in Norway during the stepped-up basis regime. The facts are as follows:

1. More than half of the wealth in assets subject to the capital gains tax is unrealized capital gains.
2. Of assets subject to the capital gains tax, unrealized capital gain is largely found in private business holdings.
3. Assets transferred in inheritance are much more appreciated than those that are realized.
4. The yearly amount of inherited capital gain exempted via step-up is a substantial fraction of the tax base of realized capital gains.
5. Inheritances that benefit from the stepped-up basis exemption come from disproportionately wealthy households.

In the second part of the paper, we show that the removal of step-up in Norway led to a large increase in taxable realizations. Investors whose portfolios were exposed to step-up increased their yearly taxable realizations by an average of \$2,023. Total government revenues

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<sup>7</sup>As an example of a reform that abolished an inheritance transfer tax and introduced a carryover regime, this reform has parallels to both the United States’ aborted 2010 reform and other recent proposals in the United Kingdom. An important difference, however, is that Norway stepped-up the basis of inheritance transfers regardless of whether they occurred at the time of the giver’s death. This issue is discussed in more detail in Section 6. In the US and the UK, step-up is only available for testamentary (i.e., at death) bequests. Additionally, the US and UK have estate taxes (the tax base is the amount left by the decedent) rather than inheritance taxes (the tax is levied on the amount received by the heir).

from the capital gains tax were 7% higher following step-up's removal than they would have been otherwise. The increase in taxable realizations was driven by investors with the most highly-appreciated stock portfolios.

The paper proceeds as follows: Section 2 provides background on capital gains as a concept, and on how capital gains are taxed. We review three options for the tax treatment of inherited capital gains, and discuss how these policies interact with an inheritance or estate tax. We then discuss recent policy history in Norway, which moved from a system with an inheritance tax in which inherited capital gains were not taxed (stepped-up basis) to a system without an inheritance tax, in which their inheritors of capital assets inherited their predecessor's unrealized capital gains tax obligation (carryover basis).

Section 5 provides a conceptual framework for understanding the effects of the tax treatment of capital gains in inheritance (e.g., stepped-up basis). Step-up policy affects the cost to the heir of realizing the inherited asset. Step-up can therefore only affect the older generation's realization behavior if the older generation is altruistic (that is: if he cares about the after-tax value of his bequests). We employ a simple consumption model to illustrate the distortions that arise under stepped-up basis if givers are indeed altruistic. Intuitively, stepped-up basis can decrease current realizations by making it relatively more cheaper to pass capital gains in inheritance. Our model also shows that the elasticity of taxable income with respect to the capital gains tax rate will be higher under a policy of stepped-up basis relative to a policy of carryover basis – demonstrating that stepped-up basis amplifies the distortions of capital gains taxation.

Section 3 describes our data, including our novel measure of unrealized capital gain. We use transaction-level data in stock, private businesses and real estate to back out individual asset holdings at the end of the year. Once we know an individual's end of year holdings in

an asset, we can calculate his unrealized capital gain in the asset as the asset’s end-of-year value minus what the individual originally paid to acquire the asset. We measure inherited capital gains as the amount of beginning-of-the-year unrealized capital gain in assets that we observe being transferred in inheritance later in the year.

Section 4 uses our novel data to document several new facts about unrealized capital gains in Norway under the stepped-up basis regime. A large portion of the value of Norwegian household wealth is appreciation beyond the initial value of the household’s investment, implying a large stock of unrealized capital gain. The majority of unrealized capital gain in taxable assets is within private businesses (unlisted stock). This unrealized capital gain in private business is particularly likely to be passed in inheritance, relative to unrealized capital gain in other asset categories. We also show that the benefits of a policy of stepped-up basis accrue to the very top of the wealth distribution: unrealized and inherited capital gains are even more concentrated than the distribution of wealth itself.

Section 6 provides the first ever estimates of how individuals’ capital gains realization behavior responds to changes in the tax treatment of capital gains passed intergenerationally. To create these estimates, we exploit variation in the timing and intensity of the Norwegian reforms across individual portfolios. The removal of step-up increased the cost of bequeathing appreciated stock, and investors were differentially exposed to this cost change based on their portfolio’s ratio of appreciation to total value. Investors with unappreciated stock did not experience any change in the cost of bequeathing their assets. We estimate difference-in-difference regression models that compare the effect of the reform between investors who are and who are not exposed to the reform. The key identifying assumption is that, absent the reform, realizations would have evolved similarly across investors who accumulated different returns in their portfolio. Our estimates imply that the removal of step-up for stock increased average realized capital gains for treated individuals by \$2,023 a year. These are very large

behavioral effects: in percentage terms, average realizations nearly double relative to the counterfactual level. We explore heterogeneity by the degree of treatment exposure and find that our results are driven by individuals with the most appreciated stock portfolios, who experience the largest change to the price of bequests.

Section 7 discusses the policy implications of our results. We calculate the marginal value of public funds for step-up, and discuss why, compared to other types of tax breaks, step-up is a particularly inefficient policy.

## 1.1 Connection to Prior Literature

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

Prior work that attempts to estimate the magnitude of inherited capital gain suffers from severe 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 gain within the transferred wealth. These older papers back out a measure of inherited capital gain 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 modern 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 gain in the US Survey of Consumer Finance: they measure inherited capital gain as equal to unrealized capital gain for households predicted to die in the next year. Finally, Gordon et al. (2016a,b) observe the inherited capital gain 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 gain were incentivized to choose step-up treatment, the amount of inherited capital gain they observe in their selected sample is

almost surely an underestimate. We are the first paper to combine comprehensive data on inheritance transfers with the amount of capital gains in the transferred assets. We also the first to measure inherited capital gain in a panel setting, which allows us (unlike previous papers) 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 the stock of unrealized capital gains 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). In the US, prior work has measured capital gains accruals using yearly changes in house price values 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 gain is necessary in order 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

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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 construction, excludes the wealthiest US families and has a cross-sectional structure that makes it difficult to use to analyze behavioral changes over time.



are sensitive to the capital gains tax rate, the magnitude of that sensitivity over the long term remains highly disputed.<sup>9</sup> In contrast with the prior empirical literature’s focus on the capital gains tax rate<sup>10</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 realizations behavior more sensitive to the tax rate (Holt and Shelton, 1962; Feldstein and Yitzhaki, 1978; Auerbach, 1989; Kiefer, 1990; Slemrod and Chen, 2023). Academic and thinktank-based revenue estimates 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 litera-

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<sup>9</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>10</sup>Kopczuk (2005) is a notable exception.

ture 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 in response to tax incentives (Joulfaian, 2004; Ohlsson, 2011), they do not respond as much as they would if the giver choose the timing of his transfer (lifetime vs deathtime) with only tax considerations in mind (Kopczuk, 2007). Our finding in Section 6 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 5 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 gain). 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 pushes 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

### 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 the original purchase price (which is called the owner’s “basis” in the asset)<sup>11</sup>, that owner has capital gains:

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<sup>11</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.

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

Note that our definition of capital gains includes all gain accumulated during an investor’s holding period, whether or not the gain has been recognized for tax purposes upon sale or other realization event (we will distinguish the subset of capital gains that have been realized by referring to them as “realized capital gains”). 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 will use the term “capital gains” to include both capital gains and losses throughout this paper.

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>12</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<sup>13</sup> only taxed when *realized* through the sale or other specified disposition of the underlying asset. Therefore an

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<sup>12</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>13</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.

individual may own a stock for many years and accrue a large amount of *unrealized* capital gain in the stock. But until 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>14</sup> Taxing capital gain 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>15</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, unrealized capital gains passing in inheritance 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

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<sup>14</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>15</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.

market value at the time of the transfer.

## 2. Carryover Basis

Under a system of carryover basis, the heir inherits the capital gains that the original owner has never realized 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 appreciation since the acquisition by the original owner. Formally, this result is accomplished by deeming the heir's basis in the asset to equal 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 disappear will be realized at that time. 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 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 used for inheritance transactions around the globe. Canada, for example, imposes forced realization events to tax as-yet-unrealized capital gains that are transferred as gifts or inheritance. In Australia and Mexico, inheritors of capital assets carryover 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 both the US and UK.

### 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 gain. 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 estate tax, whereas a dying investor who bequeaths the unrealized asset itself pays only the estate tax (if any).

## 2.3 Capital Gains and Inheritance Taxation in Norway, 1992-2018

### 2.3.1 Overview

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%. 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 1. 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 details on the rates and brackets over time. Figure 1 depicts the top rate for gifts and inheritances

between close relatives: a rate that fell from 20% to 10% in 2009.<sup>16</sup> In 2014, the gift and inheritance tax was abolished, so all rates for subsequent years are set to 0%.

During our period of study, Norway moved from a system of stepped-up basis for appreciated assets transferred as gifts or inheritance, to a system of carryover basis for such assets. This change was accomplished in two steps. In 2006, carryover basis was introduced for appreciated gifted or inherited stock. Recipients of gifted or inherited stock from 2006-2013 continued to be subject to inheritance tax on value of the stock they received<sup>17</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 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

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<sup>16</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>17</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.

over ten years. In these cases in which the original owner could have realized 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.

### 2.3.2 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<sup>18</sup>). 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. 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](#)). 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

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<sup>18</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.



empirical analysis.<sup>19</sup>

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.

### 2.3.3 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 exemp-

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<sup>19</sup>The removal of step-up 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 8th, 2005, under the headline “One Year Left” ([Amundsen, 2005](#)). A second mention appeared in *Levanger-Avisa* on February 19th, 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. Throughout the spring and summer of 2005, media coverage of the upcoming change became more extensive.

tion 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 6). First of all, our results in Section 6 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 gain 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](#)). We therefore do not expect any of our documented increase in capital gains realizations (Section 6) to be a shift from dividends to capital gains realizations.

### 3 Data

We combine several administrative data sources collected by the Norwegian government. We begin with detailed information about all Norwegian households’ 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 allows us to calculate a novel measure of unrealized capital gains at the individual asset level, and then

aggregate that measure to each Norwegian household and to the entire Norwegian economy. While [Eika et al. \(2020\)](#) notably use this same transaction data to compute a measure of household’s yearly accrued capital gains, 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

### 3.1 Data on Yearly Wealth & Income

In Norway, the tax authorities collect 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 includes information on (taxable) realized capital gains at the individual-year level. Realized capital gains can be decomposed into gross gains and gross losses, for real estate realizations and non-real estate realizations.

The Norwegian wealth data is perceived to be high quality, and we are confident that it 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 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 assets, such as goodwill and other intangible assets, are not valued at all. Although we will use the assessed values of unlisted companies in some of our analysis, we will also supplement 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. 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 rich of Norway ([Alstadsæter et al., 2019a](#)).

### **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 1993–2018. 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 2003–2014. These data contain similarly detailed information on the type of transfer, the identity of the buyer and seller, and the transaction price. The data contain information on the last transaction prior to 2003, and all subsequent transactions from 2003–2018. 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 high average participation rate than directly-held stock. However, they are a much smaller fraction of overall wealth for the richest Norwegians (See Appendix Figures [A2](#), [A3](#)). 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 holdings of each asset as the individual buys and sells. We measure an individual's basis in a held asset as 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.

#### **3.3.1 Tracking Basis & 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. In order 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, basis is then increased and decreased accordingly. We employ two alternative assumptions to measure how basis changes with interim transactions. Our primary results use a first-in-first-out assumption, and as robustness check, we create alternative calculations using an average basis assumption.

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 - basis), and then comparing that calculation to the realized capital gains reported in each individual's 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 Thompson-Reuters Datastream.

For unlisted stock, we consider two different methods of year-end valuation, each of which is useful for a different purpose. First, we consider a 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 serves as the heir's new basis for unlisted stock received in inheritance. This measure almost certainly undervalues the value of these companies (among other reasons, it does not include intangibles). However, since this is the government's attempt to value the unlisted asset, it illustrates how the government (given the same valuation problems it currently faces) might think about a potential tax base

of unrealized capital gains. Second, we create our own measure of unlisted company value by scaling up the company’s sales, income, and asset (including intangibles) 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 either of these values are 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 gain passing in inheritance. We construct this measure using the transactions data, described above, for stock and real estate. We observe gift and 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 gain in an inheritance transaction as the tax-assessed value of the asset at the beginning of the year minus the basis associated with the transferred asset. Since the tax-assessed values at the beginning of the year are the same values recorded in the inheritance data, we can compare the amount of capital gain transferred in inheritance to the value of all (not just stock and real estate) inheritance transfers.

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 31st, 2018.

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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.

## 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 gain in Norway as of end-of-year 2004 — the last year before the removal of step-up was announced.

**Fact 1.** *More than half of the wealth in assets subject to the capital gains tax is unrealized capital gains.*

See Table 1 Panel (a) and Figure 4 Panel (a). At the end of 2004, \$68.2 – \$78.5 Billion<sup>21</sup> of unrealized capital gain was outstanding in asset categories subject to the capital gains tax<sup>22</sup>. This amount was equal to 55–64% of the \$123.4 B of wealth in these asset categories held by Norwegian households in 2004.

**Fact 2.** *Of assets subject to the capital gains tax, unrealized capital gain is largely found in private business holdings.*

See Table 1 Panel (a) and Figure 4 Panel (b). \$53.2 Billion of unrealized capital gain was present in unlisted shares at the end of 2004 (79% of \$67.0 B total value in unlisted shares). In Norway, top wealth is very concentrated in private business holdings (see Appendix Figure A3). 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 than holdings of listed stock or taxable real estate (which are on average 42% and 29% appreciated, respectively).

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<sup>21</sup>The upper bound of this range assumes all mutual fund holdings are 100% appreciated. The lower bound of this range assumes no one has any unrealized capital gains in mutual funds.

<sup>22</sup>Our definition of assets subject to the capital gains tax includes listed and unlisted stock, mutual funds, and taxable real estate. It notably excludes primary residences and other forms of real estate that are exempt from capital gains tax if the owner meets certain holding period requirements. Wealth in other possibly-taxable asset categories is a very small share of household wealth (see Appendix Figure A2).



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

See Table 1 Panels (b) and (c). The ratio of capital gains to value in inherited assets is 57%, whereas the equivalent ratio for realized assets is 8%. This large aggregate difference are driven by the underlying differences for listed (65% vs 1%) and unlisted (71% vs 7%) shares. Real estate, whether taxable or non-taxable, does not show a similar pattern.

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

See Table 1 Panels (b) and (c). Although 38 times as much *value* is realized than is inherited in 2004, the large differences in appreciation within those assets (Fact 3) means that only about 5 times as much *capital gain* is realized than is inherited in 2004. Specifically, \$310 million dollars of inherited capital gain disappears 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 dollars of inherited capital gain makes up 25% of that year’s amount of realized capital gain 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.*

See Figure 5. Households in the Top 0.01% of net worth in 2004 own 22% of wealth in stock and taxable real estate. These top households own a similar share of unrealized capital gain in these assets. But these top households pass an even larger fraction of the inherited capital gain that benefits from step-up – the Top 0.01% of households pass 42% of the inherited capital gain that benefits from the step-up exemption in 2004. In contrast, the right-hand side Panels of Figure 5 show that the distributions of wealth, unrealized capital

gain and inherited capital gains in non-taxable real estate (primarily primary residences) are much more equally distributed across the wealth distribution.

## 5 Conceptual Framework

This section presents a conceptual framework for understanding the effects of step-up. Step-up makes it more costly for heirs to receive and realize appreciated assets as inheritance. Under the assumption that givers of bequests are altruistic (i.e., that they care about their heirs' after-tax value of the bequest), we show that step-up will disincentivize realizations 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) agrees 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>23</sup> We do not entertain these alternative assumptions because they would imply that givers do not respond to changes in inheritance tax rates or step-up policy, which would be inconsistent with our empirical findings in Section 6.

### 5.1 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 the individual's 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

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<sup>23</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.

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 cost of inheriting and then realizing ( $c_I$ ):<sup>24</sup>

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

## 5.2 The Cost of Realizing & Inheriting

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

We first define a “per-dollar cost of realization” as the asset-specific price to extract 1 unit of value from a potentially appreciated capital asset. Realizing value from a (potentially appreciated) capital asset  $n$  in time  $t$  costs

$$c_{R,nt} \equiv \tau_{c,t} \cdot \gamma_{nt}$$

where  $\tau_{c,t}$  is the statutory capital gains tax rate and  $\gamma_{nt}$  is the ratio of capital gains to total value of the asset  $n$  in time  $t$ . All assets face the same statutory tax rate on realized capital gains. But the fact that the capital gains tax is levied on capital gains, rather than market value, means that  $c_R$  will vary across assets, because it is cheaper to realize the same amount from less-appreciated assets. As an illustration, suppose an individual owns two 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 individual

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<sup>24</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 to  $W = \frac{C}{1 - c_R(\gamma)} + \frac{B}{(1+r)(1 - c_I((\gamma+r)/(1+r)))}$ . Doing so complicates the notation and does not change any of our conclusions, so we set  $r = 0$  outside of this footnote.

realizes the full \$100 value from Stock 1, it will cost  $\tau_c \times \$1$ . If the 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 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 heir’s cost of inheriting \$1 of an asset and then realizing the accompanying capital gain (if any). The cost of receiving a (potentially appreciated) capital asset  $n$  as a gift or inheritance in time  $t$  and then immediately<sup>25</sup> realizing value from that asset is equal to the inheritance tax bill (if any) plus the capital gains tax bill from the heir’s realization (if any).

$$c_{I,nt} \equiv \begin{cases} \tau_{I,t} & \text{under stepped-up basis} \\ \tau_{I,t} + \tau_{c,t}\gamma_{nt} & \text{under carryover basis} \end{cases}$$

where  $\tau_{I,t}$  is the statutory inheritance tax rate,  $\tau_{c,t}$  is the statutory capital gains tax rate, and  $\gamma_{nt}$  is the fraction of capital gains to total value of the asset  $n$  in time  $t$ . For notational convenience, we will also define the indicator  $\iota_{nt}$  to equal 0 when a step-up regime is in place at time  $t$  for asset  $n$  and equal 1 when in a carryover basis regime is in place. We can then write the per-dollar cost of inheritance as  $c_{I,nt} = \tau_{I,t} + \iota_{nt}\tau_{c,t}\gamma_{nt}$ .

Figure 2 depicts how our two costs,  $c_R$  and  $c_I$ , are affected by the removal of stepped-up basis. The cost of consumption,  $c_R$  is unaffected. The cost of inheritance  $c_I$  increases, particularly for assets with large ratios of unrealized capital gain to value. In a stepped-up basis regime, the heir did not have to pay capital gains tax if he inherited and then immediately realized an asset. The cost of inheritance was thus equal to the inheritance tax rate  $\tau_I$  (the flat dashed line in Figure 2 Panel (a)). When step-up is removed, the heir now has

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<sup>25</sup>Alternatively, if we assume that the heir realizes the inherited asset  $T$  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:  $c_{I,nt} = \tau_{I,t} + \beta^T \cdot \iota_{nt} \cdot \tau_{c,t} \cdot \gamma_{nt}$

to pay capital gains taxes when he realizes the asset. The cost of inheritance is thus the sum of the inheritance tax and the heir's capital gains tax obligation, and depends sharply on the amount of unrealized capital gain in the asset (the solid blue line in Figure 2 Panel (a)).

In practice, the statutory capital gains rate remained at 28% in Norway from 1992 until 2013. Therefore the 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 never realizing, on the other hand, was affected by several policy changes during our time period. Figure 3 illustrates the effect of policy changes in 2006, 2009 and 2014, depending on the type of asset in question. In the step-up regime (prior to 2006 for stock and prior to 2014 for non-stock), the cost of bequests does not depend on the fraction  $\gamma$  of asset value that is taxable capital gain – it is instead equal to the inheritance tax rate  $\tau_i$  for everyone. Once a carryover basis regime is established, the price of bequests becomes heterogeneous, and depends steeply on the fraction  $\gamma$  of asset value that is capital gains.

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

Returning to the consumption model of Section 5.1, we can rewrite the budget constraint by plugging in our definitions for costs  $c_R$  and  $c_I$ :

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

In order to maximize utility subject to this budget constraint, our individual will, naturally, set  $u_B/u_C = (1 - c_R)/(1 - c_I)$ . 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). *As long as the income effect is not too*

large, 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 A for formal proof. Briefly: the change in  $\iota$  weakly raises the cost of bequests relative to present consumption ( $\frac{c_L}{c_R} \uparrow$ ). If the substitution effect dominates the income effect, consumers reallocate their wealth toward current consumption and away from bequests, leading to a net decrease in  $C$ .

**Lemma 1** (Step-Up Disproportionately Affects Highly-Appreciated Assets). *As long as the income effect is not too large, the increase in realizations  $C$  associated with replacing stepped-up basis with carryover basis (i.e., a change from  $\iota = 0$  to  $\iota = 1$ ) will be larger for individuals whose portfolios have a larger fraction  $\gamma$  of unrealized capital gains. In particular, individuals whose portfolios do not have any unrealized capital gains ( $\gamma = 0$ ) will not be affected by a change in step-up policy.*

Since  $\iota$  only enters the individual's maximization problem budget constraint when multiplied by  $\gamma$ , this follows directly from Proposition 1.

**Proposition 2** (Step-Up Affects the Relationship Between Realizations and the Capital Gains Tax Rate). *If the income effect is not too large, then the realization elasticity with respect to the capital gains tax rate  $\tau_c$  is higher under stepped-up basis ( $\iota = 0$ ) than under carry-over basis ( $\iota = 1$ ).*

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. 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. Carryover means there is no longer a wedge between tax cost the original owner would need to pay to realize and the cost the heir would pay to realize. This result is related to prior work by [Slemrod and Kopczuk](#)

(2002); Kopczuk (2005) which shows that broader tax bases lead to lower 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.

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

In 2005, following thirteen years without substantial changes to capital gains and inheritance tax rates<sup>26</sup>, it was announced that step-up would be removed for stock (including 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 that the announcement of the coming removal of step-up triggered two types of responses. Holders of some highly appreciated assets chose to make their bequests earlier than originally planned, triggering a large surge of gifts in late 2005, before step-up was removed. Other highly-appreciated owners substantially increased capital gains realizations, both in the announcement year (2005) and the years immediately following.

Capital gains realizations remained at their higher level throughout our post-period data. Furthermore, relatively less capital gain in stock passes in inheritance transfers in the post-period, compared to the increasing total value of all types of inheritance transfers.

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<sup>26</sup>See Appendix Table A1 for detail on minor modifications to the inheritance tax brackets during this time.

## 6.1 Anticipatory Bequest Responses

As discussed in Section 2, 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 doing so (Amundsen, 2005; Vigdal, 2005). Figure 7 shows that many of them did so. The later months of 2005 saw an unprecedented number of stock-based-gift transactions, in which an outlier amount of capital gain of stock was transferred.

## 6.2 Inherited Capital Gains in the Post-Period

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 away from highly-appreciated stock in particular, following the 2006 reform. Figure 8 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 8 Panel (b) shows that inherited stock had a somewhat smaller fraction of unrealized capital gain to value after 2006.

## 6.3 Capital Gains Realization Responses

For owners disinclined to quickly bequest their assets in late 2005, the fact that future bequests would not benefit from step-up increased the cost of bequests relative to consumption. In Section 5, we demonstrate that in a very simple model of realizations and bequests, this relative price change would imply increased realizations. In this section we seek to learn whether the removal of step-up actually caused such an increase in taxable realizations.



### 6.3.1 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 net capital gains realizations more than tripled in 2005 compared to the previous year, and remained high until 2008’s financial crisis. Figure 9 documents this change, which corresponded to a 205% increase in tax revenue from the capital gains tax in 2005.

However, as evidenced by Figure 9, 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.

### 6.3.2 Defining the Target Parameter

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 policy reform. Our target parameter is thus an average treatment effect for the treated (an “ATT”).

Formally, denote an individual  $i$ ’s amount of realized capital gains in year  $t$  as  $Y_{i,t}$ . Let  $D_{i,t} = d$  denote exposure to step-up of magnitude  $d$  in year  $t$ , and  $D_{i,t} = 0$  otherwise. Let  $Y_{i,t}^d$  denote the potential outcome of an individual if she experiences treatment exposure of magnitude  $d$ , and  $Y_{i,t}^0$  denote the potential outcome if the individual is not exposed. The average effect of the removal of step-up for all individuals affected by the removal is:

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

We can also define treatment effects specific to each level of treatment exposure ( $D_{i,t} = d$ ). The average effect of removal of step-up for those exposed to degree  $d$  is:

$$ATT_t(d) = E[Y_{it}^d - Y_{it}^0 | D_{it} = d]$$

Note that the aggregate  $ATT_t$  is a weighted sum over all the  $ATT_t(d)$  with  $d > 0$ .

### 6.3.3 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 that would have, in the absence of the reform, experienced a parallel change in realizations around the time of step up's removal. Such a control group would allow us to difference out time effects by constructing a difference-in-difference (DiD) estimator.

In fact, not all stock owners were equally exposed to the removal of step-up. As explained in greater detail in our conceptual framework (Section 5), step-up policy impacts the price of bequests more for assets that are more appreciated, and assets with zero or negative appreciation do not experience any change in the price of bequests from the 2006 reform. We therefore take portfolios of people who own stock at the beginning of 2005, but who have zero or negative appreciation in their portfolios, as our potential control group (relative to the treatment group of people who owned appreciated stock at the beginning of 2005).

What can untreated group outcomes teach us about counterfactual treated group outcomes? We assume that in the absence of treatment, average capital gains realizations for the two groups (including realizations of stock and of any other assets) would experience the same percent change over time. Under this assumption (stated formally in Assumption 1), we can employ a difference-in-difference estimator to identify both the multiplicative effect

that treatment has on the outcome (in terms of percent changes), and the level of the average treatment effect for the treated (ATT).

**Assumption 1** (Parallel Trends in Percent Changes). *The average outcome for the group of individuals with treatment exposure  $d$  would have, in the absence of treatment, evolved proportionally to the average outcome of the untreated group.*<sup>27</sup>

$$\frac{E[Y_{it}^0|D_i = d, Post = 1] - E[Y_{it}^0|D_i = d, Post = 0]}{E[Y_{it}^0|D_i = d, Post = 0]} = \frac{E[Y_{it}^0|D_i = 0, Post = 1] - E[Y_{it}^0|D_i = 0, Post = 0]}{E[Y_{it}^0|D_i = 0, Post = 0]}$$

We also require a standard “no anticipation” assumption (Assumption 2).

**Assumption 2** (No Anticipation).

$$E[Y_{it}^0|D_i = d, Post = 0] = E[Y_{it}^d|D_i = d, Post = 0] \quad \forall d$$

Under Assumptions 1 and 2, we can identify an  $ATT_t(d)$  for each level of treatment exposure  $d$ , from which we can aggregate to our summary parameter of interest:

$$ATT_t = E[ATT_t(d)|D > 0]$$

Additionally, if we wish to add time-invariant covariates  $X$ , we modify our two previous assumptions:

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

$$\frac{E[Y_{it}^0|X_i = x, D_i = d, Post = 1] - E[Y_{it}^0|X_i = x, D_i = d, Post = 0]}{E[Y_{it}^0|X_i = x, D_i = d, Post = 0]} =$$

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<sup>27</sup>This assumption 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).

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

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

$$E[Y_{it}^0|X_i = x, D_i = d, Post = 0] = E[Y_{it}^d|X_i = x, D_i = d, Post = 0] \quad \forall d$$

And add an overlap condition:

**Assumption 3** (Overlap in each period).

$$P(D = 0|X) > 0 \quad \forall X$$

The overlap assumption implies that a match can be found for all persons with  $D > 0$ . If there are regions where the support of  $X$  does not overlap for  $D = 0$  and  $D > 0$ , 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 the ATT for each  $(d, x)$  pair, and aggregate to  $ATT_t = E[ATT_t(d, x)|D > 0]$ .

#### 6.3.4 Estimation

We recover the ATT 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:

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

with  $E[\epsilon_{it}|TREAT_i, POST_t] = 1$ . The exponentiated coefficient  $\exp(\beta_1)$  can be interpreted as the percent 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:

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

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

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

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

### 6.3.5 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, realizations are 46% higher than their counterfactual level. 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 in 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 very qualitatively similar.

Figure 11 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. Realizations do not display a clear pattern in the pre-period. The realization response began as soon as the repeal of step-up was announced (2005) and similar high levels of realizations are sustained throughout the post-period.

As shown at the bottom of Table 2, our ATT estimates can be converted into estimates of increased tax revenues by simply 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 dollars of additional capital gains realizations, implying \$195.16 million of increased tax revenue (relative to counterfactual). This implies that 7% 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 12 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, and results appear to be driven by extremely large responses among the most appreciated investors.

## 7 Discussion & 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 gain, but also 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 formalize the value of public expenditure on step-up by calculating the ratio of step-up's benefits relative to its total cost to the government.

### 7.1 Marginal Value of Public Funds

In order to compare the cost of step-up to other potential government expenditures, we use our estimates to calculate a marginal value of public funds (MVPF) for step-up. The MVPF ([Hendren, 2016](#); [Hendren and Sprung-Keyser, 2020](#)) 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. 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. If we assume that step-up only affects government revenue through capital gains tax collection<sup>28</sup>, then we can write:

$$MVPF_{SU} = \frac{\tau_c \times RICG_{SU}}{-\tau_c \times ATT \times N_{TREAT}}$$

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,  $\tau_c \times ATT \times N_{TREAT}$  is the total change in capital gains tax revenue from the removal of step-up.

To calculate the benefit to the heirs of their exempted capital gain, we need to know not only the historical amounts of inherited capital gain that experienced step-up, but also whether and when that capital gain would have been taxable under a counterfactual carryover basis regime.  $RICG_{SU}$  should include all previously-inherited capital gain that is 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. Firstly, we assume that the ratio of inherited capital gain in stock to total inheritance value was constant during the step-up regime, and set this ratio at the observed value of .073 for inherited capital gain in 2003–2004. We therefore estimate the amount of inherited capital gain from 1995–2002 as the observed aggregate value transferred in inheritance, multiplied by .073. Secondly, we assume that the speed at which heirs realized their capital gain followed a constant hazard rate during the step-up regime (i.e., that the heirs’ time to realization followed an exponential

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<sup>28</sup>It is possible that step-up also increases inheritance tax revenue, in which case our MVPF estimate would be an underestimate. Although we present evidence in Section 6 that step-up affects the composition of inherited assets, we are unsure as to whether it affected the level of inheritance (which is rising rapidly over time, both before and after step-up).



distribution). We estimate this constant hazard rate using Maximum Likelihood Estimation on the observed pattern of realizations for inherited capital gain that was inherited from 2003–2004. 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  $\frac{\$239 \text{ million}}{\$697 \text{ million}} = 0.34$ .

The MVPF quantifies the “leakiness” of Okun’s famous bucket metaphor for redistributive government policies.<sup>29</sup> Lower MVPFs imply that, as the particular public spending is transferred to the beneficiaries, more revenue than usual leaks out due to behavioral responses. Comparing our MVPF estimate with the estimates of MVPFs for other government programs (Hendren and Sprung-Keyser, 2020) thus provides an important perspective on step-up’s distortionary effects. An MVPF of 0.34 is a bit lower than standard for spending programs targeted at adults, in which the government trades-off a desire to give money or other goods to the beneficiaries with the program’s distortionary effect on (labor) income. Compared to other tax breaks, however, step-up is shockingly inefficient: MVPF estimates for tax rate cuts exceed 1.<sup>30</sup> This is because most tax rate cuts reduce distortions, whereas step-up provides a tax break for its beneficiaries (who notably come from extremely wealthy backgrounds, see Section 4) while increasing overall distortions to capital gains realizations.

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. Such a policy change would be distortion-reducing, could be accomplished in a

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<sup>29</sup>“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)

<sup>30</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.

budget-neutral manner<sup>31</sup>, and would have the possible added benefit of distributing the tax break more widely among capital gains realizers (rather than the select subset of realizers who inherited their assets).

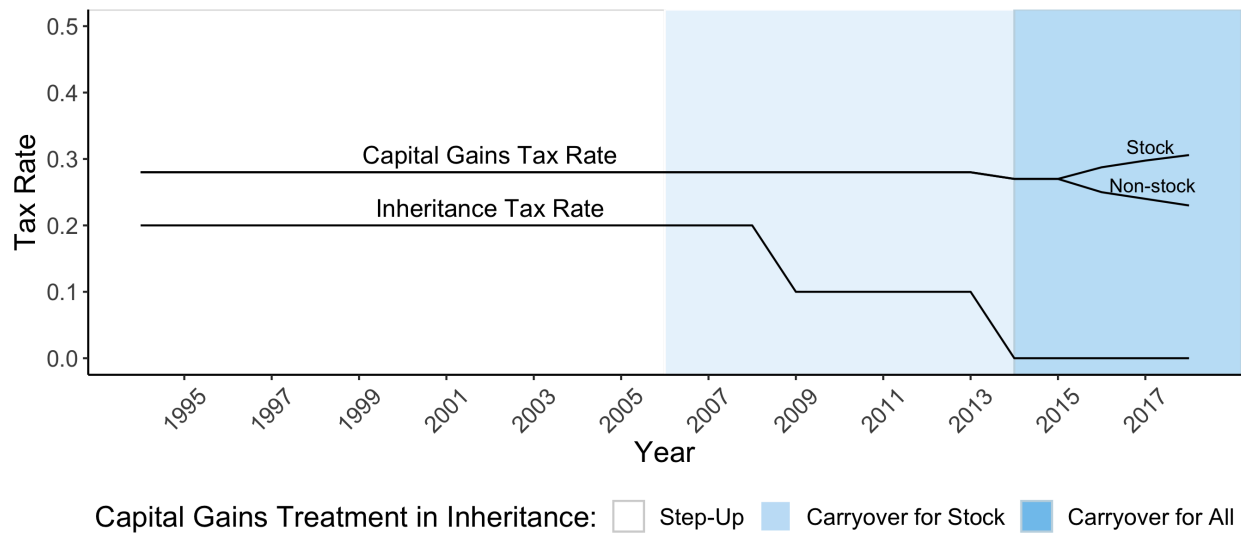
## 8 Conclusion

This paper presents the first empirical estimates of how the tax treatment of inherited capital gains affects 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.

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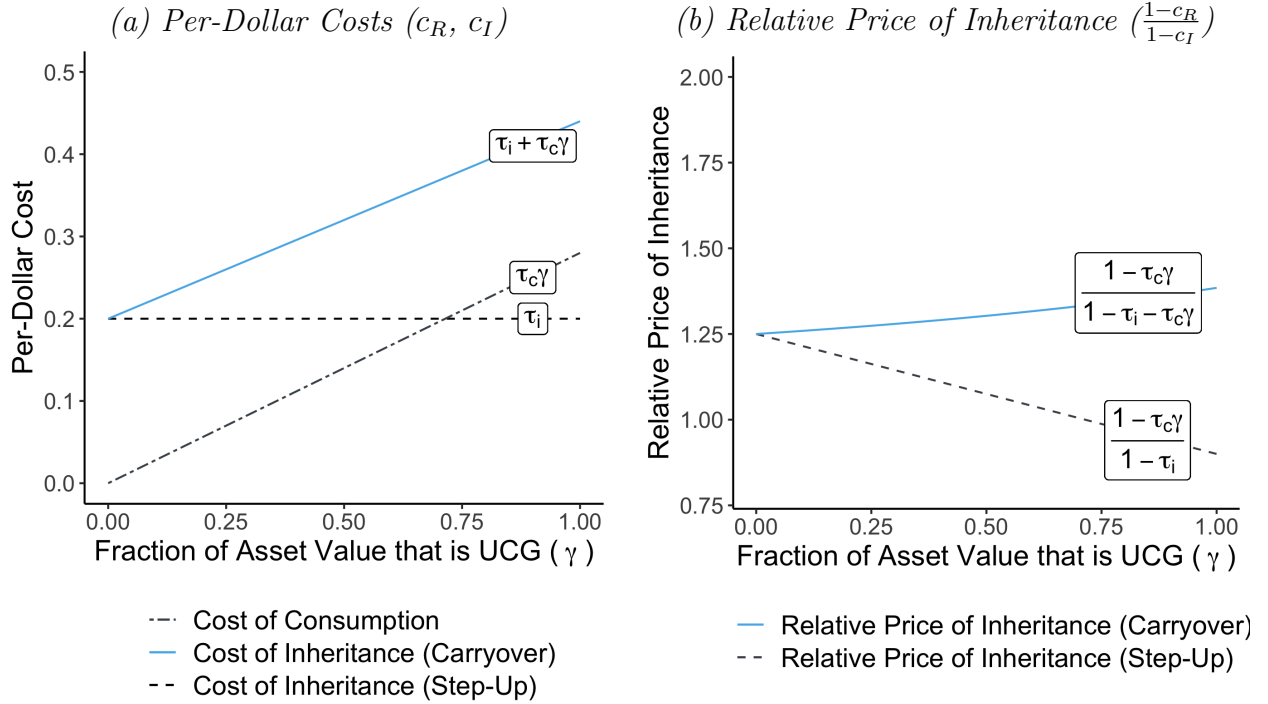
<sup>31</sup>The exact rate reduction that could be financed by the repeal of step-up depends on the elasticity of capital gains relations with respect to the tax rate *within a carryover basis regime*. We are not aware of existing estimates within the Norwegian context, but expect the elasticity to be lower than it was during the stepped-up basis regime (See Proposition 2, Section 5).

Figure 1: Capital Gains and Inheritance Policy in Norway, 1994–2018



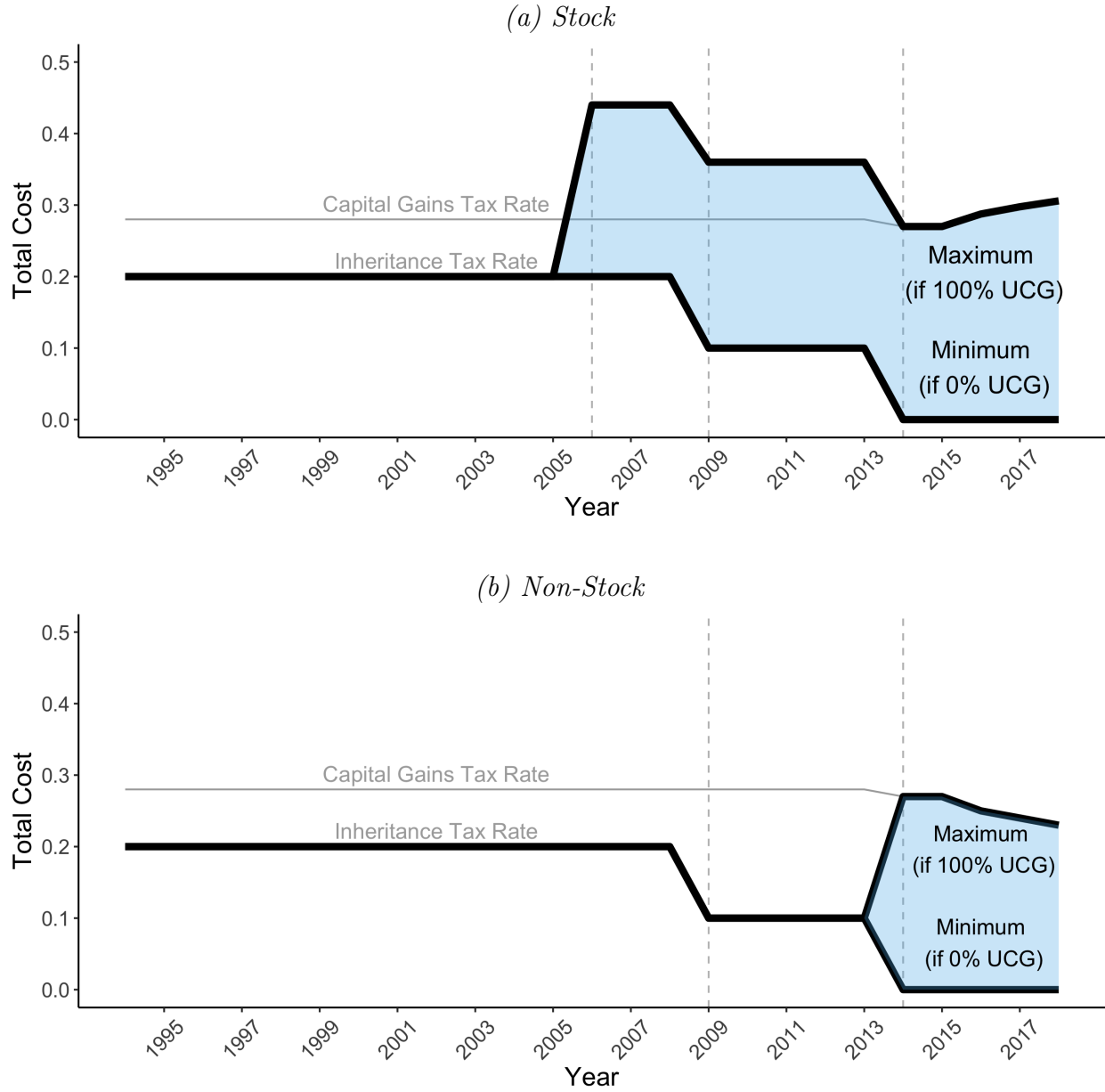
*Note:* This figure summarizes the changes to capital gains and inheritance taxation that took place during our study period. The statutory capital gains tax rate on all taxable assets was steady at 28% until 2014. In 2015, separate capital gains tax rates were introduced for stock and non-stock assets. 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 never-realized 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 2: 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 5.2 as  $c_I = \tau_I + \tau_c \gamma$ ), and thus how it affects the price of inheritance relative to present consumption. 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 blue line  $\tau_I + \tau_c \gamma$ ). The cost of original owner consumption (the dot-dashed line  $\tau_c \gamma$ ) does not change with the change in step-up policy. 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 tax rates in place in Norway from 1994 – 2013.

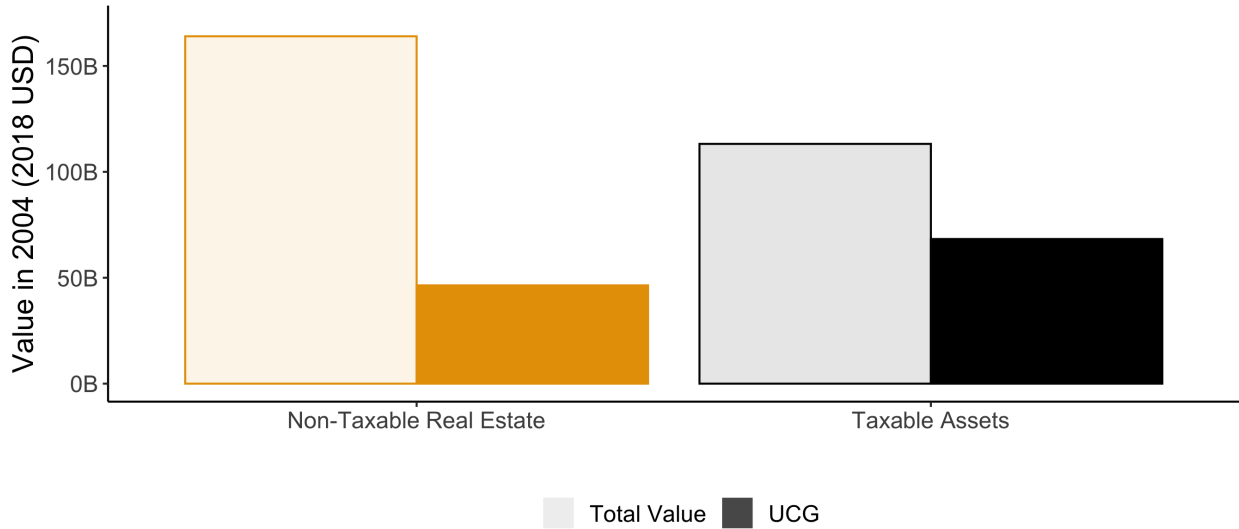
Figure 3: Range of Per-Dollar Inheritance Costs, by Year & Asset Class



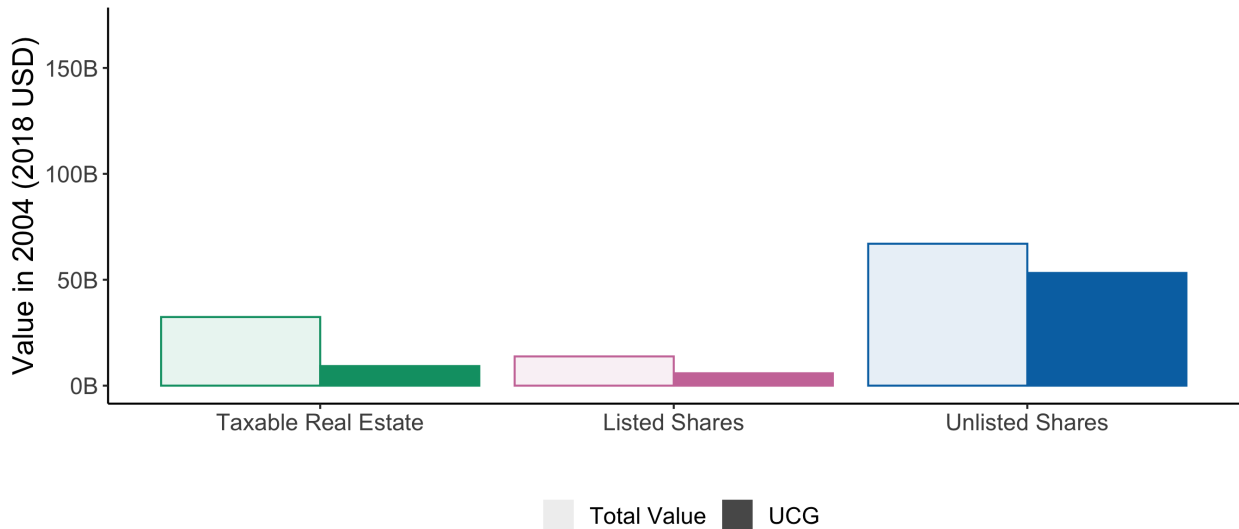
*Note:* This figure depicts the range of per-dollar cost of inheritance  $c_I = \tau_I + \iota \tau_c \gamma$  for assets of a given class (stock or non-stock) in a given year. Prior to 2006, Norway had a stepped-up basis regime ( $\iota = 0$ ), so all assets had an inheritance cost equal to the statutory 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 gain in a carryover basis regime have an effective tax rate equal to the sum of the capital gains and inheritance tax rates.

Figure 4: Total Wealth and Unrealized Capital Gain, by Asset Type

(a) *Non-Taxable Real Estate and Taxable Assets*

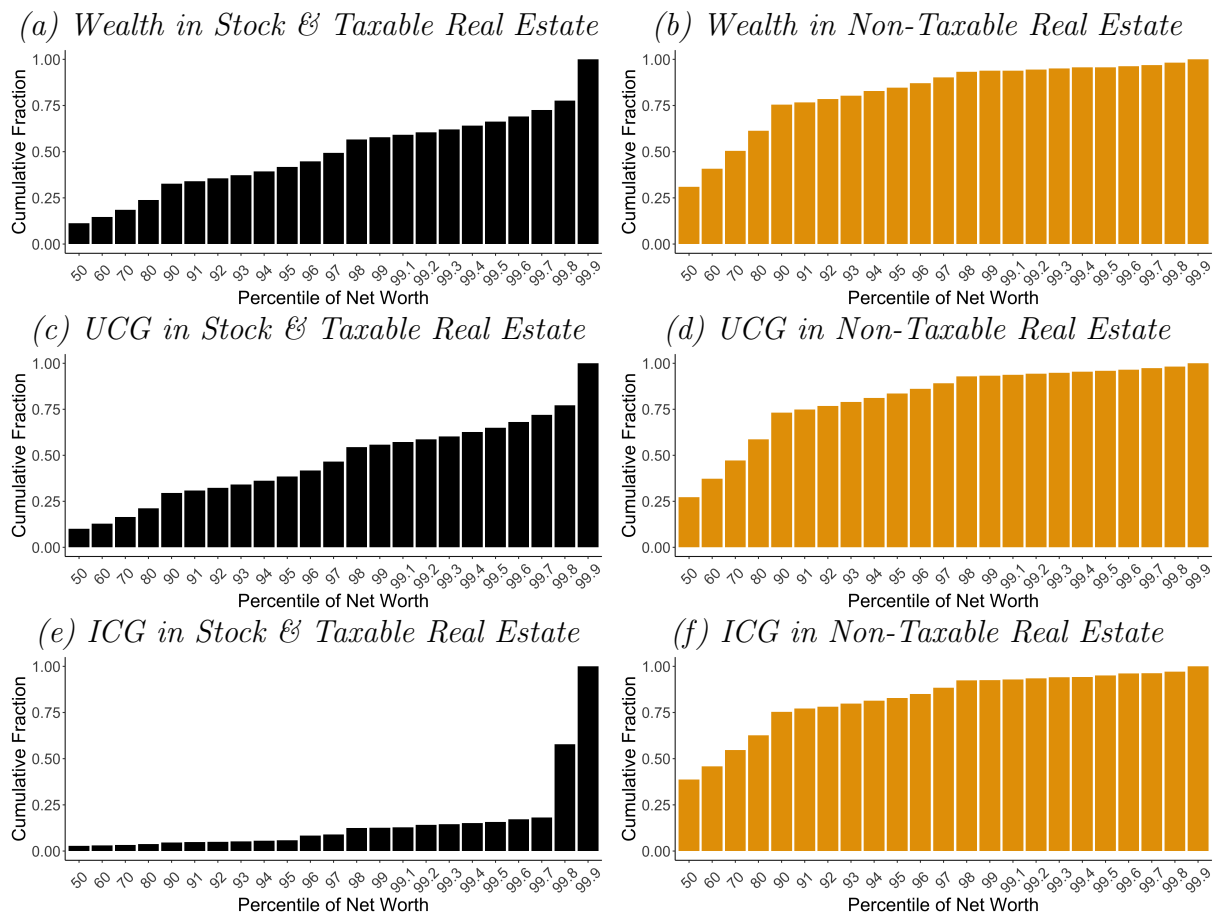


(b) *Taxable Assets by Type*



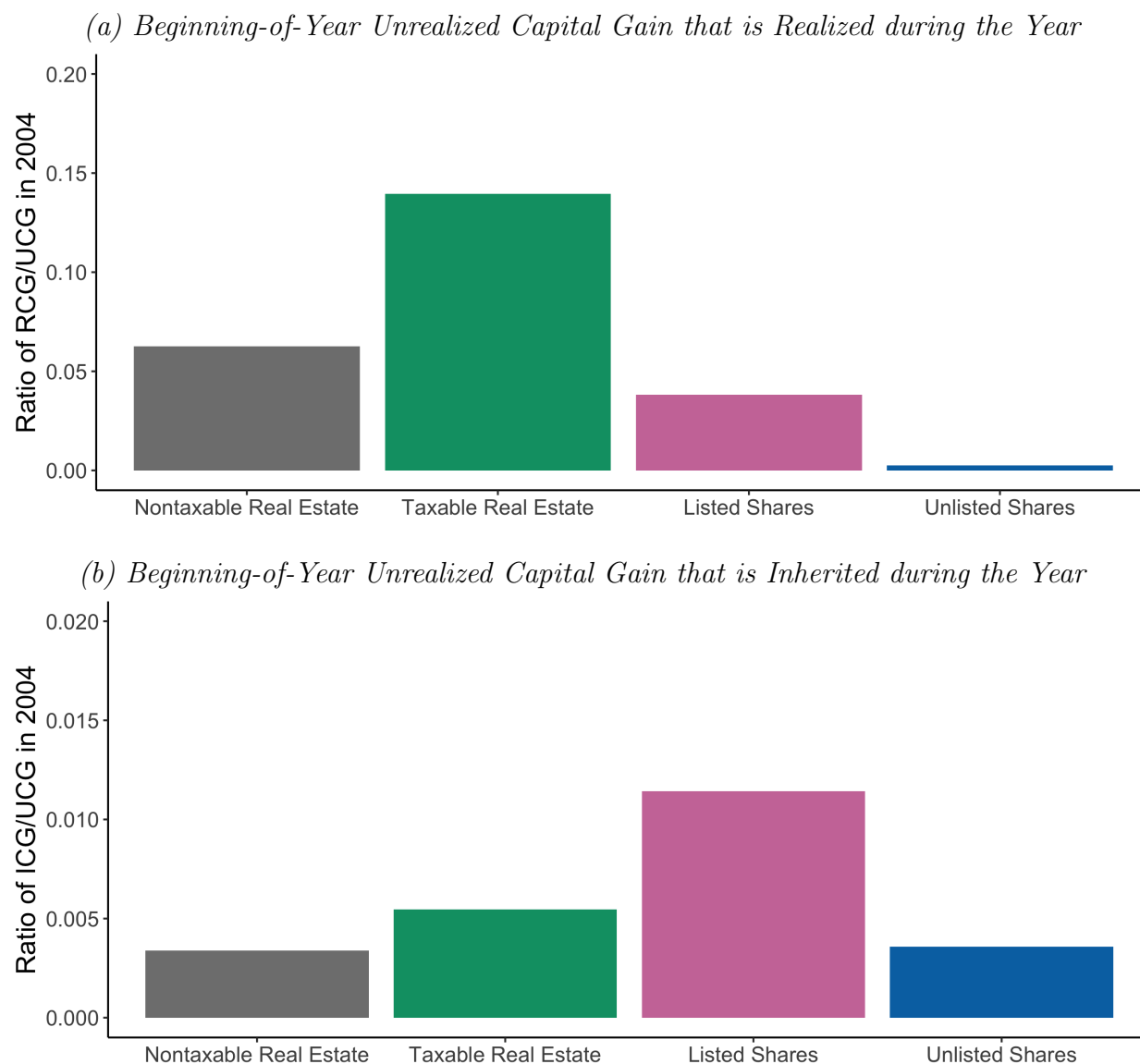
*Note:* This figure displays the total value and amount of aggregate unrealized capital gain in various asset types in 2005. Panel (a) displays these values for Non-Taxable Real Estate and for all Taxable Assets as a combined category. Panel (b) breaks out taxable assets into its three component categories: Taxable Real Estate, Listed Shares, and Unlisted Shares. The lightly shaded bar on each graph represents the total value in the asset category. The darkly shaded bar for each category represents the aggregate amount of unrealized capital gains in the asset category. Unrealized capital gains are a large fraction of asset value, especially in unlisted shares.

Figure 5: Distribution of Wealth, Unrealized Capital Gain and Inherited Capital Gain in Taxable Assets & Non-Taxable Real Estate, 2004



*Note:* This figure displays the distribution of wealth, unrealized capital gains and inherited capital gain during 2004 with respect to households' percentile of net worth. Panels (a), (c) and (e) display these distributions for stock or taxable real estate. Panels (b), (d) and (f) show corresponding figures for the distribution of non-taxable real estate. Distributions of taxable asset wealth and capital gain are concentrated at the very top of the wealth distribution. In contrast, Non-taxable real estate (the largest category of which is primary residences) are much more evenly distributed throughout the wealth distribution.

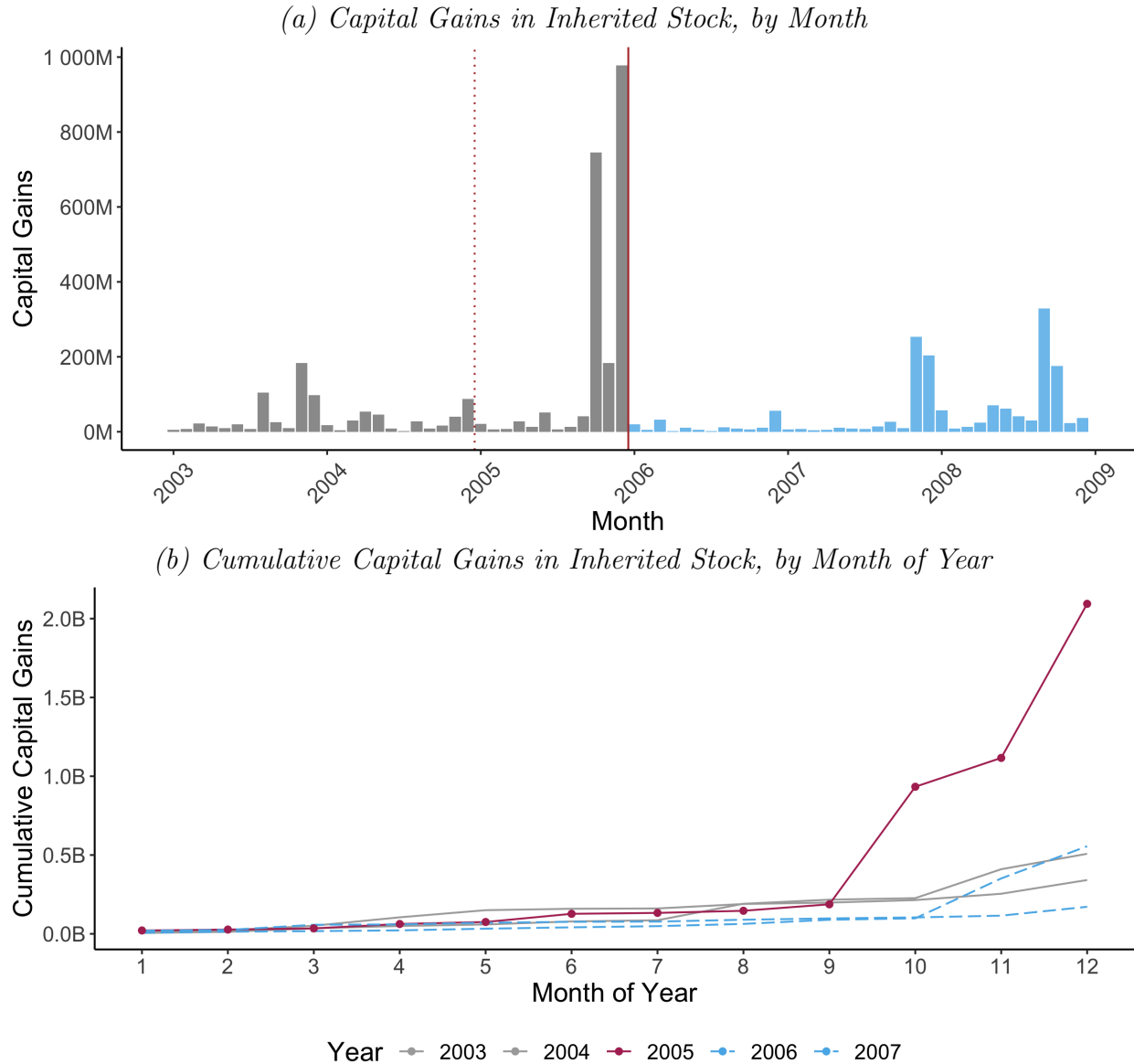
Figure 6: Fraction of Unrealized Capital Gain Realized or Inherited in 2004, by Asset Type



*Note:* This figure displays the ratio of capital gains that are realized (Panel a) or inherited (Panel b) during 2004 with respect to the stock of unrealized capital gains at the beginning of 2004. Of taxable asset types, a larger fraction of unrealized capital gains in Taxable Real Estate is realized during the year, whereas a much larger fraction of Listed Shares are transferred in inheritance.

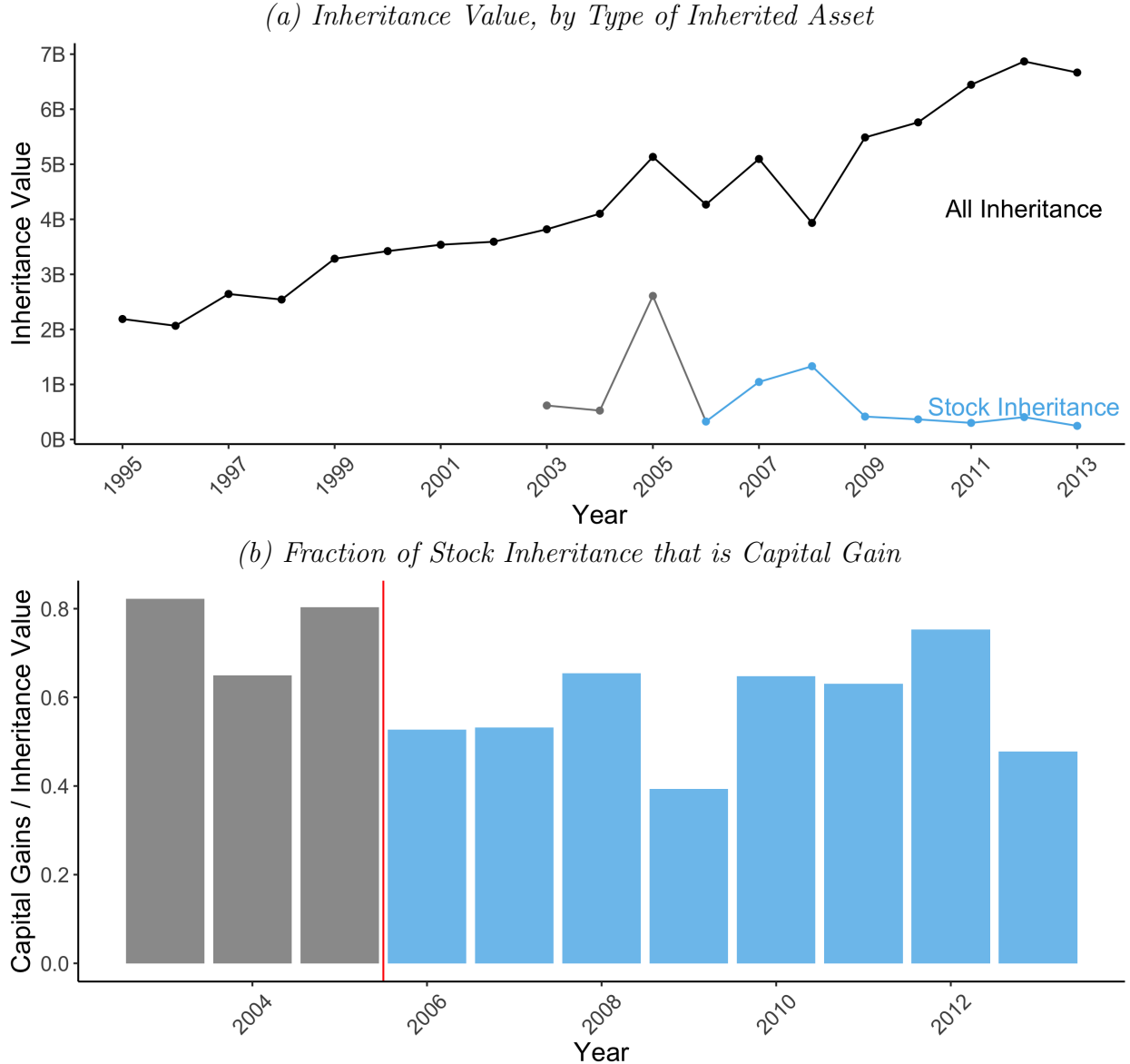


Figure 7: Anticipatory Inheritance Transfers in Late 2005



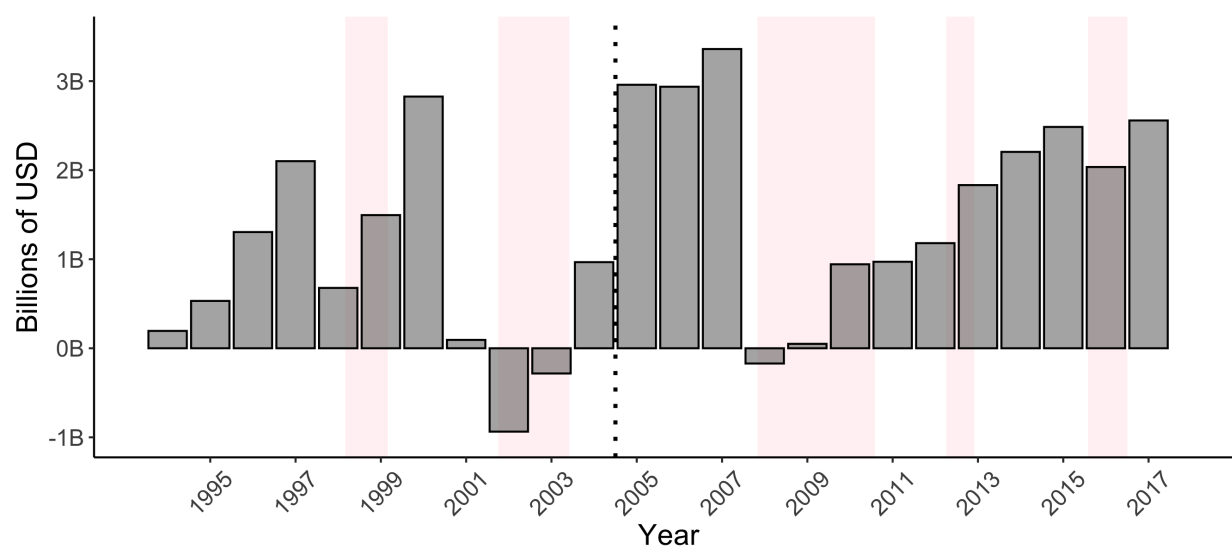
*Note:* This figure demonstrates the anticipatory transfers that occurred in late 2005, which were triggered by the announcement that step-up would be removed for stock on January 1, 2006. Transfers made prior to that date would still be subject to stepped-up basis treatment. Panel (a) shows that the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

Figure 8: Inheritance Trends Following the Removal of Step-Up for Stock



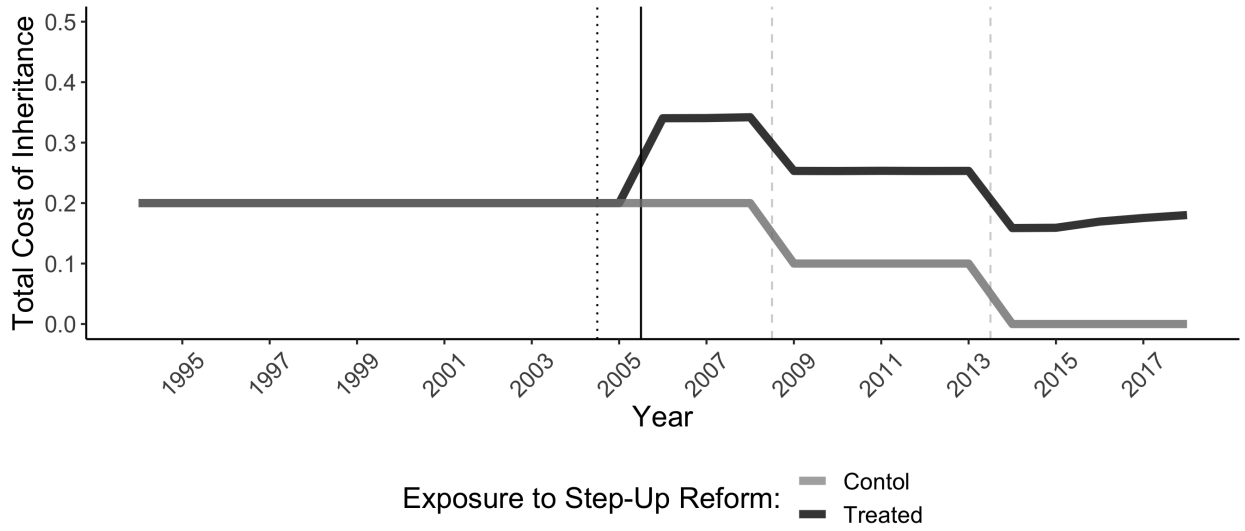
*Note:* Panel (a) shows that the value of all inheritance (i.e., of cash or of any other asset) is growing over time, from around \$2.19 billion in 1995 to around \$6.67 billion in 2013, the last year prior to the abolition of the inheritance tax. The value of stock transferred in inheritance, on the other hand, does not show any 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.

Figure 9: Aggregate Net Capital Gains Realizations, 1994-2018



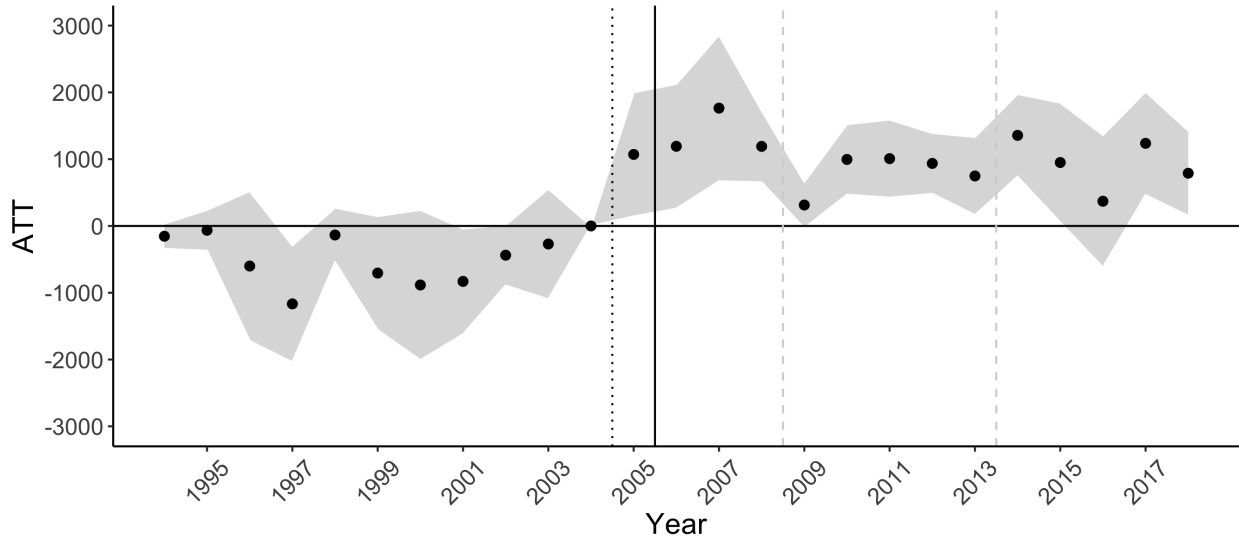
*Note:* This figure depicts the total amount of net capital gain (i.e., capital gain - capital loss) realized in Norway from 1994 to 2018, in terms of 2018 USD. Pink bars denote recessionary periods, as classified by the OECD. The dotted black line indicates the announcement of the removal of step-up for stock in 2005. Net capital gains realizations more than 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 10: Average Per-Dollar Inheritance Costs ( $c_I$ ), for Treated and Control Group



*Note:* This figure depicts the average of our measure of the “total cost of inheritance”, defined as  $c_I = \tau_I + \iota_t \tau_c \gamma$  in Section 5.2, for the treatment and comparison groups in our analysis of the removal of step-up for stock. 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 11: Average Increase in Realizations for All Treated Portfolios (Event Study)



*Note:* This figure shows the average response, among all treated individuals, to the removal of stepped-up basis for inherited stock. Treated individuals are defined as those with any positive amount of unrealized capital gain in their stock portfolio at the beginning of 2005. The control group is individuals with zero capital gain, or net capital losses, in their stock portfolio at the beginning of 2005. The y-axes present the level of the estimates 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. 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.

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

*(a) Asset Value & Unrealized Capital Gain*

| Asset Type                            | Total Value | UCG   | UCG/Value |
|---------------------------------------|-------------|-------|-----------|
| Taxable Assets including Mutual Funds | 123.4       | 78.48 | 0.64      |
| Mutual Funds                          | 10.2        | -     | -         |
| Stock & Taxable Real Estate           | 113.2       | 68.28 | 0.6       |
| Taxable Real Estate                   | 32.4        | 9.24  | 0.29      |
| Listed Shares                         | 13.8        | 5.84  | 0.42      |
| Unlisted Shares                       | 67          | 53.2  | 0.79      |
| Nontaxable Real Estate                | 164         | 46.4  | 0.28      |

*(b) Realizations & Realized Capital Gain*

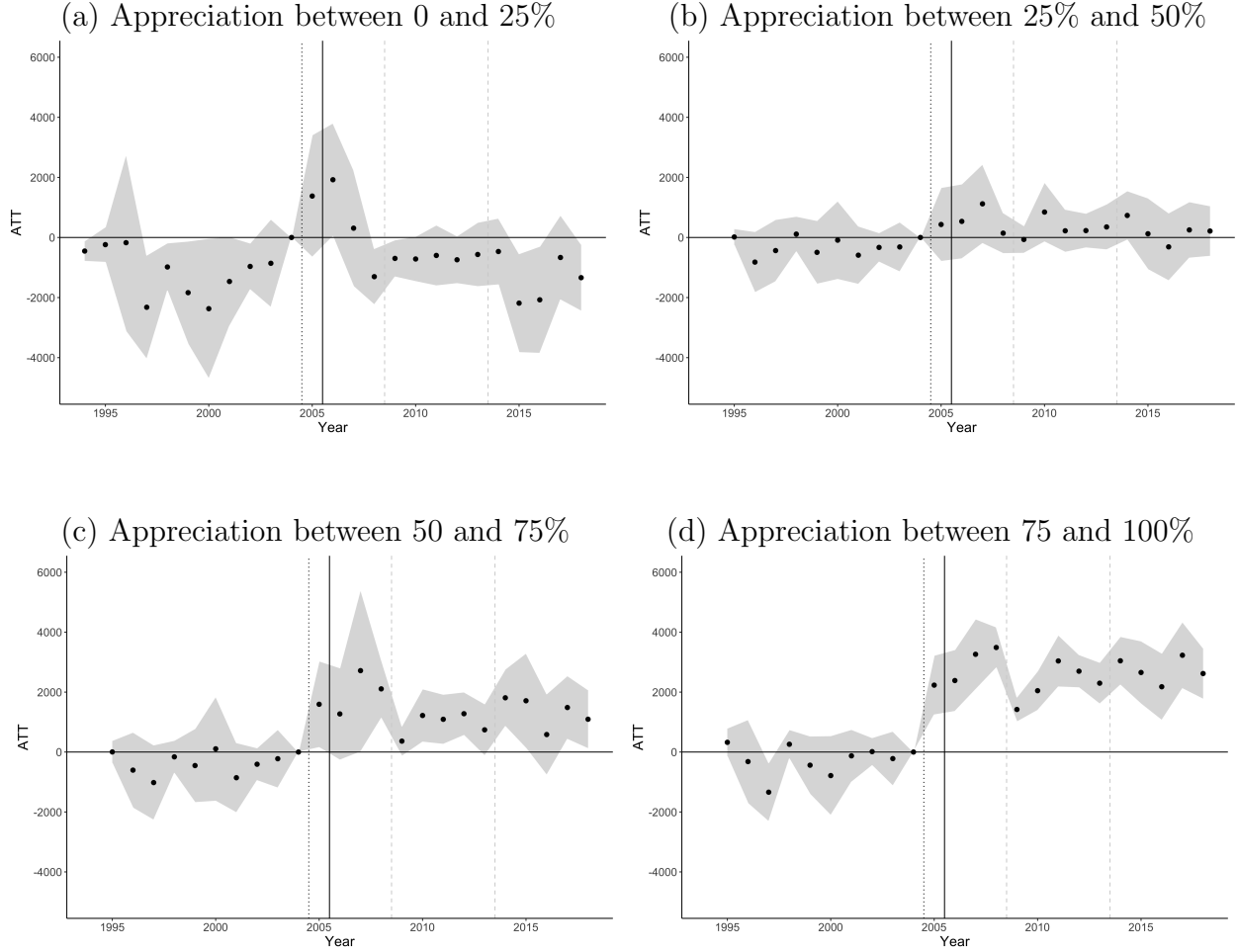
| Asset Type                  | Amount Realized | RCG  | RCG/Amount Realized |
|-----------------------------|-----------------|------|---------------------|
| Stock & Taxable Real Estate | 20.42           | 1.65 | 0.08                |
| Taxable Real Estate         | 2.31            | 1.29 | 0.56                |
| Listed Shares               | 16.2            | 0.22 | 0.01                |
| Unlisted Shares             | 1.91            | 0.13 | 0.07                |
| Nontaxable Real Estate      | 6.29            | 2.9  | 0.46                |

*(c) Inheritances & Inherited Capital Gain*

| Asset Type                  | Amount Inherited | ICG  | ICG/Amount Inherited |
|-----------------------------|------------------|------|----------------------|
| Stock & Taxable Real Estate | 0.54             | 0.31 | 0.57                 |
| Taxable Real Estate         | 0.17             | 0.05 | 0.3                  |
| Listed Shares               | 0.1              | 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 gain in certain asset categories in Norway in 2004. Panel (a) presents the total amount of wealth (“Total Value”) in each category, along with the amount of Unrealized Capital Gain (“UCG”). Panel (b) displays the value of these assets that are realized in 2004 (“Amount Realized”), along with the Realized Capital Gain (“RCG”). Panel (c) displays the value of these assets that are inherited in 2004 (“Amount Inherited”), along with the Inherited Capital Gain (“ICG”).

Figure 12: Average 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 estimates 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 .25. Panel (b) shows the corresponding figure for individuals with 2005 stock holdings with  $\gamma$  between .25 and .5. Panel (c) is the corresponding figure for those with  $\gamma$  between .5 and .75. Panel (d) is the corresponding figure for those with  $\gamma$  between .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 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.

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***<br>(0.109) | 0.483***<br>(0.094) | 0.492***<br>(0.073) |
| <i>Covariates:</i>                                |                     |                     |                     |
| Indicator for any unlisted holdings               |                     | X                   | X                   |
| Decade Age Bin                                    |                     |                     | X                   |
| N   | 4,124,605           | 4,124,605           | 4,011,557           |
| <i>Implied Treatment Effects:</i>                 |                     |                     |                     |
| $\exp(\beta_1) - 1$                               | .59                 | .62                 | .64                 |
| ATT   | \$2,023             | \$2,163             | \$2,152             |
| Increased Tax Revenue (ATT $\times$ $N_{TREAT}$ ) | \$697.02 million    | \$745.23 million    | \$741.43 million    |

*Note:* This table shows our baseline difference-in-difference estimates, which estimate Equations 1 and 3 using Poisson Pseudo Maximum Likelihood. Individuals are included in these regressions if they owned stock directly 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 one if the individual is exposed to the removal of step-up (i.e., has positive appreciation in his/her portfolio at the beginning of 2005). The indicator “POST” equal one for years after 2004, and zero before then. The first row of the table presents the coefficient that is output from the Poisson regression. In order to interpret this coefficient (in terms of percent changes in the outcome variable) we need to exponentiate this 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 amount of increased tax revenue (relative to counterfactual) by multiplying the ATT by the number of individuals in the treatment group. Column (1) includes no covariates. Column (2) includes an indicator for whether a portfolio includes any unlisted stock (including holding companies). Column (3) includes indicators for an individual’s 10-year age bin. All covariates are fully saturated indicators.



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# Appendix

## A Model Proofs

**Proof of Proposition 1** (Step-Up Depresses Realizations) *As long as the income effect is not too large, 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 simply to increase  $p$ , the relative price of bequests. 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.

*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:  $e_{cb}^M = e_{cb}^H - s_c\eta_c$ . We know  $s_c \geq 0$  and, if realizations are a normal good, then  $\eta_c > 0$ . Therefore  $e_{cb}^M$  is positive as long as  $s_c\eta_c$  is not too large.  $\square$

## B Valuing Unlisted Firms in the Norwegian Data

### B.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>32</sup>. We regress a ratio of the listed firm’s equity value (i.e., market price times common shares outstanding) relative to the factor ( $X \in \{sale, asset, ebitda\}$ ) 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.

## C Appendix Tables & Figures

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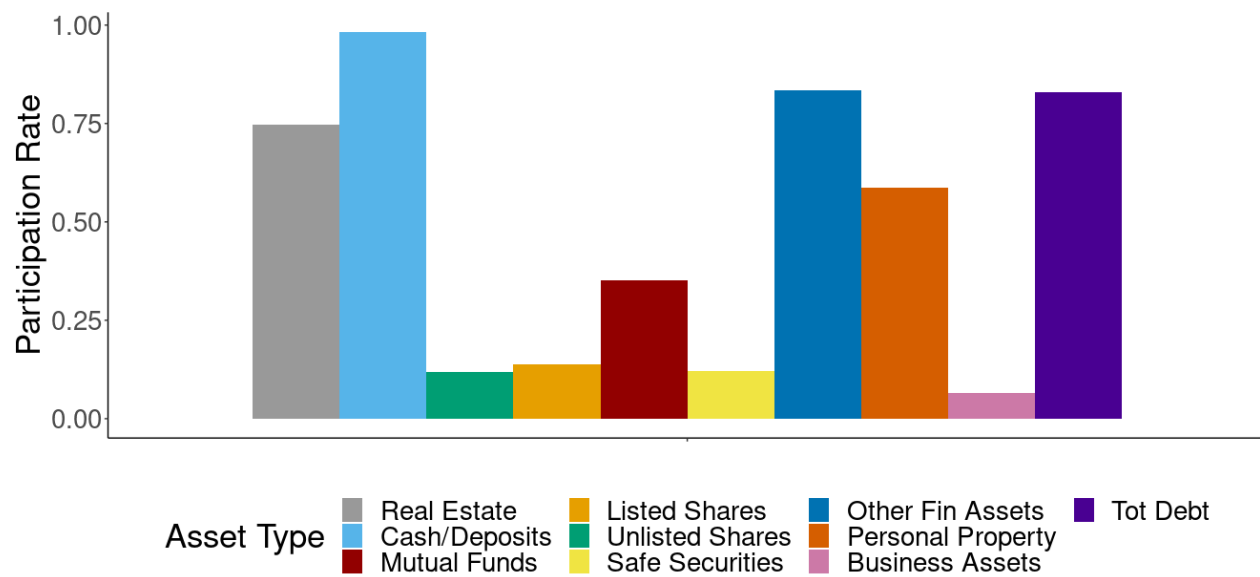
<sup>32</sup>Norwegian firms alone do not have sufficient industry variation to estimate multipliers for all the industries of unlisted firms.

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             |

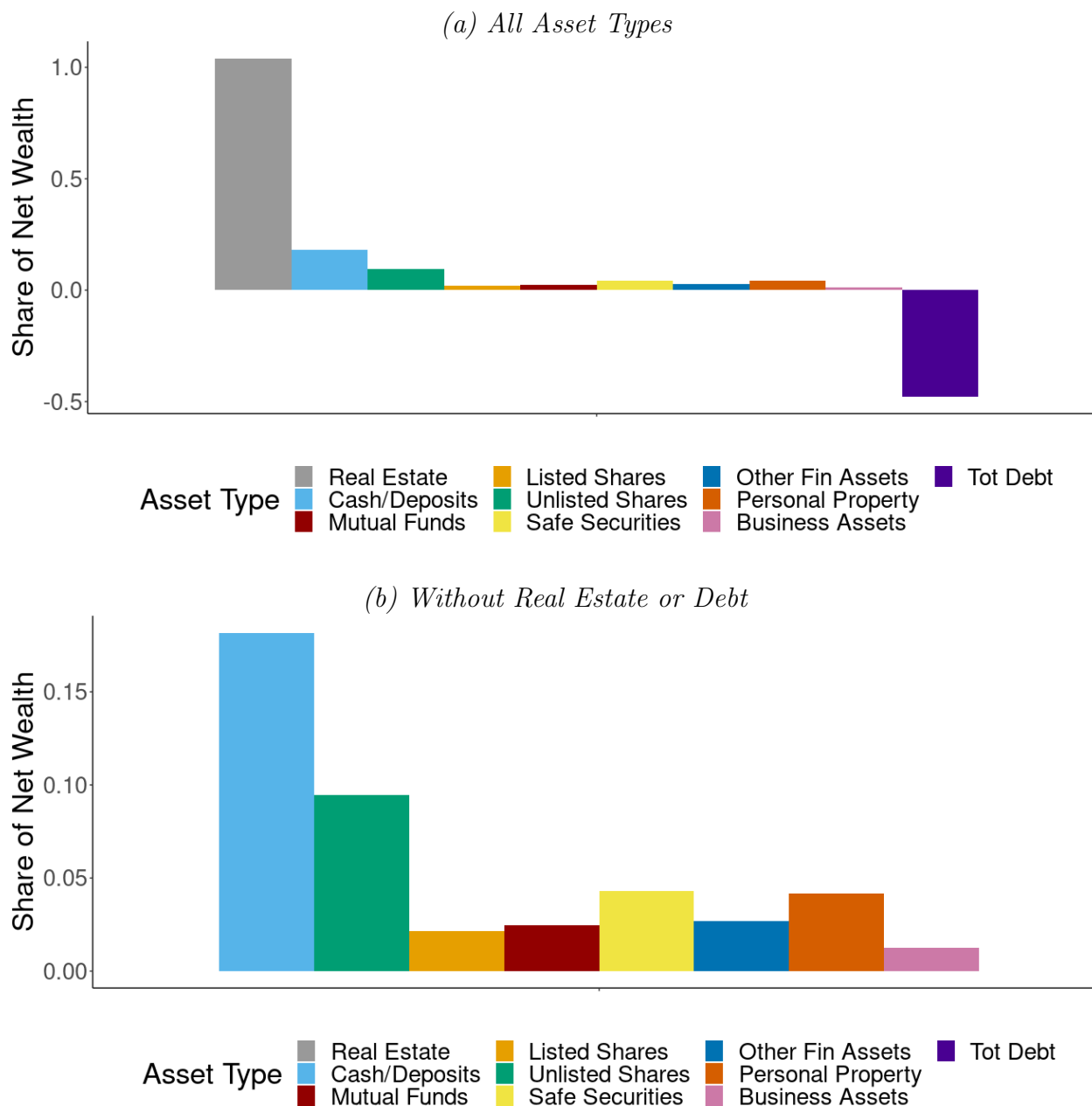
*Note:* This table depicts the Norwegian inheritance tax scheme from 1985 until the inheritance tax was abolished in 2014. Inheritance tax was levied without distinction between *inter vivos* gifts and bequests at the time of death. The rate structure depended on the cumulative amount of the gift/inheritance 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%.

Figure A1: Ownership Rates by Asset Category in 2004



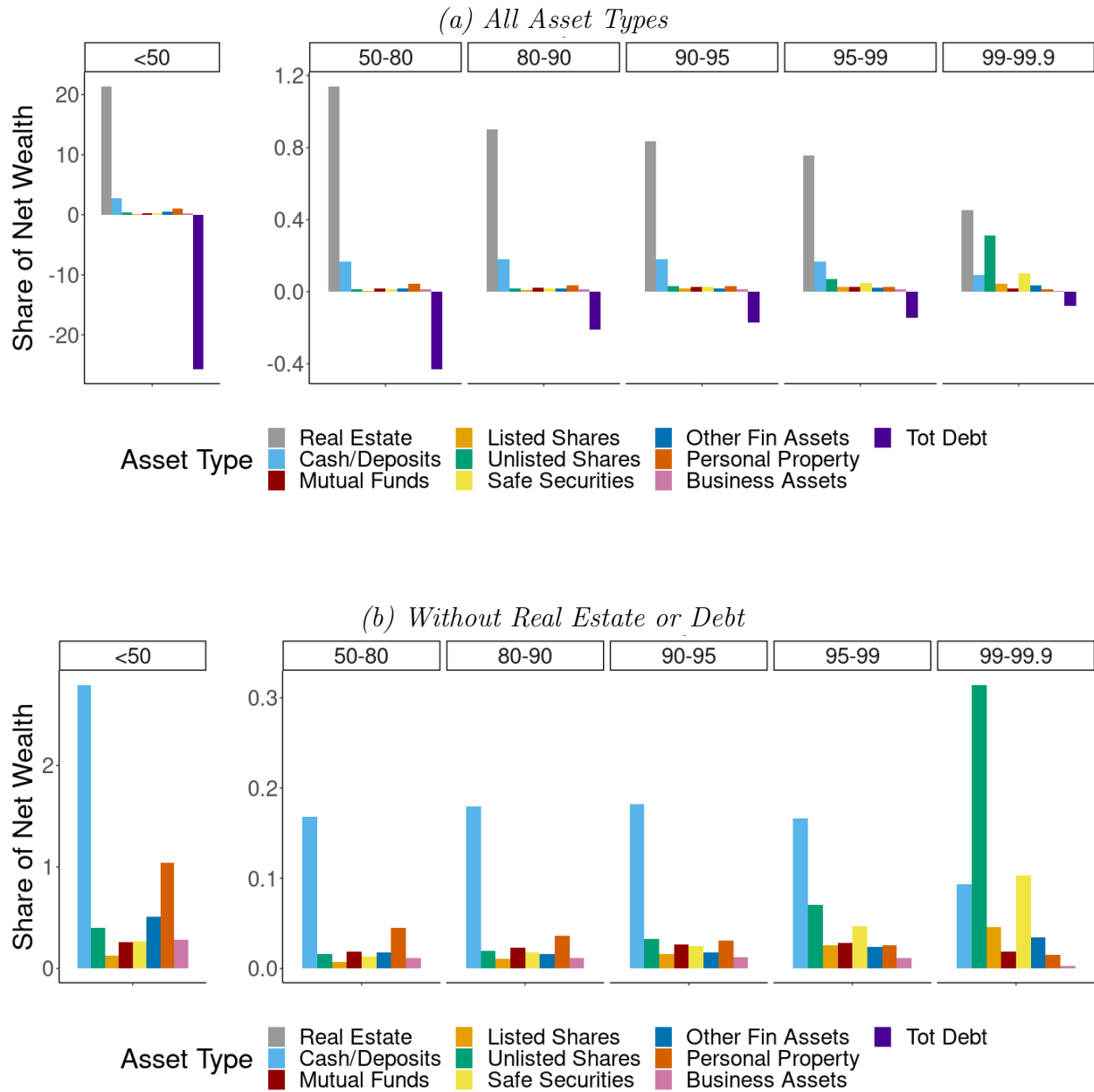
*Note:* This figure depicts the percentage of Norwegian households that hold each asset type at the end of 2004. 14% of Norwegian households owned listed stock and 12% of Norwegian households owned unlisted stock in 2004.

Figure A2: 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 A3: 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).