The Role of Capital Income for Top Income Shares in Germany*

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Abstract

A large literature has documented top income share series based on income tax statistics using the common methodology established by Piketty (2001, 2003). The widespread disappearance of capital income from the income tax base poses a major challenge to the comparability of these series both over time and between countries. In Germany, capital income was gradually excluded from the income tax base between 2001 and 2009. Using a rich data set containing all income taxpayers' files we provide a homogeneous top income share series including full capital incomes from 2001 to 2010. Missing capital income since 2009 is extrapolated using a composite measure of stock dividends and interest income tax flows. We find that up to the top percentile the drop displayed in the German raw-data series in 2009 is largely attributable to the disappearance of capital income from the income tax base and not to the crisis. However, the very top of the income distribution is disproportionately hit by the crisis.

JEL Classification: D31; H2

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1 Introduction

Personal income tax data have proven to be an invaluable data source for gauging the long-run development of income concentration. Many countries introduced a modern income tax more than 100 years ago, whose records allow the construction of long-run series on top income shares. These series can be used to analyze the dynamics and driving forces of income concentration over time and across countries. Over the past decades, income concentration increased in many industrialized countries. The increase began earlier and is higher in English-speaking countries like the UK and the US than in continental European countries like Germany and France.

The World Top Incomes Database (WTID) contains long-run top income share series for 26 countries using a common methodology and a common data base, i.e., personal income tax statistics (Alvaredo et al., 2014). Many of the results have been published in two collective volumes (Atkinson and Piketty, 2007, 2010, see Roine and Waldenström, 2015 for a recent review). However, income tax data suffer from the drawback that tax reforms change the definition of taxable income and, hence, the share of income documented in tax data. Much effort has been made to harmonize top income shares over time (see, e. g., Atkinson, 2007).

In particular, the disappearance of capital income from the income tax base in many countries poses a major challenge to the comparability of top income share series both over time and between countries.[1] Capital income such as interest income, dividends or returns on pension funds is now often taxed separately from the personal income tax (PIT) by flat rates or is fully tax-exempt. In Germany, capital income had been gradually excluded from the PIT tax base since 2001. Since 2009, it has not been recorded in PIT data at all, due to the introduction of a final withholding tax on capital income.[2] Since capital income is largely concentrated among

[1]Nordic countries introduced dual income taxation in the 1990s, other European countries such as Austria, Switzerland and the Netherlands followed.

[2]The schedule dualization does not necessarily reduce the data quality on top incomes: e.g., in the Nordic countries and the Netherlands, the gross income information is still available in tax statistics or in the microdata (Aaberge and Atkinson, 2010, Atkinson and Søgaard, 2013, Roine and Waldenström, 2010, Salverda, 2013). In Austria, however, capital income is also not reported in PIT data (Altzinger et al., 2011, 2012), being one reason for Austria not to be included in the WTID.

top income taxpayers, German top income shares assessed on PIT statistics most likely underestimate income concentration at the top after 2001 and even more after 2009.

In Germany, the exclusion of capital income from the income tax base coincides with the highest output drop of the post-war era: German GDP decreased by 5.1% in 2009. Consequently, it is unclear whether the drop in top income shares is due to the crisis or due to changes in the tax base definition. Following the great recession, top income shares fell in most countries in 2008–2009, indicating that the first-round effect of the crisis disproportionately hit the top of the income distribution.[3] The German series also display a drop, but it is unclear whether this is due to the crisis or due to the exclusion of capital income from the PIT tax base.

Our main goal is to provide a harmonized series of top income shares between 2001 and 2010 that includes full capital incomes. We first estimate German top income series from 2001 to 2010 using the most recently available income tax data.[4] We then harmonize the PIT tax base definition so as to comprehensively include capital incomes exploiting a rich dataset that includes individual tax returns of all taxpayers. Until 2008, this harmonized series can be directly simulated using income tax microdata, which allows us to vary the fraction of capital income included in the overall taxable income. We simulate three top income share series, each applying one of the three taxable income definitions prevailing between 2001 and 2010. We thereby document the sensitivity of German top income shares to the gradual disappearance of capital incomes from the income tax base. From 2009 onwards, we need to extrapolate capital income. In order to extend our harmonized series including full capital incomes to the years after 2008, we develop an approach how to add missing capital income to the essentially non-capital income share series assessed on the tabulated income tax statistics since 2009. We check several proxies

[3]However, these drops do not necessarily change the evolution of income concentration in the long run: Piketty and Saez (2013) discuss the recession's impact on top income shares and conclude that long-run inequality is determined rather by regulatory changes such as tax reforms than by economic downturns. Long-run analyses of top income shares have come to similar conclusions when analyzing earlier recessions. Theoretical analyses provide strong arguments for the power of institutions such as tax progression (Piketty, 2003, 2007, Piketty and Saez, 2003, 2007).

[4]In Germany, annual income tax statistics are available with a four year lag. Statistics from 2011 will most likely be available in fall 2015.

for capital income, such as tax flow aggregates, national accounts, stock dividends and survey data. The harmonized series updates and extends the existing series with capital gains provided by Dell (2007, 2011) from 2001 to 2010 and the series without capital gains provided by Dell (2007) from 2001 up to 2008. Furthermore, the updated series allows us to disentangle the impact of the recession from the impact of the tax reform that excluded capital income from the PIT in Germany.

Our main findings are as follows. First, excluding taxable capital gains reduces top income shares only by little. Second, we find that the drop of top income shares in the crisis year 2009 is largely attributable to the disappearance of capital income from the underlying data. The recession seems to have had a minor impact on the top decile of the German income distribution, but a substantial impact on the very top, i.e., the top 0.1% and top 0.01%. Third, a composite measure of stock dividends and interest income tax flows turns out to be a suitable proxy for capital income missing in the tax data since 2009. Fourth, including imputed capital income increases top income shares by between 8% for the top decile and almost 28% for the top 0.01% in 2009.

The paper is organized as follows: Section 2 provides an overview over the data used and the methodology employed to arrive at top income share estimates. Section 3 presents the trends in top income shares with and without capital gains when using the raw income tax data. In section 4, we then turn to check the sensitivity of the top income series to legislative changes in the definition of capital income by simulating three homogeneous series. In section 5, we briefly describe data sources for potential proxies for missing capital income and present top income series including capital income up to 2010. Section 6 concludes.

2 Data and Methodology

In the following, we provide a brief description of both data and methodology for the estimation of top income shares. More details on the employed data can be found in Appendix C. For the estimation of top income shares we use both tabulated income tax statistics available annually since 2001 for the years 2001–10 (PIT statistics) and

a rich data set that includes the tax returns of all income taxpayers available for the years 2001–08 (PIT microdata). Both data sources are provided by the German federal statistical office (Destatis).

PIT statistics give the number of tax units and reported income by income bracket and provide the basis for our top income share series including capital gains. These data were also used by Dell (2011) for the last update of the German series in the WTID.[5] Reported income is taxable income after income source specific deductions, but before personal allowances which we will refer to as gross taxable income (GTI) (*Gesamtbetrag der Einkünfte*).

Using PIT statistics, we apply the Pareto interpolation method commonly used in the top income share literature since the seminal contribution of Piketty (2001, 2003) to obtain thresholds and average incomes of top income groups for each year. Top income shares result from dividing the cumulative income above the income threshold of a fractile by an external total income. An alternative approach suggested by Atkinson (2005) places upper and lower bounds for the estimated shares and refrains from assuming a form of distribution. Since the true density function of income is not known, we can assign tax units arbitrarily to particular incomes subject to the two constraints that the number of people in the interval and their mean income remain constant. We display shares, thresholds and average incomes based on this so-called mean-split histogram in the Appendix Tables B.2 and B.5.

As there are numerous tax exemptions, a presumably high level of tax avoidance and tax units who do not file an income tax return, tax statistics neither comprise the whole population, nor do they include total income. In the German PIT, tax units are either married couples or bachelors. As population total, we therefore use the sum of married couples and bachelors published in population statistics of Destatis. Following Dell (2007) we define adults as those aged 20 and above. This population total is reported in Table A.1 from 1998 to 2010. We also

[5]Annual tax statistics do not include tax units who only paid payroll tax and did not file an income tax return. This is, however, of limited importance for the estimation of top income shares. As long as a tax unit receives other income than wages above certain thresholds, filing an income tax return is mandatory. In addition, even when wages are the only income source, filing a tax return is favorable for most high-income tax units. E.g., even though 31.9% of all income taxpayers do not file a return paying only payroll tax in 2007, this share drops to 3.7% in the top decile.

follow Dell (2007) for the construction of the income total and use 90% of total primary household income less employers' social security contributions as published in national accounts. Thereby, we ensure the comparability of Dell's and our series over time. Dell (2007) argues that the bottom 30% not recorded in the tax statistics earns less than 5% of gross income such that the 10%-20% missing in the tax records from the total primary household income is more likely to be non-taxable or hidden income of the tax filers.[6] The income total construction is described in Appendix A and reported in Table A.2.

PIT statistics suffer two drawbacks of substantial importance for our research question: First, taxable capital gains are not reported separately. Series excluding capital gains can thus not be derived. Second, PIT statistics only report the taxable income after income source specific deductions and are thus sensitive to changes in the definition of taxable income. This is of particular importance for the estimation of top income shares with respect to capital income: the share of capital income reported in German PIT statistics declined to zero as a result of two tax reforms in 2002 and 2009. We provide a detailed description of the reforms in Appendix D.

PIT microdata comprise the full sample of all income taxpayers' tax returns. For each taxpayer, we have information on capital income and capital gains. Until 2008, PIT microdata include information on both total dividends and interest income before source-specific deductions. We can thus derive homogeneous top income series based on varying definitions of capital income and, thereby, check the sensitivity of top income shares to the gradual disappearance of capital income from the PIT tax base. Furthermore, we can compute shares including and excluding capital gains. In PIT microdata, we can directly sort taxpayers by fractiles, so we do not need an interpolation method and can chose the sorting in accordance with the income definition applied. Top income shares are derived using the same population and income totals as the interpolated shares from PIT statistics described above. For top income shares excluding capital gains, we substract the sum of taxable capital gains observed in PIT microdata from the income control described

[6]Results from a more comprehensive database seem to support this assumption: Using an integrated dataset containing tax microdata and SOEP surveydata (ITR-SOEP), Bach et al. (2009, 2013) find that gross income less transfers and capital gains does not account for more than 85% of national accounts' total household income.

above.[7]

Since 2009 we completely lack information on the capital income total and its distribution among top income individuals.[8] We therefore have to impute capital income by fractile based on external proxies for household capital income. Any suitable proxy would have to correlate strongly with capital income reported in PIT microdata. For the years 2001 to 2008, we can test the correlation of external data sources with capital income in the PIT. Five indicators might provide proxies for capital income on the household level: Household sector capital income from national accounts, tax flow statistics on dividends and interest income, stock market indices, GDP, and capital income observed in German survey data. We compute correlations between the dividend and interest income totals in PIT microdata by fractile with these external sources. Each of these sources bears particular advantages and disadvantages on which we elaborate in section 5. Appendix C provides additional information on the employed data sources.

3 Top Income Shares, 2001–2010

Over the last two decades income concentration at the top increased substantially in Germany. Figure 1 reports series both including and excluding capital gains since World War II for the top 10%, 5%, and 1%. After a quite stable development since the 1960s, the year 1995 seems to mark a turning point.[9] The share of the richest decile increased from 32% in 1995 to 38% in 2010 by almost 20%. The share of the richest percentile increased from 9% in 1995 to 12% 2010 by almost 30%. Despite a short period of modest decrease in the beginning of the 2000s, income concentration of the top 10% and top 5% never returned to the low levels of the preceding three decades. Contrasting the series with and without capital gains

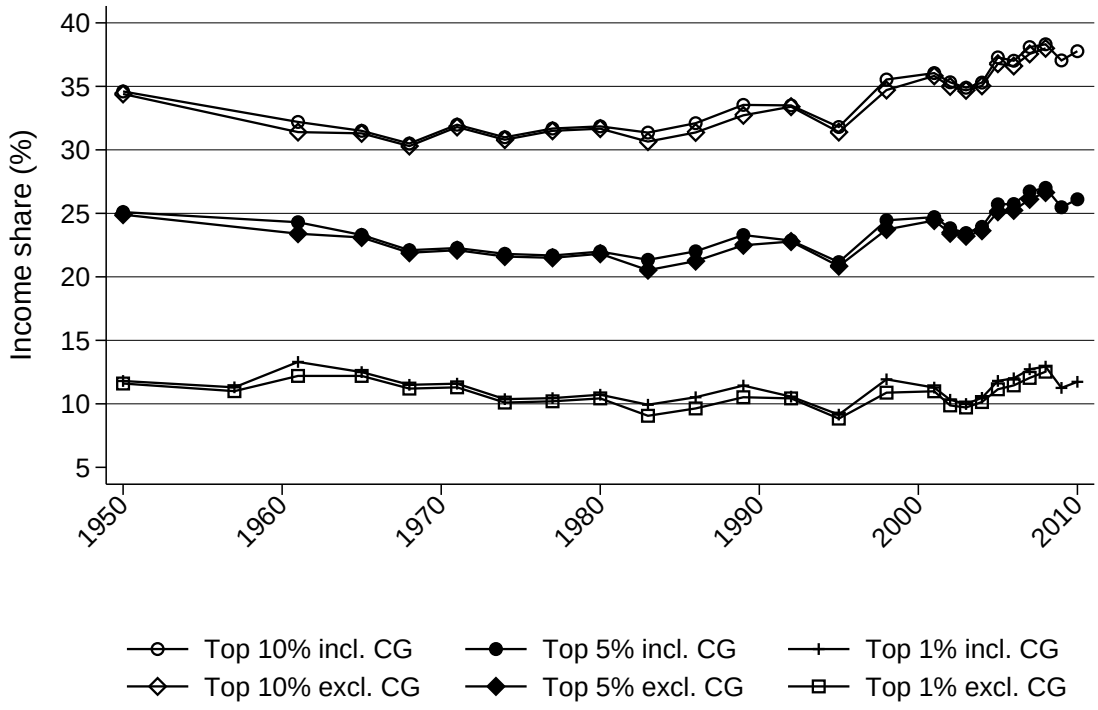
[7]The income total, however, does not include capital gains as there does not exist an aggregate statistics on them. Substracting capital gains from the income total is hence a pragmatic approach that aims at preventing shares excluding capital gains to be mechanically lower than shares including capital gains.

[8]One should note that income from renting and leasing is not part of the German tax law definition of capital income and, consequently, is still observed in the data.

[9]See Dell (2007) for an extensive discussion of the long-run development of top income shares in Germany from 1891 to 1998.

reveals that realized taxable capital gains are of minor importance up to the richest percentile. One should keep in mind, however, that most realized capital gains have never been documented in German PIT data: they were largely not taxable in Germany before 2009 and thus not part of the underlying income concept of the top income share series.[10] Since 2009 capital gains from stock shares have been subject to the withholding tax and can thus not be observed in income tax data, either.

Figure 1: Top income shares in Germany (with and without capital gains), 1950-2010



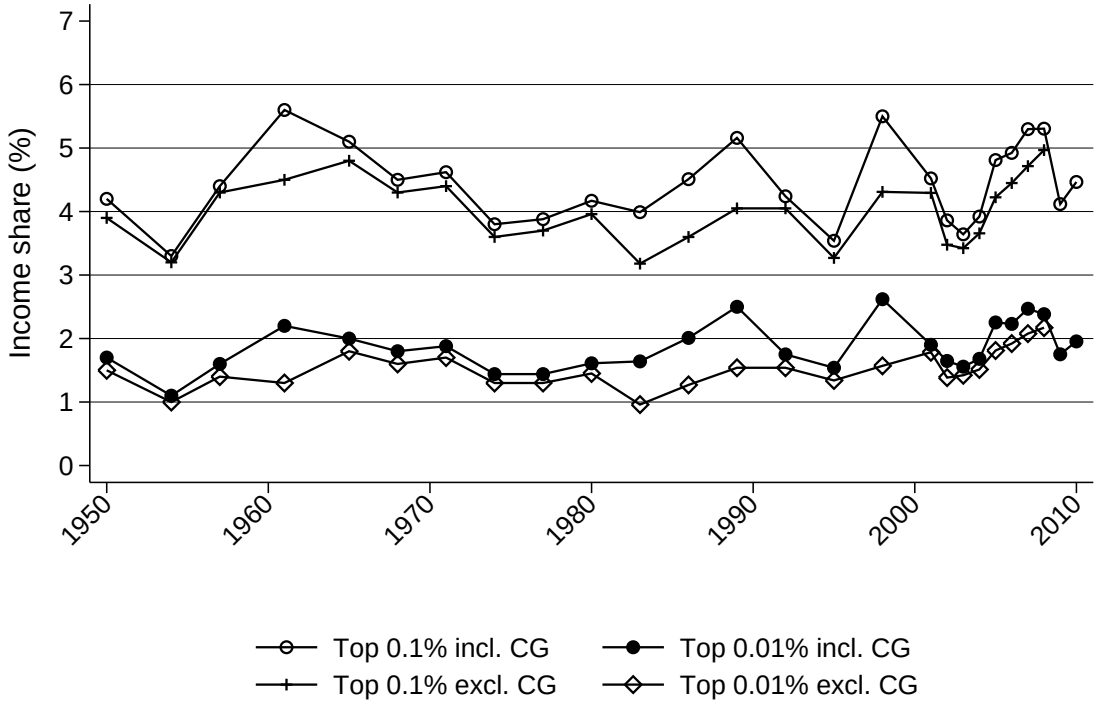
Notes: Ranking including and excluding capital gains, respectively. Fractile thresholds are obtained using the Pareto interpolation method.
Source: PIT statistics and PIT microdata, WTID for 1950-1998 and own calculations since 2001.

Figure 2 turns to the development of the very rich, i.e., the top 0.1% and top 0.01%. Income shares accruing to these groups did return to levels of 1995 in the

[10]E.g., capital gains from stock shares and real estate were tax-exempt to a large part. See Appendix D.2 for details on German capital gains taxation and changes therein over our data period. In general, the German share of capital gains in total taxable income is low compared to other countries such as Sweden or the US (Roine and Waldenström, 2012). The impact of capital gains is somewhat higher if they are defined before income source-specific deductions (Bach et al., 2013). Even though the taxable share of capital gains is low in Germany, their importance for top incomes can be high: Roine and Waldenström (2012) show that in Sweden, capital gains are a substantial and reoccuring addition to top incomes and not just a transitory component.

early 2000s, but steeply and steadily increased ever since. Between 2003 and 2008, the share of the top 0.1% increased from 3.6% to 5.3% by more than 40%. The exclusion of capital gains has a larger effect for the very top in both stabilizing the series over time and reducing their income share. However, excluding capital gains enforces the trend of increasing income concentration.

Figure 2: Top income shares in Germany (with and without capital gains), 1950-2010



Notes: Ranking including and excluding capital gains, respectively. Fractile thresholds are obtained using the Pareto interpolation method.
Source: PIT statistics and PIT microdata, WTID for 1950-1998 and own calculations since 2001.

There are two developments one should be aware of when interpreting the observed recent trends from 2001 to 2010 in Figures 1 and 2. First, several tax reforms are likely to have induced income timing. Second, changes in the definition of taxable income reduced top income shares mechanically.

Reforms in capital income taxation and changes in the top marginal PIT tax rate may have had an impact on capital income realization in 2001, 2008 and 2009: 2001 was the last year where corporation tax could be fully credited against PIT. Hence, 2001 was marked by an all-time high in dividend distribution which boosted

capital income in 2001 in comparison to the following years. Dividend income from closely held corporations in 2009 may have been preponed to 2008.[11] In turn, interest income may have been postponed to 2009, as the marginal top tax rate on interest income was reduced from 45% in the PIT to 25% in the final withholding tax in 2009.

The marginal top PIT tax rate changed frequently between 2001 and 2008: between 2000 and 2005, the top marginal tax rate was gradually reduced from 51% in 2000 to 48.5% in 2001, to 45% in 2004, and reached its low of 42% in 2005. As the gradual reduction up to 2005 had been anticipated since the year 2000, we expect some income shifting from the earlier years to 2005 and later years. If top incomes react more elastic to taxation than incomes at lower levels, this shifting may have increased top income shares. Hence, the tax reform might have contributed to the subsequent increase in top income shares between 2004 and 2008. However, top income shares continued to increase in 2007 and 2008, when the top marginal tax rate was raised to 45% again, suggesting that income timing is not the driving force behind the increase in top income shares.[12]

Apart from changes in reporting behavior, two reforms changed the definition of capital income, thereby mechanically reducing the observed income share accruing to the top where capital income is concentrated: In 2002, the share of dividends that was reported in PIT taxable income decreased by 62.5%. In 2009, dividend and interest income was completely excluded from the PIT tax base due to the introduction of a final withholding tax on capital income.

The reduced share of dividend income in GTI may explain some of the decrease in top income shares after 2001. In 2009, when capital income was entirely excluded

[11] In 2008, the tax rate on corporate gains distributed in the same year was exceptionally low due to the introduction of the final withholding tax on capital income in 2009. Therefore, some corporations was preponed dividend distribution. See Appendix D.3 for details on the withholding tax reform.

[12] The increase in the top tax rate only applied to incomes above 250,000 €. One could argue that income shifting to 2007 and 2008 is still plausible because of two other legislative changes regarding income from unincorporated businesses and dividend income: For unincorporated business income, the lower top tax rate persisted until 2007. In 2008, dividends may have been preponed, which might have overcompensated reactions to the increased top tax rate. (See footnote 11 above and Appendix D.3 for details.) However, our harmonized series show that top income shares excluding capital income only slightly decrease in 2008 (see scenario 3 in section 4 and Appendix Table B.8), indicating that the increase is unlikely to be driven by taxable income responses to tax reforms.

from the PIT, all fractiles experienced large losses. However, the mechanical effect of the exclusion of capital income coincides with the largest output drop of the post-war era. In 2009, German GDP decreased by 5.1%. From 2008 to 2009, the share of the top percentile went down by 12% and the share of the top 0.1% even by 22%. In the wake of economic recovery in 2010, top income shares slightly increased.

In the following sections, we will focus on the mechanical effect of the gradual exclusion of capital income from the PIT tax base. Estimating the magnitude of income timing is beyond the scope of this paper. While section 4 concentrates on the impact of changes in taxable capital income until 2008, section 5 turns to the reform of 2009 and the development thereafter to disentangle crisis and tax reform effect.

4 The Role of Capital Income

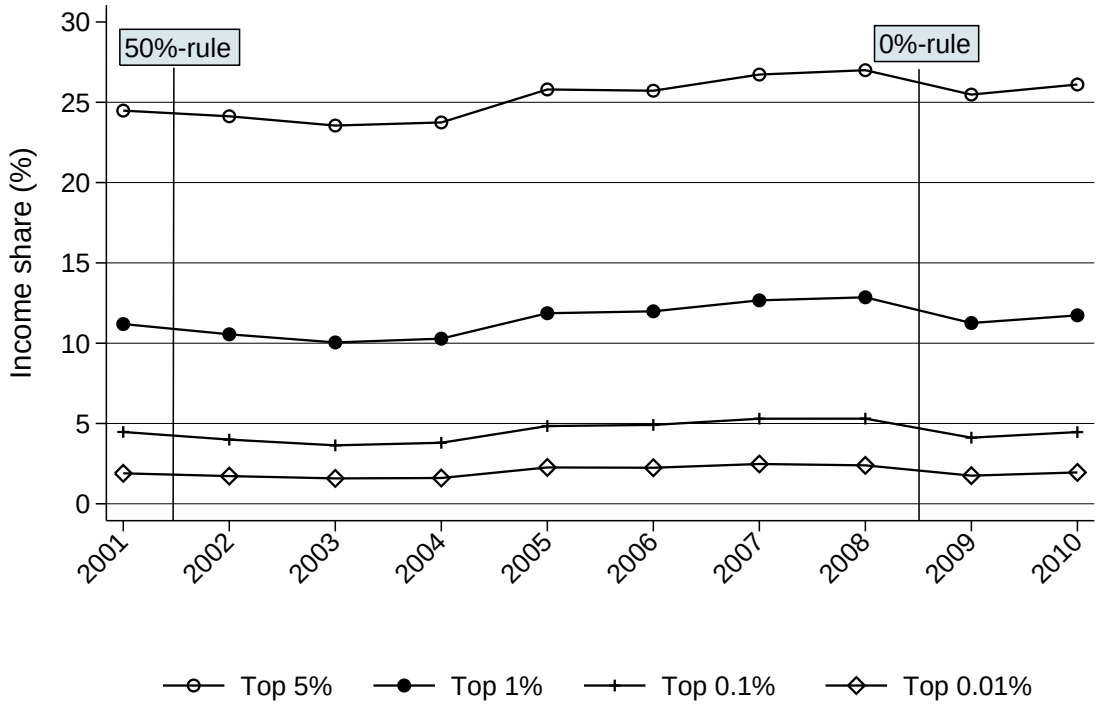
Between 2001 and 2008 two tax reforms induced the gradual disappearance of capital income from the income tax base. In the following, we first provide a brief overview of the two reforms. Further, we provide details on the income composition of the top fractiles with a particular emphasis on capital income when moving to the top of the distribution. We then turn to check the sensitivity of the top income series to the disappearance of capital income from the underlying data. We derive three harmonized top income series based on varying income tax legislations: Scenario 1 corresponds to German tax legislation until 2001. Scenario 2 applies the legislation in force between 2002 and 2008. Scenario 3 corresponds to the legislation since 2009.

Figure 3 indicates the timing of the two reforms within the picture of the raw data top income shares basically zooming in into the development between 2001 and 2010 already presented in Figures 1 and 2.

Until 2001, capital income defined as the sum of dividends and interest income was fully taxable in the PIT.[13] Dividends were defined as gross dividends before corporation tax. We refer to this legislation as the 100% rule, which corresponds

[13]When we speak of capital income in the following, we essentially refer to dividends from incorporated firms and to interest income. All other income that also stems from capital in a systematic view, such as rents, is not included in this concept.

Figure 3: Top Income Shares in Germany, 2001-2010

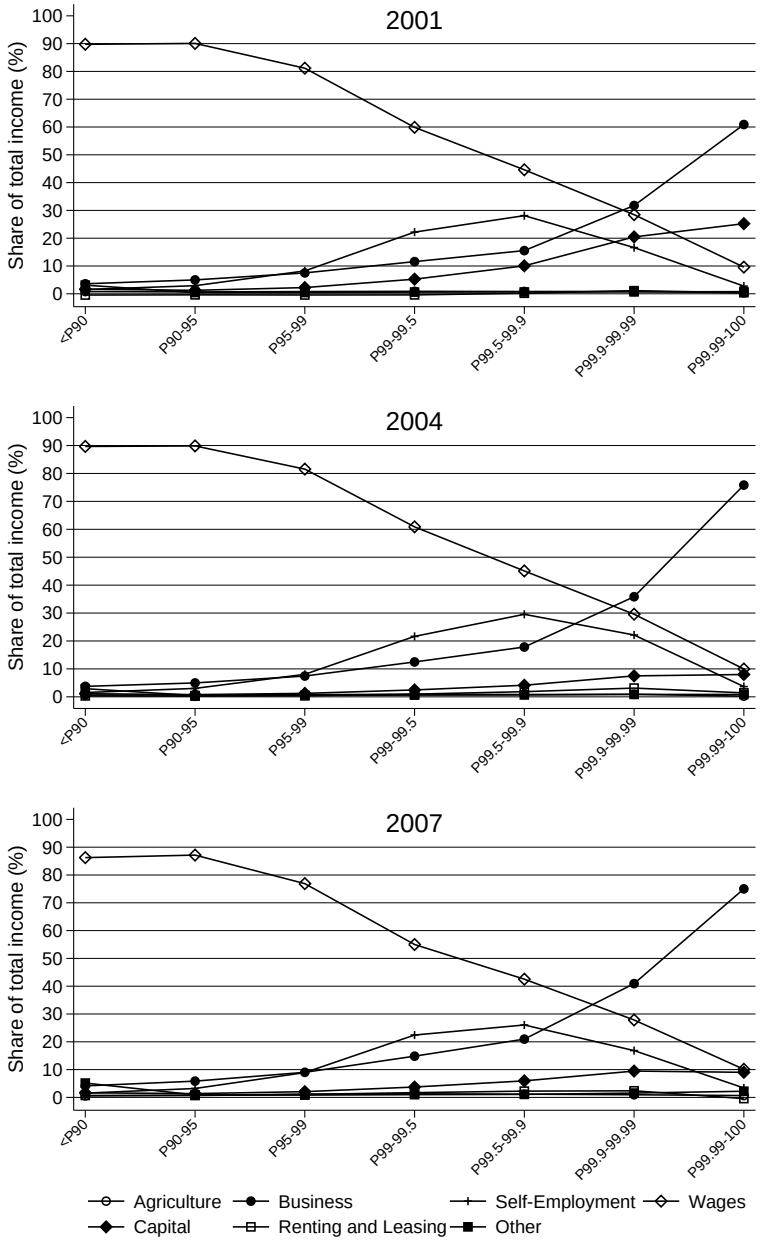


Notes: Shares are including capital gains. Fractile thresholds are obtained using the Pareto interpolation method.
Source: PIT statistics, own calculations.

to the income definition of our updated series. The first reform in 2002 changed the definition of taxable dividends from the full gross dividend (before corporation tax) to half the cash dividend (after corporation tax). We refer to this legislation as the 50% rule. Even though the effective tax rate on gross dividends only slightly changed, the share of taxable dividend income in gross taxable income was reduced by almost two thirds (62.5%). The second reform in 2009 introduced a final withholding tax on capital income, which led to the complete exclusion of capital income from taxable income. Consequently, PIT statistics do not have any information on capital income since 2009. Additionally, the ranking of individuals based on these statistics most probably differs from the years before since the ranking is based on non-capital income since then. We refer to this legislation as the 0% rule. Further details on the three tax regimes are given in Appendix D.

Both reforms are expected to affect primarily the top of the income distribution where capital income is concentrated. Figure 4 gives the composition of taxable

Figure 4: Income composition within top fractiles in Germany, 2001, 2004 and 2007



Source: FAST, own calculations.

income within top fractiles. The bottom half of the top decile generates 90% of income through wages. For the next four percent the wage share drops to 80% and then continues to decrease quite sharply. The top 0.01% has a wage share of only 10%. According to Bach et al. (2009) the German affluent rely much less on wages than their counterparts in France and the U.S. The role of self-employed[14] income increases up to the 99.99th percentile and then decreases towards the very top. Even though the importance of capital income increases towards the top, it fails to generate the largest part of top incomes. The very top accrues the bulk of their income through entrepreneurial income from unincorporated businesses. With the gradual exclusion of capital income from the tax base, the share of capital income of the top 0.01% declines from almost 30% in 2001 to about 10% in 2004 and 2007. The magnitude of this decline is reinforced by exceptionally high dividend payments in 2001.

Three top income series under simulated tax regimes each based on a homogeneous capital income definition are presented in Figure 5. Simulations do not account for behavioral responses. Scenario 1 shows top income shares if capital income had fully entered taxable income (100%-rule), as it was the case before 2002. Scenario 2 shows top income shares applying the 50%-rule. Between 2002 and 2008, this series corresponds almost perfectly with the raw data series.[15] Scenario 3 shows top income shares if capital income had been excluded from the PIT tax base already in the years prior to 2009 (0%-rule).[16]

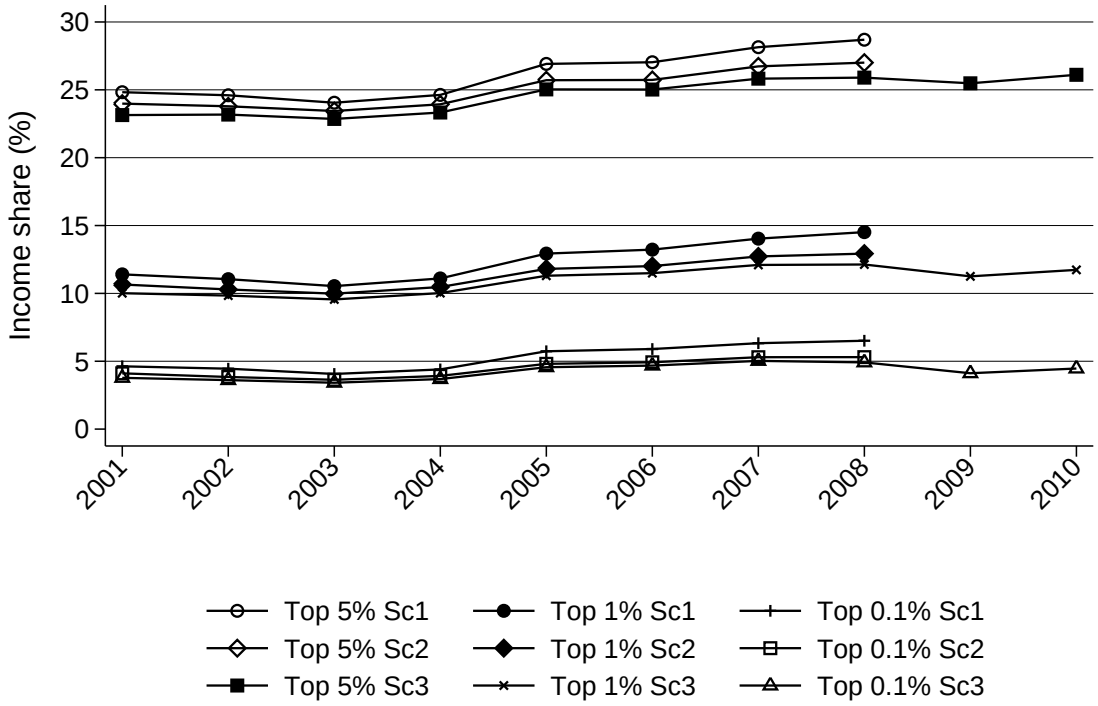
The three scenarios allow us to draw two main conclusions. First, a significant portion of the drop in top income shares in 2009 observed in Figure 3 using the raw PIT statistics can be explained by the tax reform. Second, estimates of top income shares would be both at a higher level and would have increased at a higher rate

[14]Self-employed income and unincorporated business income differ by the payment of the local business tax. Some professions are excluded from its liability (mostly physicians and lawyers) and their income is than classified as self-employed instead of business.

[15]Differences are due to a transitional period that began already in 2001, and was relevant for fewer and fewer incomes in later periods. Scenario 2 simulates GTI according to post-2001 legislation without these transitional exceptions, which makes quite a difference in 2001 and 2002, but only little difference after 2002.

[16]See Appendix Tables B.7 and B.8 for harmonized shares of scenarios 1–3 including and excluding capital gains.

Figure 5: Top income shares under simulated tax regimes



Notes: Scenario 1 refers to pre 2001 rules (100%-rule), Scenario 2 to 2001/02-2008 rules (50%-rule) and Scenario 3 to post 2008 rules (0%-rule). Tax units are sorted according to the scenario-specific taxable income definition. See Appendix Tables B.7 and B.8 for harmonized shares of scenarios 1–3 including and excluding capital gains.
Source: PIT microdata until 2008, PIT statistics thereafter, own calculations.

between 2004 and 2008 if capital income had not vanished from PIT statistics.

The first conclusion is illustrated by scenario 3. Top income shares would have decreased only slightly from 2008 to 2009, if capital income was excluded from the tax base already. The drop in scenario 3 decreases towards the top: while the drop is 2% for the top 5%, it exceeds 7% for the top 1%, 16% for the top 0.01% and reaches 22% for the top 0.01%. From this, we can draw the conclusion that the output drop in 2009 disproportionately hit the very top of the non-capital income distribution, albeit to a smaller degree than raw data shares presented in Section 3 would suggest. To quantify the portion of the 2009 drop that can be explained by the reform we compare the drop in scenario 3 with the raw data series presented in Figures 1 and 2. The top 1% share drops by 1.6 %-points in raw data shares, and by 0.87 in scenario 3. I.e., the drop is only about half of the size if capital income had been excluded in 2008 already. The top 0.1% share drops by 0.64 %-points using

raw PIT statistics, and still by 0.5 %-points in scenario 3.

The second conclusion is illustrated by scenario 1 and scenario 2. If capital income would have been subject to the 100%-rule (scenario 1) instead of the 50%-rule (scenario 2), then estimated top income shares would be both at a higher level and would have increased at a higher rate between 2001 and 2008. Simulating the 100%-rule instead of the 50%-rule raises the top percentiles' share by more than 1.5 %-points in 2008, 1.2 of which accrue to the top 0.1%. This indicates the heavy concentration of dividend income at the very top. The share of the top percentile under the 50%-rule increased by about 24% between 2004 and 2008, whereas their share increased by 30% under the 100%-rule of scenario 1.

In sum, harmonized series show that top income shares increased more than previous series by Dell (2005, 2007, 2011) suggest. Much of the decrease in raw-data top income shares between 2001 and 2003 is driven by the introduction of the 50% rule. Consequently, scenario 1 including full capital incomes is our preferred series for the extension of the WTID given in Appendix Table B.7. Top income shares excluding capital income reveal that much of the 2009 drop in the raw-data series can be explained by the introduction of the 0% rule. However, the series excluding capital income still display a drop in 2009, whose size increases towards the very top. In order to extend our preferred series including capital income to 2010, we cannot rely on micro data but have to extrapolate capital income by suitable proxies, which are introduced in section 5.

5 A Proxy for Missing Capital Income

As capital income was completely excluded from the PIT in 2009, our harmonized series including full capital incomes (scenario 1) ends in 2008 and cannot be extended without imputation of capital incomes at the top. In this section, we discuss several proxies for capital income to extrapolate personal capital income at the top to 2009 and later years. Our goal is to obtain top income shares including capital income for 2009 and 2010 extending the series of scenario 1.

We use the following external sources for capital income: household sector

capital income from national accounts, tax flow statistics on dividends and interest income, stock market indices, GDP, and capital income observed in German household survey SOEP. In order to derive the best proxy for capital income, we test for each top income fractile the correlation between both external dividend and interest income information and the corresponding capital income reported in PIT microdata, which until 2008 displays individual interest and dividend income separately. Each of the external sources has specific advantages and disadvantages regarding their potential correlation with personal capital income at the top, on which we will elaborate below.

In order to extrapolate top fractiles' capital incomes using any of these external sources, we assume that the fractiles' shares in the corresponding source observed between 2001 and 2008 remains constant after the withholding tax reform. In the following, we describe the data sources and discuss to what extent the above assumption seems reasonable.

- National accounts of dividends and interest income comprise the most comprehensive concept of capital income in the household sector.[17] The definitions of both the household sector itself as well as dividend and interest income are more comprehensive than the corresponding PIT definitions.[18] The fact that the capital income definition is not linked to tax law makes national accounts a promising proxy at the first glance. But at the second glance, the broad definition of both the household sector and its capital income presents the major drawback for national accounts dividends as a proxy for household sector dividends as defined in the PIT. In particular, dividends in national accounts comprise distributed profits of both incorporated and unincorporated firms (Schwarz, 2008).[19] By contrast, the PIT definition of dividends (which is what we need to proxy) includes only profits from incorporated firms (profits from unincorporated firms are classified as business income, self-employed income or agricultural income). This difference

[17]It does, however, not include capital gains.

[18]In addition to private households, the national accounts' household sector includes unincorporated businesses if they are owned by a single person (as opposed to partnerships) as well as private non-profit organizations.

[19]Moreover, capital income of the household sector includes interest income and dividends that is not distributed but reinvested by private insurances and pension funds.

in the dividend definition is of particular relevance for the quality of national accounts as a proxy for dividends in the PIT definition if the tax reform has induced income shifting: If, for example, profits from unincorporated firms (which are still subject to the personal PIT tax rate) are shifted towards interest income via changes in the leverage of firms, national accounts report more interest, less dividends, and unchanged total capital income. However, dividends according to the PIT definition would remain unchanged, therefore our proxy would be too low: we would double-count the reduction in unincorporated firm profits, as it would already show up in top incomes as reported in PIT statistics. Using national accounts would thus underestimate dividend income and suggest too low top income shares. For interest income, the national accounts aggregate seems less problematic.

- Tax flow statistics report withheld revenues from taxes on dividends from corporations and on interest income. Tax flows are reported separately for dividends and interest income. The withholding pre-tax on dividends and interest income existing until 2008 could be counted against both PIT and corporation tax liability by the end of the year. The tax base generating these tax flows can be calculated by dividing the tax flows by the respective tax rates. Dividends can then be grossed up using the pre-year corporate tax rate in order to match our gross dividend definition. However, tax flow statistics suffer from several drawbacks: First, their aggregate level depends on the level of the saver's allowance which varied greatly between 2000 and 2007 (see Appendix Figure E.4). Since 2007, the allowance is lower than in previous years, which might induce a mechanical increase of the proxy, yielding too low extrapolated capital income. Second, the interest tax base does not include private loans. Third, aggregates include interest and dividends received by corporations and unincorporated businesses. This difference in the definition of interest income compared to the PIT could have an impact on the quality of the proxy in the case of shifting: Shifting capital income from the firm level to the private level thus leaves the proxy unchanged, while private capital income in the PIT definition would increase. Extrapolated private capital income

would thus be too low.[20] Last, the tax base definition for interest income was broadened in 2009 and includes capital gains from stock shares since then. Although the effect of this additional tax base is expected to be small in 2009 as transitional rules are quite generous, the broader tax base will become apparent in the long-term, inducing comparatively high extrapolated values for interest income. Consequently, extrapolated capital income using tax flow statistics might lose quality as a proxy for the PIT definition of capital income. Both level and direction of the error depends on the extent and direction of income shifting and on the size of capital gains from stock shares.

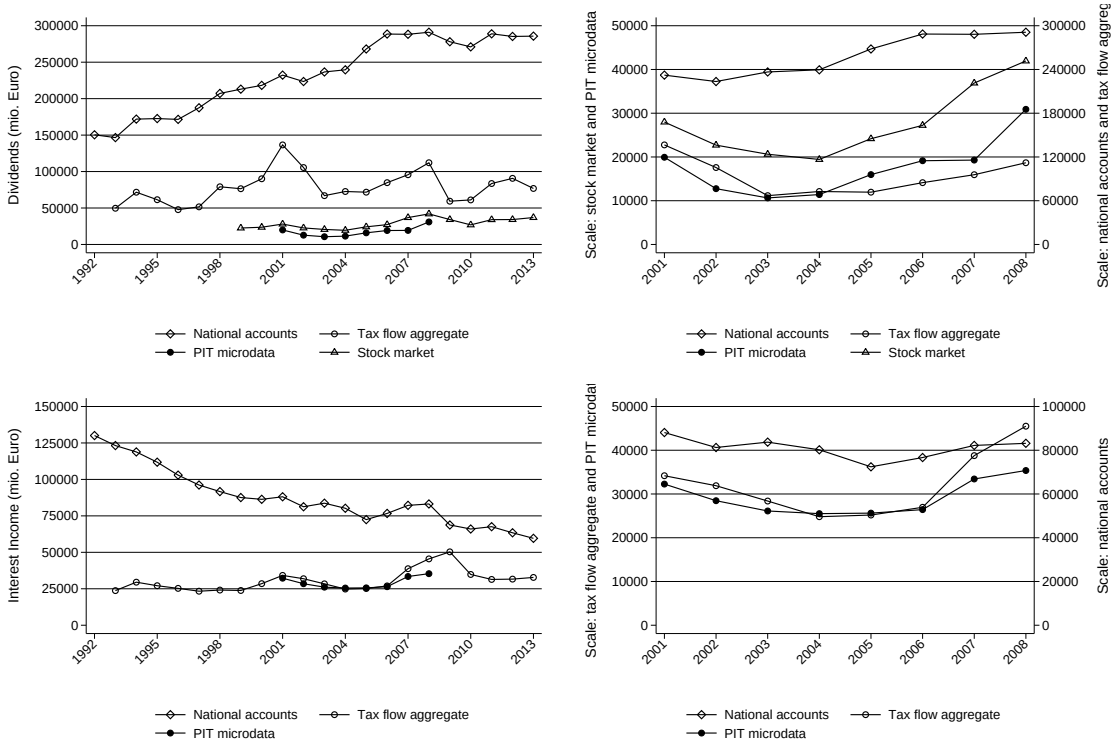
- Aggregated dividends from German stock companies can be derived using the most comprehensive German stock index (CDAX). Neither do all dividends in this aggregate flow go to the household sector, nor are the recipients necessarily German taxpayers. In addition, dividends from closely held corporations are not included in the aggregate. However, its time series might be a good indicator for the dividend development of private stock market portfolios and consequently display a similar trend as private dividend income.

- GDP might also serve as a proxy for capital income, as it reflects economic activity in general. We use lagged GDP, as dividends are usually distributed profits of the preceding year. Interest income also turns out to correlate stronger with lagged GDP than with GDP in the same year. As in the case of national accounts dividends, the share of personal dividend and interest income in GDP will change after the reform if income is shifted towards these income sources. Then, the extrapolated capital income will be too low.

- The SOEP is a representative panel study containing individual and household data in Germany from 1984 onwards and was expanded to the New German Laender after reunification in 1990. All household members are interviewed individually once they reach the age of 16. SOEP reports gross household income by

[20] It is, however unclear in which direction of shifting would dominate: business to private shifting is more plausible in the case of unincorporated business income (which is subject to the high PIT tax rate). Private to business shifting might be favorable in the case of corporations, as the corporate tax rate (15%) is even lower than the private capital income tax rate (25%) which yields an accumulation effect in the long run. Furthermore, deductions can only be claimed at the firm level. See Jenderny (2015) for a detailed discussion of plausible shifting directions.

Figure 6: External proxies for capital income, 1992–2013



Notes: Values are in 2010 prices. Aggregated income from PIT microdata corresponds to comprehensive incomes before deductions as defined by scenario 1 in section 4.
Source: Tax flow statistics, PIT microdata, stock market indices (CDAX), and German national accounts (household sector).

component including the sum of dividend and interest income. Like most population surveys, SOEP lacks information on individuals at the top of the income distribution. In general, households up to the top 1% are well represented.[21] We use capital income from the top 10% without the top 1% of households (P90–99).[22]

The external aggregates for dividend and interest incomes described above are shown in Figure 6. Aggregated dividends from national accounts, tax flow statistics and the German stock market (CDAX) are reported in the upper graphs. Aggregated interest income from national accounts and tax flow statistics is given in

[21]Appendix Figure E.5 shows that top income shares of the top decile based on SOEP using thresholds from PIT statistics are of similar magnitude as shares based on PIT statistics. The gap increases moving further to the top indicating that SOEP underestimates income concentration at the top.

[22]From 2009 onwards, it is also possible to use the German data of the Euro Area Household Finance and Consumption Survey (HFCS). The drawback of this survey is its recent availability. So far, we can only check capital income in 2009 reported in the first wave in 2010. The advantage of the survey lies in its focus on wealth. Like SOEP it reports income from financial assets, but provides additional wealth information such as the stock market portfolio.

the lower graphs. Additionally, all graphs show the corresponding income aggregates from PIT microdata between 2001 and 2008. The graphs on the left-hand side give an idea of the levels and the evolution of the time series from 1992 to 2013. The graphs on the right-hand side show the years where we can compare the external information to the PIT capital income aggregates (2001–2008). They also use a different scale for the national accounts aggregates and for the dividend tax flow aggregate in order to give a better comparison of the relative changes between the series.

All dividend aggregates show a drop in 2009, albeit of very different magnitude. The tax flow aggregate peaks in 2008 and displays a large drop by almost 50% in 2009. This might be boosted by preponed dividend distribution in 2008 as discussed in section 3. Stock market dividends also peak in 2008, but their development is much smoother over the years. They decline in 2009 and 2010, and slightly recover in 2011. National accounts dividends show a trend similar as stock market dividends. In sum, the time trend of aggregated PIT dividends seems to correspond closest with stock market dividends.[23] However, trends slightly differ in 2007 and 2008: PIT microdata display less dividend growth in 2007 and more dividend growth in 2008. This could reflect the same dividend preponement in 2008 as in the tax flow aggregate.

Aggregates for interest income converged over the past two decades. The higher level of national accounts interest income as compared to the tax flow aggregate in the 1990s might be due to the high savers' allowance (see Appendix Figure E.4) and the inclusion of reinvested interest income from private pension insurances. The convergence could be explained by the gradual broadening of the tax base, e.g., the decrease of the savers' allowance. The national accounts' aggregate peaks in 2008, followed by a pronounced drop in 2009, while the tax flow aggregate peaks in 2009 and drops in 2010. To some extent, we expect that taxable interest income was postponed to 2009, as the final withholding tax substantially reduced the marginal tax rate on interest income for high-income tax units.[24] Both level and time trend of

[23]Stock market dividends and dividends in PIT microdata also nearly coincide in levels. But one should keep in mind that German stocks are not entirely owned by German private households.

[24]A second explanation for the tax flow aggregate's peak in 2009 could be the inclusion of

the tax flow aggregate largely coincide with the PIT aggregate. The smaller growth rate of the PIT aggregate in 2007 and 2008 might be due to income timing. If interest income was postponed to 2009, the PIT aggregate should reflect this timing effect more than the tax flow aggregate, which partly includes interest income of corporations and of non-resident persons who were not subject to an equally large tax rate reduction.

In sum, the time series reveal that PIT microdata aggregates follow similar trends as external capital income aggregates. In particular, PIT dividends seem to correspond closest to CDAX dividends. For PIT interest incomes the tax flow aggregate seems to display a more similar development. For both income sources, trends differ from the tax flow aggregates' trends in 2007 and 2008, which can most likely be explained by taxable income reactions to tax law changes (pre-ponement of dividends to 2008 and post-ponement of interest income towards 2009).

The selected proxy should not only correlate with the PIT aggregates of dividends and interest income, but also with capital income of the top fractiles. Table 1 shows correlations between external aggregates and PIT fractiles' aggregates indicating to which extent the correlation varies over top income fractiles. The upper part of Table 1 refers to dividends, while the lower part refers to interest income. The first column gives the correlation of the fractiles' aggregate with the PIT microdata total. Columns 2 to 6 give the fractiles' correlation with external aggregates.

All fractiles' dividend or interest incomes show a high correlation with the corresponding PIT total which indicates stable fractile shares in total capital income.[25] For the extrapolation, we therefore assume the distribution of total capital income to remain constant over the fractiles.

Stock market dividends show the highest correlation with PIT dividend income for almost all top fractile groups with decreasing correlations towards the top: correlation coefficients exceed 90% for each of the top fractile groups. Lagged GDP and national accounts dividends exhibit a smaller correlation. For interest income, the

capital gains from stock shares in the tax flow since the introduction of the withholding tax in 2009. However, as there were generous transitional rules, we expect this effect to be small in 2009.

[25] Table D.4 shows that the distribution of capital income over top fractiles is quite stable over time.

Table 1: Correlation between fractile capital income and proxies 2001–08

Dividends						
$DIV_{FRACTILE}$	DIV_{PIT}	DIV_{NA}	DIV_{CDAX}	GDP_{LAG}	CAP_{SOEP}	DIV_{TF}
<P90	96.1	80.4	92.6	90.0	5.5	68.2
P90–95	93.1	90.6	95.5	84.7	16.7	64.0
P95–99	97.1	93.3	95.9	83.4	13.6	58.3
P99–99.5	98.1	87.5	97.4	89.4	15.2	65.9
P99.5–99.9	99.0	81.6	97.4	93.5	15.0	69.3
P99.9–99.99	99.8	78.1	95.6	94.2	12.1	70.2
Top 0.01%	97.2	79.0	92.4	90.2	8.2	69.3
Interest						
$INT_{FRACTILE}$	INT_{PIT}	INT_{NA}	–	GDP_{LAG}	CAP_{SOEP}	INT_{TF}
<P90	99.5	52.6		94.3	44.0	98.7
P90-95	98.6	59.2		93.8	44.7	99.3
P95-99	99.2	44.9		96.8	31.6	97.3
P99-99.5	99.5	47.9		95.9	35.7	98.1
P99.5-99.9	98.9	54.2		94.4	39.3	99.1
P99.9-99.99	95.6	55.9		90.8	45.0	97.9
Top 0.01%	56.9	54.3		84.6	47.5	94.4

Notes: Correlations between aggregated dividends / aggregated interest income by disjoint fractile. Sorting sc1: fractiles defined including capital income (100% rule) $DIV_{FRACTILE}$/$INT_{FRACTILE}$: Aggregated dividend/interest income in (disjoint) fractile groups in PIT microdata DIV_{PIT}/INT_{PIT}: Total dividend/interest income in PIT microdata DIV_{NA}/INT_{NA}: Household sector dividends/interest income in national accounts DIV_{CDAX}: Aggregated dividends from German stock companies (CDAX index) GDP/GDP_{LAG}: (Lagged) GDP CAP_{SOEP}: Capital income of P90-99 from SOEP survey data. DIV_{TF}/INT_{TF}: Aggregated dividend/ interest income calculated from tax flow statistics
Source: Own calculations using PIT microdata, stock market indices (CDAX), SOEP, national accounts, and tax flow statistics.

tax flow aggregate shows the highest correlation, closely followed by lagged GDP. Correlation with SOEP capital income is comparatively low for both dividends and interest income, which might reflect the fact that we cannot distinguish dividends from interest income in SOEP data.

The correlations with external totals confirm for both capital income sources that the findings of Figure 6 hold over different top income fractiles. Based on these results, we choose stock market dividends and the tax flow aggregate as proxies for dividend income and interest income, respectively, and use the average proportion observed between 2001 and 2008 to extrapolate capital income by fractile for 2009 and 2010. Adding this extrapolated capital income to the non-capital income reported in tax statistics in 2009 and 2010 yields our harmonized series shares of Scenario 1.

Note, however, that the shares we observe from 2009 onwards correspond to the 0% rule (Scenario 3) and tax units are ranked accordingly. By contrast, our

extrapolation requires the non-capital income of the top fractiles sorted by total income (i.e. by 100% rule income, Scenario 1), which would be slightly lower than what we observe. We take a pragmatic approach and correct for the sorting effect by applying the average sorting effect from 2001 to 2008, which is reported in Appendix Table B.10. To check the robustness of the external information used, we also use the dividend tax flow and national accounts aggregates as well as the national accounts interest aggregate for extrapolation of the respective income type and derive capital income extrapolations for all combinations of sources for dividends and interest income. Furthermore, we use SOEP P90–99 average capital income and lagged GDP to extrapolate the sum of interest and dividend income.[26]

Figure 7 and 8 display our extended series including capital income. As scenario 3 is constructed to match the taxable income definition since 2009, this series can be extended by the years 2009 and 2010. Scenario 3 corresponds to the simulated scenario 3 in Figure 5 applying the 0%-rule. Scenario 1 applies the 100%-rule with tax units sorted excluding capital income, which is the most comparable concept to scenario 3 in 2009 and 2010. Scenario 1 is extended by the years 2009 and 2010 including imputed capital income using the capital income proxy discussed above.

Up to the top percentile, neither the concentration of capital nor of non-capital income was substantially reduced by the crisis as can be taken from Figure 7. Even though we find higher drops between 2008 and 2009 moving to the top, both the extended scenario 1 and scenario 3 – including and excluding capital income consistently – are smoother than the series based on the original data suggest. For the top decile, raw data presented in Figure 1 suggest a decrease of 3%. But the series including full capital income (Scenario 1) shows a decline by 0.4% and by 0.03% excluding capital income (Scenario 3). A large portion of the drop observed with the raw data seems attributable to the tax reform.

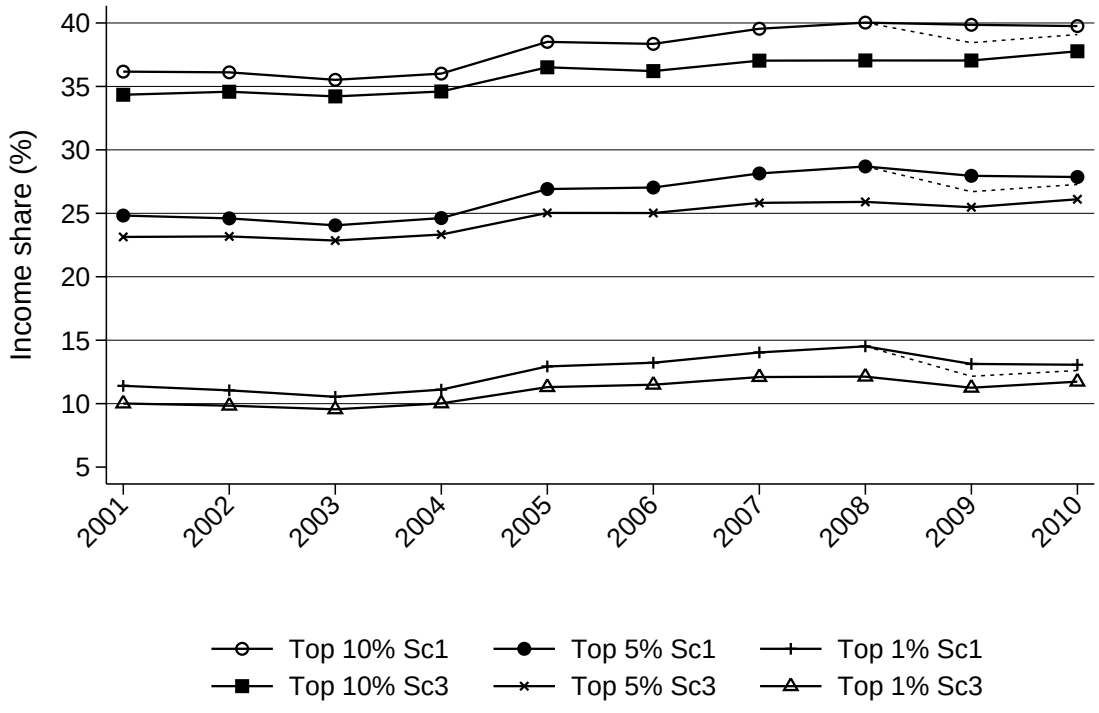
Larger changes in the homogeneous series are observed for the very top of the distribution displayed in Figure 8. Both series including and excluding capital

[26]Appendix Figure E.1 shows the development of potential capital income proxies for selected fractile groups between 2001 and 2013 in comparison to capital income recorded in microdata between 2001 and 2008. The range of all alternative capital income extrapolations is shown in Appendix Figure E.2.

income indicate a sharp drop for the top 0.1% and 0.01%. For the top 0.1%, raw data presented in Figure 2 reveal a decrease of 22%. In contrast, the series including capital income (Scenario 1) show a decline by 20% and by 16% excluding capital income (Scenario 3). Hence, the raw data drop for the very top is only partly attributable to the reform and more likely associated with the economic crisis. A possible explanation is the high portion of unincorporated business income at very top: as Appendix Table D.1 shows, total business income documented in the tax statistics declined from 116 to 101 billion Euro between 2008 and 2009.

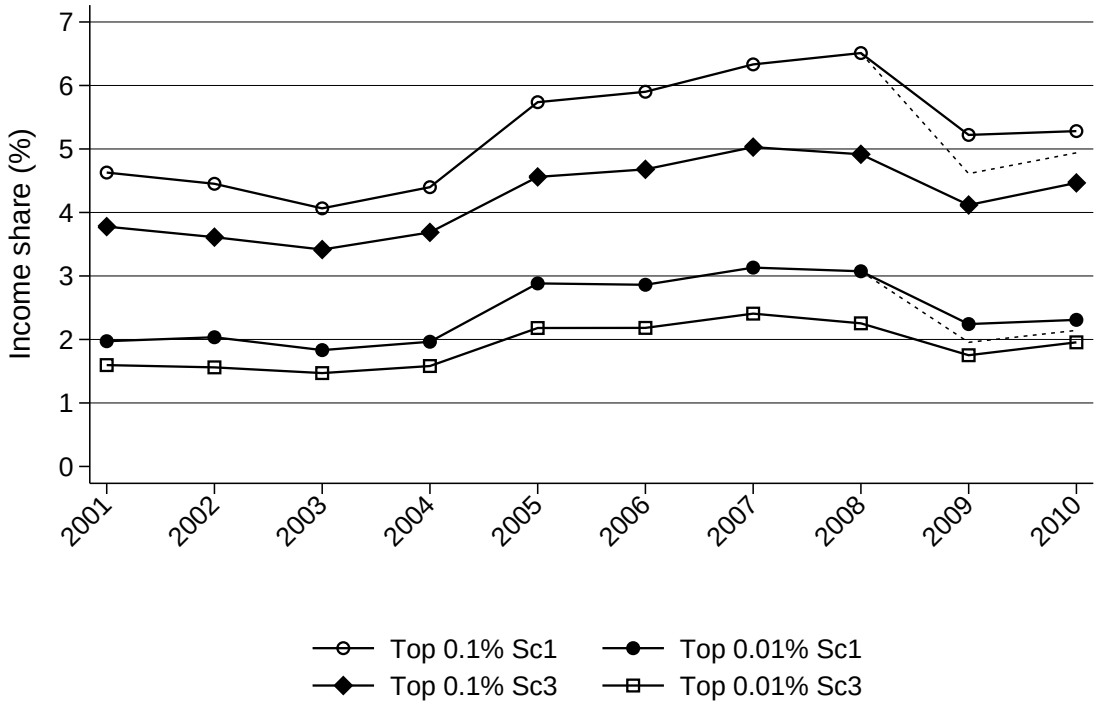
In contrast to the series assessed on raw PIT statistics, our extended harmonized series hence shows an even steeper increase in income concentration between 2001 and 2010. The income share accruing to the top decile including capital income is 8% higher than the shares assessed on the original tax data in 2009. The share of the top 0.01% is 28% higher.

Figure 7: Top income shares with imputed capital income



Notes: Scenario 1 applies the 100%-rule. Scenario 3 applies the 0%-rule. Extrapolated capital income is based CDAX dividends for dividend income and the interest tax flow aggregate for interest income – the external sources with the highest correlation. This combination marks an upper bound of our extrapolations. Dotted lines indicate the lower bound based on SOEP capital income.
Source: PIT microdata for 2001-2008, PIT statistics for 2009-2010, own calculations.

Figure 8: Top income shares with imputed capital income



Notes: Scenario 1 applies the 100%-rule. Scenario 3 applies the 0%-rule. Extrapolated capital income is based CDAX dividends for dividend income and the interest tax flow aggregate for interest income – the external sources with the highest correlation. This combination marks an upper bound of our extrapolations. Dotted lines indicate the lower bound based on SOEP capital income.
Source: PIT microdata for 2001-2008, PIT statistics for 2009-2010, own calculations.

6 Conclusions

In this paper, we derived a homogeneous series of top income shares including full capital incomes for Germany to overcome the erosion of our data base. First, we extended the existing WTID series of top income shares including capital gains to 2010, and the series excluding capital gains to 2008. Second, we used PIT microdata to explore the impact of the gradual exclusion of capital income from the PIT base on top income shares. We derived homogeneous series of top income shares corresponding to varying income tax legislations and capital income definitions. Third, we explored the correlations between top fractiles' capital incomes and external capital income aggregates. We find that a composite measure of stock dividends and interest income tax flows provides a good proxy for capital income accruing to the

rich over time. Using this proxy, we extended our harmonized series of top income shares including capital income to 2010.

Our results show that excluding taxable capital gains reduces top income shares only by little, as capital gains are largely not subject to income tax in Germany. Raw data, i.e., unharmonized, series of top income shares understate the increase in income concentration that took place in Germany between 2001 and 2010. E.g., accounting for missing capital income increases top income shares by 8% for the top decile and by 28% for the top 0.01% in 2009. Furthermore, the recession in 2009 seems to have had a minor impact on the top decile of the German income distribution, but a substantial impact on the very top, i.e., the top 0.1% and top 0.01%.

Missing capital income in income tax statistics will lead to an underestimation of German top income shares assessed on the commonly used income tax statistics in the future. Correcting non-capital income shares with our capital income proxy provides a better picture of ongoing increasing income concentration in Germany. Yet, its quality is prone to shifting behavior and determined to decrease for future extrapolations. We expect that the tax reduction on capital income will provoke even higher income accumulation at the top of the distribution in the years to come which will not be documented by income tax data.

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Appendix A Sources of total income and total population

In the following, we explain the construction of our control totals in detail.

The control total for population is the number of individuals aged 20+ using population statistics from the statistical yearbooks following Dell (2007). E.g., numbers for the year 2008 are published in the Statistical Yearbook of 2010 (*Statistisches Jahrbuch 2010*). The number of tax units is computed using the following formula:

Tax Units = Married Couples/2 + Bachelors - Children (up to 19 years)

Table A.1: Control total for population, Germany, 1998-2010

Year	Total tax units in 1000	Total recorded in tax statistics in 1000
1998	45,155	28,293
2001	46,802	27,413
2002	47,584	27,294
2003	47,927	26,647
2004	46,338	26,154
2005	48,574	26,264
2006	47,942	25,934
2007	48,297	26,327
2008	48,578	26,128
2009	48,823	26,062
2010	49,192	26,411

Notes: Total recorded in tax statistics refers to income and payroll taxpayers in 1998 and to only income tax payers from 2001 to 2010.
Source: Statistical yearbooks, various years, PIT statistics, own calculations.

The income total is based on the national accounts published in *Fachserie 18 Reihe 1.5 Volkswirtschaftliche Gesamtrechnungen. Inlandsproduktberechnung, Lange Reihen ab 1970, Stand März 2014*. Total household income is the sum of

Compensation of employees (Residents) (*Arbeitnehmerentgelt (Inländer)*) (Table 1.3)

+ Operation surplus (*Betriebsüberschuss*) (Table 1.10)

+ Income of self-employed (*Selbständigeneinkommen*) (Table 1.10)

+ Property income (*Vermögenseinkommen*) (Table 1.10)

- Employers' actual social contributions (*Sozialbeiträge der Arbeitgeber*) (Table 1.8).

= Total household income

Total household income, total income recorded in income tax statistics and our control total is given in Table A.2. Control total is 90% of total household income following Dell (2007). We deduct the sum of capital gains observed in the microdata from the control total for the estimation of shares excluding capital income.[27]

[27]This strategy enables us to easily interpret the difference between the series including and excluding capital gains. However, one should note that the income total in the national accounts does not include capital gains.

Table A.2: Control total for income, Germany, 1998-2010

Year	Total household income (bio. €)	Total income recorded in tax statistics (mio. €)	Control total (mio. €)
1998	1,263.7	902,992	1,137,294
2001	1,354.0	963,858	1,218,627
2002	1,356.7	959,635	1,221,003
2003	1,375.3	939,915	1,237,761
2004	1,391.8	953,835	1,252,638
2005	1,423.9	996,304	1,281,483
2006	1,477.9	1,013,694	1,330,092
2007	1,528.14	1,067,377	1,375,326
2008	1,586.81	1,099,228	1,428,129
2009	1,544.41	1,061,489	1,389,969
2010	1,587.17	1,101,833	1,428,453

Notes: Values are in current Euro. Total income recorded in PIT statistics refers to income and payroll tax in 1998 and to only income tax from 2001 to 2010.
Source: National accounts (*Volkswirtschaftliche Gesamtrechnungen*), various years, own calculations.

Appendix B Tables of Key Results

The key results on top income shares based on both PIT statistics and PIT microdata are given in Tables B.1, B.2 and B.3, respectively. Thresholds and average income for various fractiles based on PIT statistics and PIT microdata are given in Tables B.4, B.5 and B.6, respectively.

Table B.1: Top income shares based on PIT statistics and Pareto interpolation

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
			including capital gains			
2001	35.91	24.48	11.19	8.34	4.47	1.90
2002	35.70	24.13	10.56	7.62	4.00	1.73
2003	34.97	23.55	10.05	7.17	3.64	1.58
2004	35.03	23.74	10.28	7.47	3.80	1.61
2005	37.41	25.80	11.87	8.87	4.84	2.26
2006	37.03	25.72	11.99	8.98	4.91	2.25
2007	38.11	26.73	12.67	9.55	5.30	2.48
2008	38.34	27.00	12.86	9.69	5.30	2.39
2009	37.04	25.48	11.26	8.17	4.12	1.75
2010	37.77	26.11	11.73	8.62	4.47	1.95

Notes: Tax statistics include only income taxpayers. Fractile thresholds are obtained using the Pareto interpolation method.
Source: PIT statistics, own calculations.

Table B.2: Top income shares based on PIT statistics and mean-split histogram

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
			including capital gains			
2001	35.91	24.60	11.19	8.34	4.48	1.89
2002	35.69	24.17	10.56	7.71	4.00	1.73
2003	34.97	23.54	10.05	7.26	3.68	1.58
2004	35.02	23.70	10.29	7.47	3.80	1.61
2005	37.39	25.82	11.88	8.87	4.85	2.28
2006	37.01	25.73	12.01	8.99	4.92	2.23
2007	38.08	26.73	12.73	9.59	5.30	2.47
2008	38.30	27.00	12.94	9.73	5.30	2.38
2009	36.99	25.48	11.30	8.20	4.13	1.77
2010	37.70	26.11	11.81	8.65	4.49	1.97

Notes: Tax statistics include only income taxpayers. Fractile thresholds are obtained using the mean-split histogram method.
Source: PIT statistics, own calculations.

Table B.3: Top income shares based on PIT microdata

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
including capital gains						
2001	36.04	24.70	11.28	8.42	4.52	1.90
2002	35.32	23.83	10.32	7.51	3.86	1.65
2003	34.89	23.45	9.99	7.20	3.64	1.56
2004	35.30	23.93	10.47	7.63	3.92	1.68
2005	37.28	25.71	11.81	8.81	4.81	2.25
2006	37.02	25.73	12.01	9.00	4.92	2.23
2007	38.09	26.73	12.72	9.58	5.30	2.47
2008	38.31	27.01	12.93	9.73	5.31	2.38
excluding capital gains						
2001	35.82	24.44	10.99	8.13	4.29	1.78
2002	34.99	23.43	9.88	7.08	3.48	1.38
2003	34.69	23.20	9.71	6.94	3.42	1.42
2004	35.04	23.63	10.14	7.31	3.66	1.51
2005	36.78	25.13	11.15	8.16	4.22	1.81
2006	36.60	25.24	11.45	8.45	4.45	1.92
2007	37.55	26.11	12.04	8.92	4.72	2.08
2008	38.00	26.64	12.53	9.34	4.97	2.17
excluding capital gains, ranked including						
2001	35.72	24.33	10.87	8.01	4.17	1.69
2002	34.89	23.33	9.76	6.96	3.36	1.28
2003	34.59	23.10	9.61	6.83	3.32	1.35
2004	34.94	23.54	10.04	7.21	3.56	1.43
2005	36.70	25.04	11.06	8.07	4.13	1.73
2006	36.48	25.11	11.31	8.30	4.30	1.77
2007	37.49	26.04	11.96	8.83	4.62	1.98
2008	37.91	26.55	12.43	9.23	4.85	2.07

Notes: Tax statistics include only income taxpayers.
Source: PIT microdata, own calculations.

Table B.4: Thresholds and average incomes based on PIT statistics and Pareto interpolation

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
			including capital gains			
			thresholds			
2001	59,364	80,947	148,050	205,601	499,944	2,134,204
2002	58,674	79,314	144,231	208,280	446,100	1,810,919
2003	57,777	77,821	141,447	201,989	443,093	1,637,040
2004	58,623	79,468	148,116	200,929	450,476	1,759,486
2005	57,232	78,946	151,594	209,290	494,414	2,105,873
2006	57,451	79,815	157,831	219,754	524,485	2,246,380
2007	57,880	79,782	165,782	233,049	545,368	2,399,781
2008	57,637	80,441	169,936	240,399	572,489	2,450,380
2009	56,440	78,706	159,042	218,853	491,008	1,833,023
2010	57,046	80,206	163,848	226,290	517,426	2,014,588
			average incomes			
2001	107,425	146,483	334,844	499,122	1,338,381	5,678,063
2002	103,822	140,345	306,966	443,279	1,162,465	5,017,030
2003	101,304	136,449	291,050	415,624	1,054,842	4,585,641
2004	104,481	141,632	306,673	445,480	1,133,084	4,792,915
2005	106,785	147,300	338,742	506,291	1,382,262	6,462,495
2006	109,291	151,835	353,777	530,277	1,449,885	6,630,997
2007	112,999	158,498	375,630	566,494	1,570,799	7,353,360
2008	114,353	161,058	383,484	577,892	1,581,693	7,140,917
2009	106,663	146,734	324,088	470,754	1,185,629	5,045,014
2010	109,677	151,631	340,714	500,508	1,296,807	5,676,499

Notes: Tax statistics include only income taxpayers. All figures in 2010 prices. Fractile thresholds are obtained using the Pareto interpolation method.
Source: PIT statistics, own calculations.

Table B.5: Thresholds and average incomes based on PIT statistics and mean-split histogram

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
			including capital gains			
			thresholds			
2001	60,592	78,707	143,314	198,909	492,873	2,246,635
2002	58,899	76,069	136,378	191,218	423,507	1,736,659
2003	59,026	76,053	135,415	187,560	411,155	1,597,076
2004	60,021	78,834	143,314	196,258	438,440	1,732,794
2005	57,105	74,656	140,394	194,505	460,286	1,980,177
2006	58,197	76,652	148,273	206,986	498,124	2,245,317
2007	59,768	78,576	158,530	222,919	499,053	2,454,337
2008	59,536	79,104	162,319	230,545	531,899	2,501,911
2009	58,939	78,238	153,775	211,831	472,657	1,767,323
2010	59,659	79,621	157,161	217,574	497,781	1,988,181
			average incomes			
2001	107,415	147,201	334,853	499,123	1,338,884	5,646,915
2002	101,045	136,833	298,802	436,686	1,131,571	4,887,672
2003	99,629	134,121	286,278	413,669	1,049,627	4,507,042
2004	104,430	141,380	306,741	445,488	1,133,249	4,787,375
2005	102,719	141,854	326,212	487,352	1,332,172	6,251,256
2006	106,905	148,675	346,961	519,684	1,422,471	6,455,387
2007	112,911	158,500	377,397	568,480	1,570,692	7,323,307
2008	114,232	161,075	385,838	580,665	1,581,202	7,110,313
2009	106,519	146,733	325,474	472,018	1,189,551	5,089,109
2010	109,484	151,640	342,813	502,643	1,302,720	5,711,967

Notes: Tax statistics include only income taxpayers. All figures in 2010 prices. Fractile thresholds are obtained using the mean-split histogram method.
Source: PIT statistics, own calculations.

Table B.6: Thresholds and average incomes based on PIT microdata

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
			including capital gains			
			thresholds			
2001	59,219	78,524	147,133	205,219	498,301	2,238,996
2002	58,292	77,367	141,654	193,051	432,088	1,751,616
2003	57,626	76,795	140,275	189,490	413,570	1,604,844
2004	58,888	78,684	146,501	200,640	451,066	1,834,096
2005	57,314	77,330	147,448	204,569	478,436	2,062,078
2006	57,768	78,371	153,223	214,245	510,827	2,293,026
2007	58,181	79,463	159,104	225,108	541,863	2,454,649
2008	58,094	79,788	162,760	231,508	565,222	2,501,861
			average incomes			
2001	107,383	147,187	336,115	501,487	1,347,296	5,664,665
2002	102,298	138,009	298,920	435,160	1,118,084	4,770,883
2003	100,576	135,166	287,863	415,264	1,049,526	4,487,702
2004	104,853	142,201	311,058	453,407	1,164,894	4,993,472
2005	106,329	146,654	336,696	502,632	1,372,144	6,427,489
2006	109,373	152,058	354,936	531,646	1,454,856	6,590,898
2007	112,881	158,406	377,018	567,929	1,569,966	7,317,652
2008	114,233	161,038	385,586	580,295	1,581,931	7,108,534
			excluding capital gains			
			thresholds			
2001	59,155	78,403	146,231	202,880	482,610	2,097,889
2002	58,216	77,223	140,646	190,627	416,537	1,568,500
2003	57,555	76,663	139,425	187,433	401,060	1,503,807
2004	58,815	78,540	145,525	198,270	436,414	1,703,690
2005	57,221	77,149	146,157	201,440	459,131	1,854,054
2006	57,668	78,174	151,709	210,868	488,197	2,067,020
2007	58,083	79,265	157,479	221,164	517,330	2,175,782
2008	58,076	79,740	161,942	229,230	548,887	2,317,341
			average incomes			
2001	106,185	144,876	325,698	482,113	1,272,839	5,291,112
2002	100,632	134,779	284,069	407,018	1,000,168	3,983,845
2003	99,494	133,097	278,677	398,197	982,525	4,079,326
2004	103,540	139,674	299,705	432,244	1,080,645	4,472,641
2005	103,928	141,979	314,998	461,227	1,193,630	5,118,844
2006	107,159	147,763	335,337	494,685	1,302,461	5,623,890
2007	110,277	153,334	353,645	523,690	1,384,818	6,100,742
2008	112,783	158,167	371,961	554,388	1,474,699	6,445,920

Notes: Tax statistics include only income taxpayers. All figures in 2010 prices.
Source: PIT microdata, own calculations.

Table B.7: Top income shares under simulated tax regimes including capital gains

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
100% rule (Scenario 1), PIT microdata simulation						
2001	36.17	24.83	11.40	8.54	4.63	1.97
2002	36.11	24.60	11.05	8.21	4.45	2.04
2003	35.52	24.05	10.54	7.72	4.07	1.83
2004	36.01	24.63	11.10	8.23	4.40	1.96
2005	38.51	26.91	12.93	9.89	5.74	2.88
2006	38.35	27.03	13.22	10.15	5.90	2.86
2007	39.55	28.14	14.04	10.83	6.33	3.13
2008	40.03	28.69	14.52	11.23	6.51	3.07
100% rule (Scenario 1), PIT statistics & capital income extrapolation						
2009	39.86	27.96	13.13	9.81	5.22	2.24
2010	39.76	27.86	13.07	9.78	5.23	2.28
50% rule (Scenario 2), PIT microdata simulation						
2001	35.29	23.99	10.66	7.85	4.11	1.71
2002	35.28	23.79	10.29	7.48	3.84	1.64
2003	34.89	23.44	9.98	7.20	3.64	1.55
2004	35.30	23.93	10.47	7.63	3.92	1.68
2005	37.28	25.71	11.81	8.81	4.81	2.25
2006	37.02	25.73	12.01	9.00	4.92	2.23
2007	38.09	26.73	12.72	9.58	5.30	2.47
2008	38.31	27.01	12.93	9.73	5.31	2.38
0% rule (Scenario 3), PIT microdata simulation						
2001	34.35	23.14	10.01	7.30	3.78	1.60
2002	34.58	23.18	9.84	7.10	3.61	1.56
2003	34.21	22.86	9.56	6.84	3.42	1.47
2004	34.60	23.33	10.02	7.25	3.69	1.58
2005	36.51	25.03	11.30	8.39	4.56	2.18
2006	36.21	25.02	11.49	8.56	4.68	2.18
2007	37.03	25.82	12.10	9.07	5.03	2.41
2008	37.05	25.90	12.13	9.06	4.92	2.25
0% rule (Scenario 3), PIT statistics						
2009	37.04	25.48	11.26	8.17	4.12	1.75
2010	37.77	26.11	11.73	8.62	4.47	1.95

Notes: Shares refer to income including capital gains. The 100%-rule includes capital income (interest & gross dividends) fully and corresponds to pre-2002 PIT legislation. The 50%-rule includes 37.5% of gross dividends and corresponds to PIT legislation from 2002 to 2008. The 0%-rule excludes capital income (interest & gross dividends) completely and corresponds to post-2008 PIT legislation.
Source: PIT microdata and PIT statistics, own calculations.

Table B.8: Top income shares under simulated tax regimes excluding capital gains

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
100% rule (Scenario 1), PIT microdata simulation						
2001	35.90	24.52	11.06	8.20	4.35	1.81
2002	35.56	23.98	10.38	7.54	3.84	1.59
2003	35.18	23.67	10.13	7.33	3.73	1.60
2004	35.59	24.16	10.61	7.75	3.99	1.68
2005	37.58	25.89	11.85	8.82	4.74	2.09
2006	37.58	26.19	12.32	9.27	5.11	2.30
2007	38.57	27.09	12.93	9.74	5.35	2.41
2008	39.52	28.13	13.89	10.61	5.94	2.68
50% rule (Scenario 2), PIT microdata simulation						
2001	35.07	23.72	10.36	7.56	3.87	1.59
2002	34.95	23.39	9.85	7.05	3.46	1.38
2003	34.68	23.19	9.71	6.93	3.42	1.42
2004	35.04	23.63	10.14	7.31	3.66	1.51
2005	36.78	25.12	11.15	8.16	4.22	1.81
2006	36.60	25.24	11.45	8.45	4.45	1.92
2007	37.55	26.11	12.04	8.92	4.72	2.08
2008	38.00	26.64	12.53	9.34	4.97	2.17
0% rule (Scenario 3), PIT microdata simulation						
2001	34.05	22.81	9.67	6.96	3.50	1.45
2002	34.15	22.69	9.31	6.59	3.16	1.25
2003	33.98	22.59	9.26	6.55	3.18	1.32
2004	34.32	23.01	9.67	6.91	3.40	1.40
2005	35.94	24.38	10.57	7.66	3.90	1.67
2006	35.74	24.48	10.88	7.96	4.15	1.82
2007	36.41	25.12	11.34	8.33	4.37	1.95
2008	36.53	25.36	11.58	8.53	4.47	1.97

Notes: Shares refer to income including capital gains. The 100%-rule includes capital income (interest & gross dividends) fully and corresponds to pre-2002 PIT legislation. The 50%-rule includes 37.5% of gross dividends and corresponds to PIT legislation from 2002 to 2008. The 0%-rule excludes capital income (interest & gross dividends) completely and corresponds to post-2008 PIT legislation.
Source: PIT microdata and PIT statistics, own calculations.

Table B.9: Thresholds and average incomes scenario 1

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
			including capital gains			
			thresholds			
2001	59,215	78,521	147,221	205,538	501,464	2,298,459
2002	58,352	77,497	142,781	196,034	454,624	2,009,571
2003	57,714	76,960	141,473	192,484	432,387	1,787,112
2004	58,983	78,867	147,957	204,238	475,373	2,065,177
2005	57,434	77,559	149,160	208,914	510,157	2,434,955
2006	57,917	78,647	155,309	219,561	549,753	2,777,135
2007	58,341	79,768	161,655	231,265	587,771	2,916,596
2008	58,213	80,053	165,672	239,832	630,374	3,106,838
			average incomes			
2001	107,748	147,922	339,748	508,594	1,378,991	5,876,776
2002	104,582	142,493	320,050	475,596	1,289,406	5,894,521
2003	102,379	138,652	303,752	445,188	1,171,779	5,281,754
2004	106,971	146,311	329,840	488,704	1,306,607	5,835,209
2005	109,841	153,516	368,875	564,293	1,636,373	8,223,341
2006	113,318	159,752	390,745	599,990	1,743,527	8,454,153
2007	117,181	166,791	415,910	641,772	1,876,316	9,282,352
2008	119,350	171,099	432,828	669,869	1,941,362	9,166,987
2009	114,736	160,948	378,022	564,843	1,503,082	6,455,928
2010	115,450	161,819	379,398	567,732	1,519,272	6,627,866
			excluding capital gains			
			thresholds			
2001	59,164	78,421	146,373	203,248	485,087	2,128,161
2002	58,291	77,374	141,786	193,524	436,678	1,746,086
2003	57,644	76,826	140,536	190,191	418,179	1,644,789
2004	58,912	78,725	146,835	201,577	458,316	1,873,993
2005	57,335	77,361	147,665	205,259	486,820	2,128,257
2006	57,809	78,429	153,641	215,448	522,324	2,402,005
2007	58,238	79,555	159,819	226,823	556,263	2,488,084
2008	58,246	80,089	165,158	237,909	612,523	2,827,034
			average incomes			
2001	106,420	145,333	327,802	486,089	1,288,976	5,378,064
2002	102,260	137,932	298,427	433,914	1,105,802	4,568,026
2003	100,908	135,807	290,752	420,617	1,069,730	4,584,455
2004	105,168	142,801	313,646	458,034	1,178,308	4,972,773
2005	106,174	146,319	334,769	498,363	1,340,656	5,908,803
2006	110,031	153,325	360,718	542,498	1,495,050	6,732,631
2007	113,255	159,082	379,572	571,946	1,570,159	7,088,053
2008	117,307	166,979	412,356	629,916	1,764,378	7,945,091

Notes: Tax statistics include only income taxpayers. All figures in 2010 prices. All figures are based on PIT microdata, with exception of the average incomes for 2009 and 2010 which stem from PIT statistics with added capital income extrapolation. 2009 and 2010 figures are only available including capital gains. Threshold incomes are not available for 2009 and 2010 as they would require distributional assumptions for the capital income.
Source: PIT microdata, PIT statistics, own calculations.

Table B.10: Sorting effect of capital income (including capital gains)

Year	Top 10%	Top 5%	Top 1%	Top 0.5%	Top 0.1%	Top 0.01%
non-capital income shares by sorting scheme						
Scenario 3: 0% rule income, sorted by 0% rule income						
2001	34.35	23.14	10.01	7.30	3.78	1.60
2002	34.58	23.18	9.84	7.10	3.61	1.56
2003	34.21	22.86	9.56	6.84	3.42	1.47
2004	34.60	23.33	10.02	7.25	3.69	1.58
2005	36.51	25.03	11.30	8.39	4.56	2.18
2006	36.21	25.02	11.49	8.56	4.68	2.18
2007	37.03	25.82	12.10	9.07	5.03	2.41
2008	37.05	25.90	12.13	9.06	4.92	2.25
Scenario 3b: 0% rule income, sorted by 100% rule income						
2001	34.12	22.92	9.80	7.08	3.57	1.46
2002	34.42	23.03	9.70	6.97	3.48	1.47
2003	34.08	22.73	9.44	6.72	3.31	1.40
2004	34.48	23.21	9.91	7.13	3.57	1.51
2005	36.39	24.92	11.19	8.26	4.42	2.07
2006	36.07	24.89	11.36	8.42	4.52	2.06
2007	36.86	25.66	11.94	8.90	4.85	2.29
2008	36.84	25.70	11.92	8.82	4.66	2.08
Sorting effect (Scenario 3b share as % of Scenario 3 share)						
annual						
2001	0.99	0.99	0.98	0.97	0.94	0.91
2002	1.00	0.99	0.99	0.98	0.96	0.94
2003	1.00	0.99	0.99	0.98	0.97	0.95
2004	1.00	0.99	0.99	0.98	0.97	0.95
2005	1.00	1.00	0.99	0.99	0.97	0.95
2006	1.00	0.99	0.99	0.98	0.97	0.94
2007	1.00	0.99	0.99	0.98	0.96	0.95
2008	0.99	0.99	0.98	0.97	0.95	0.92
Average sorting effect 2001–08 $\widehat{=}$ correction factor applied after 2009						
–	1.00	0.99	0.99	0.98	0.96	0.94

Notes: The sorting effect indicates the difference between the shares we observe in PIT statistics from 2009 onwards (0% rule income shares, tax units sorted by 0% rule income) and the shares that we need for extrapolation from 2009 onwards (0% rule income shares, tax units sorted by 100% rule income). We use the average difference between these two Scenarios to correct non-capital top income shares from PIT statistics before capital income extrapolation.
Source: PIT microdata, own calculations.

Appendix C Data

PIT Statistics

In Germany, there are two series of tabulated income tax statistics provided by Destatis: A payroll tax and income tax statistic is published every three years and includes both payroll and income taxpayers. These data are the source for the series 1891-1998 produced by Dell (2007). The personal income tax statistic is provided annually since 2001 and comprises all tax units that filed an income tax return in the respective year. These data are the source for the extension of the German series in the WTID by Dell (2011). Both data provide the number of tax units and reported income by income bracket. Threeannual data contain information on income composition by income bracket, additionally.

Tax Flow Statistics

Tax flow statistics are provided annually by Destatis and report aggregated tax flows by tax type. These types comprise the withholding tax on dividend income (since 1992) and on interest income (since 1993). Tax bases correspond to taxable income on the personal and on the corporate level. Since 2009, tax flows have continued to be reported for dividends and interest separately. However, the tax flow on interest has since been reported jointly with the tax flow on capital gains from stock shares.

Stock Market Indices

The most comprehensive German stock market index (CDAX) includes all German stocks that are traded on the Frankfurt stock exchange. There are two CDAX time series: the performance index describes the value of the market portfolio with reinvested dividends. The course index describes the value of the market portfolio without reinvested dividends. Both are corrected for events that have no impact on portfolio values, such as the issuing of new stocks. The dividend sum can be computed by multiplying the difference between the two indices' monthly growth rates by the market capitalization. Both indices are published as a monthly time series by the German Central Bank (*Bundesbank*) since 1994. Time series nos. are BBK01.WU001A (CDAX course index), BBK01.WU018A (CDAX performance index), and BBK01.WU080U (CDAX market capitalization, since 1999). For details on index computation see Deutsche Börse AG (2014). For the general method of deriving dividend yields and capital gain yields from stock market indices, see Dimson et al. (2002).

PIT Microdata

We use microdata on PIT returns from 2001 to 2008. The data is the full sample of all German income tax returns for these years and serves also as the basis for annual tabulated statistics. Like the annual statistics, these data do not contain tax units who receive wage income only and do not file an income tax return. The impact of these missing cases for the top is limited as explained in section 2. The data comprise details on the tax unit's income composition. In particular, the level of taxable capital gains, capital income and dividends are reported. The microdata are provided by Destatis via remote execution access.

Appendix D Changes to the Definition of Taxable Income in Germany

Capital income consisting of interest income and divideds gradually disappeared from the progressive PIT base over the past 15 years in Germany. Reforms since 2001 most frequently modified the taxation of dividends, but also the taxation of interest income and capital gains. Finally in 2009, the introduction of a flat tax on capital income (*Abgeltungsteuer*) removed this income source from the PIT base completely and consequently from income tax statistics as well. In the following, we describe regulatory changes to the taxation of capital gains and capital income and their impact on income tax data as a data source for the estimation of top income shares. Since we use both PIT statistics and PIT microdata, we focus on the reforms' impact on both gross taxable income as reported in the PIT statistics and the PIT microdata quality with respect to top incomes.

D.1 Composition of Taxable Income

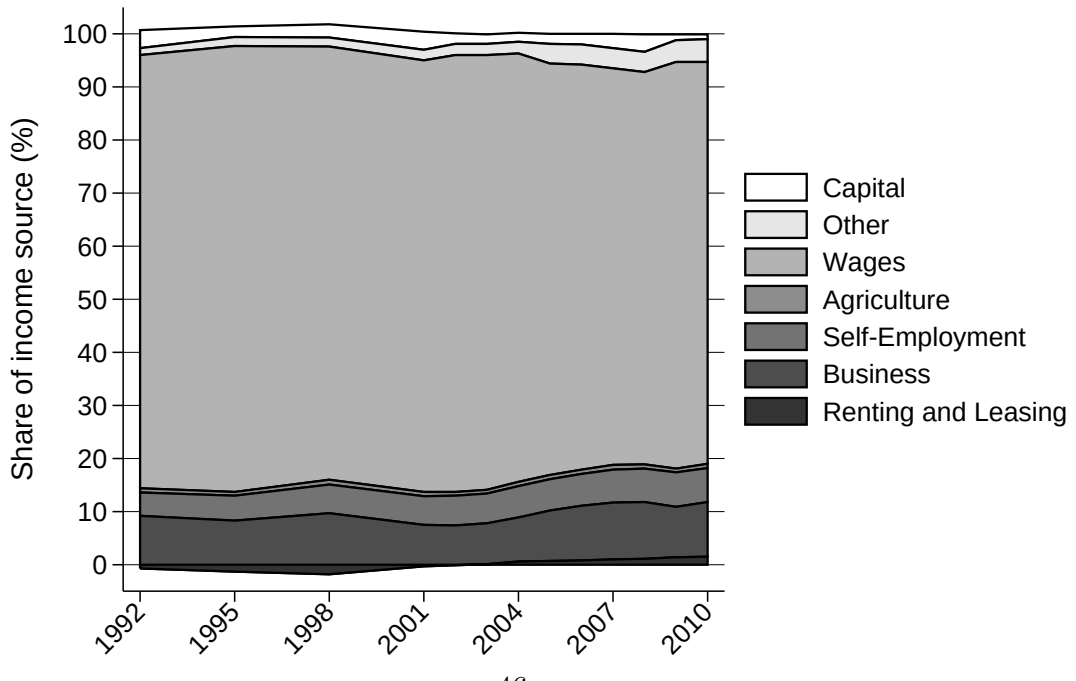
The composition of aggregate taxable income and its development over the period 1992-2010 is illustrated in Figure D.1. Wages are by far the most important income source in Germany amounting to about 80% of aggregate taxable income, whereas income from agriculture and forestry contribute an almost negligible share. The share of capital income consisting of interest income and dividends decreases sharply both after the exclusion of a large part of dividends in 2002 and after the introduction of a flat tax for capital income in 2009. Since then, capital income is not documented in income tax data with only few exceptions described in Section D.3.

Table D.1: Composition of aggregate taxable income in billion Euro)

	GTI[a]	A & F[b]	Business[c]	Self-Empl.	Wage[d]	Capital[e]	R & L[f]	Other[g]
				pre 2001/2002				
1992	792.6	6.2 (0.8)	73.4 (9.2)	35.1 (4.4)	649.1 (81.6)	27.4 (3.4)	-5.5 (-0.7)	10.2 (1.3)
1995	843.7	6.3 (0.7)	69.9 (8.3)	39.4 (4.7)	711.3 (84.0)	16.9 (2.0)	-11.3 (-1.3)	14.2 (1.7)
1998	890.9	7.7 (0.9)	86.7 (9.7)	48.6 (5.4)	729.5 (81.6)	22.7 (2.5)	-16.5 (-1.8)	15.2 (1.7)
2001	959.2	7.8 (0.8)	71.4 (7.5)	51.9 (5.4)	775.6 (81.3)	32.2 (3.4)	-3.3 (-0.3)	18.9 (2.0)
				50% Rule				
2002	949.9	7.0 (0.7)	70.2 (7.4)	52.6 (5.6)	776.5 (82.3)	19.3 (2.0)	-1.3 (-0.1)	19.4 (2.1)
2003	934.9	6.8 (0.7)	71.8 (7.7)	52.4 (5.6)	765.3 (81.9)	17.0 (1.8)	0.9 (0.1)	20.0 (2.1)
2004	945.5	7.2 (0.8)	78.8 (8.3)	55.3 (5.8)	767.4 (80.7)	16.4 (1.7)	5.1 (0.5)	20.5 (2.2)
2005	990.1	7.7 (0.8)	93.9 (9.5)	58.9 (5.9)	768.6 (77.5)	19.0 (1.9)	7.1 (0.7)	37.1 (3.7)
2006	1008.2	8.2 (0.8)	104.7 (10.3)	60.9 (6.0)	772.8 (76.3)	20.2 (2.0)	8.5 (0.8)	38.0 (3.8)
2007	1061.4	9.2 (0.9)	113.8 (10.7)	65.8 (6.2)	797.3 (74.7)	29.1 (2.7)	10.9 (1.0)	41.0 (3.8)
2008	1092.3	8.9 (0.8)	118.0 (10.7)	69.6 (6.3)	811.9 (73.9)	35.9 (3.3)	12.0 (1.1)	41.8 (3.8)
				Dual Tariff				
2009a[h]	1054.8	7.9 (0.7)	101.0 (9.5)	68.9 (6.5)	812.5 (76.6)	11.9 (1.1)	14.5 (1.4)	43.7 (4.1)
2009b[h]	1074.9	7.9 (0.7)	101.0 (9.4)	68.9 (6.4)	812.5 (75.4)	29.7 (2.8)	14.5 (1.3)	43.7 (4.1)

Notes: Values are in current billion €. Values in parentheses are the share of each income source in total taxable income. Annual tax statistics do not include non-filers (filing is not mandatory for tax units who earn exclusively wage income). [a]GTI: gross taxable income. [b]A & F: Agriculture and Forestry. [c]Business: unincorporated business income. [d] Wage: includes pensions from civil servants (Beamte) [e]Capital income: taxable dividends and interest income. [f]R & L: Renting and Leasing. [g]Other: predominantly pensions and some taxable capital gains (from stock shares and real estate). [h]2009a and 2009b define capital income differently: 2009a shows figures for those capital incomes that are taxed with the personal tax rate, and the corresponding GTI (tax statistics definition). 2009b additionally includes those capital incomes, that are taxed at the withholding tax rate, but are nonetheless reported in the PIT files. Capital income shares in 2009b refer to a correspondingly corrected measure of GTI.
Source: own calculation based on Destatis (1996, 1998-2007, 2000, 2001-2010).

Figure D.1: Composition of taxable income in Germany, 1992-2010



Source: Own calculations since 2001.

D.2 Taxation of Capital Gains

German tax law distinguishes five types of capital gains: capital gains from financial assets (i), capital gains from real estate (ii), capital gains from selling a not incorporated business (iii), capital gains from selling shares of a closely held corporation (iv) and capital gains realized inside the unincorporated business sphere (v).[28] In post-war Germany, a large portion of these capital gains has always been tax exempt. As a consequence, private capital gains reported in German tax statistics are fairly low[29] and can only be reconstructed partly by using PIT microdata.

Capital gains from financial assets (i) and real estate (ii) were tax exempt if held longer than a certain time period. We therefore observe them only to a limited degree in microdata. For those capital gains from stock shares that were reported, only 50% were taxable between 2002 and 2008. For capital gains from financial assets, this exemption ended in 2009: since then, they have been excluded from the PIT and instead fully subject to the flat tax on capital income.[30]

Capital gains from selling an unincorporated business (iii) are only taxable if exceeding a quite elevated threshold. But if these capital gains exceed the threshold, the taxable share is reported quite consistently in PIT files over time. Capital gains from selling shares of a corporation (iv) are taxable if the tax unit's share exceeds a certain threshold.[31] Capital gains of this type typically stem from closely held companies, but apply to stock company shares as well, if the tax unit's capital share is high enough. Capital gains (iv) have thus always been included in PIT files, and their size is reconstructible from micro data. Their taxable share, however, changed from 100% before 2002 to 50% in 2002, and 60% in 2009. Their contribution to gross taxable income in PIT statistics is thus mechanically reduced in 2002 and slightly increases again after 2009.

Last, capital gains can also be realized inside the business sphere (v) as part of the business profit. In these cases, we do not observe capital gains as such in the microdata, but it is included in the business profit and therefore in gross taxable income. This might be relevant after 2009, as it has become more attractive to shift capital income to the business sphere.

As capital gains from financial assets and real estate have been mostly tax

[28]None of the five types of capital gains was ever part of the PIT's definition of capital income until 2009. Type (i) and (ii) were classified as "other" income, and type (iii) to (v) accrue to agriculture and forestry, self-employed, or business income. Only type (i) has been classified as capital income since 2009, if it is reported in the PIT file.

[29]In some years, capital gains reported in tax statistics were even negative in sum, as losses were deductible from other income sources under certain conditions.

[30]For financial assets (i), this period was six months until 1998 and one year from 1999 to 2008. For real estate, the period was two years until 1998 and since then ten years.

[31]The threshold for corporation shares was 1% until 1995, 25% from 1996 to 1998, 10% from 1999 to 2001, and since then 1% again.

exempt, capital gains in German PIT files predominantly stem from selling unincorporated businesses (iii) and corporation shares (iv) where the tax unit holds a considerable share.

D.3 Taxation of Capital Income

In the last two decades, two tax reforms (2001/02, 2009) reduced the level of taxable capital income and hence reduced the level of gross taxable income (GTI) (*Gesamtbetrag der Einkünfte*) reported in PIT files. As capital income is concentrated at the top of the income distribution, top income shares based on PIT statistics are also reduced mechanically. Reforms mainly changed the taxation of dividends. Legislative changes to the taxation of capital income are summarized in Table D.3.

Table D.2: Changes in the Definition of Taxable Capital Income

		GTI Definition in PIT
pre 2001		$Y_{non\text{-}cap} + (INT - Deduct_{INT}) + (D_{gross} - Deduct_{D_{gross}})$
2001/02–2008		$Y_{non\text{-}cap} + (INT - Deduct_{INT}) + (D_{gross} \cdot (1 - t_{corp}) - Deduct_{D_{gross}}) \cdot 0.5$
since 2009	(i)	$Y_{non\text{-}cap} + INT + (D_{gross} \cdot (1 - t_{corp})$
	(ii)	$Y_{non\text{-}cap}$
	(iii)	$Y_{non\text{-}cap} + Y_{shifted}$

Notes: $Y_{non\text{-}cap}$: personal income other than capital income (not affected by reforms) D_{gross}: gross dividend before corporate taxation; INT: interest income; Deduct: deductions always refer to expenses that directly relate to the tax base. t_{corp}: corporation tax rate applied to dividends
Source: German income tax law (ESTG).

Pre 2001

- Dividends from German corporations are subject to the corporation tax. Before 2001, the corporation tax on distributed dividends was a pure pre-tax to the PIT. The gross dividend, say, e.g., 100 €, was subject to the corporation tax of 30%. The shareholder received the cash dividend of 70 €. However, the shareholder's GTI comprised the full gross dividend of 100 €, which was then taxed at the personal tax rate. The corporation tax could be credited against the resulting PIT tax claim. GTI before 2001 thus included gross dividends before taxes on the corporation level.
- Interest income was also fully taxable at the personal PIT rate.
- Capital income related expenses[32] could be fully deducted and therefore reduced GTI.

[32]These are, e.g., capital costs, travel expenses related to general meetings, etc.

Table D.3: Changes in Capital Income Taxation

	pre 2001	2001/02–2008	since 2009
	Gross Dividends (D_{gross})		
tax base	100%	$(1 - tcorp) * 50\%$	$(1 - tcorp) * 100\%$
deductions	100%	50%	–
tax rate	PIT	PIT	$min(W, PIT)$
corp. tax credit	*yes*	*no*	*no*
income source	*capital*	*capital*	*capital*
	Interest (INT)		
tax base	100%	100%	100%
deductions	100%	100%	–
tax rate	PIT	PIT	$min(W, PIT)$
income source	*capital*	*capital*	*capital*
	Cap. Gains from Stock Shares (GC I)		
tax base	100%	50%	100%
deductions	100%	50%	–
tax rate	PIT	PIT	$min(W, PIT)$
definition	$specific\ cases^a$	$specific\ cases^a$	$comprehensive^b$
income source	*other*	*other*	*capital*
	Cap. Gains from Closely Held Corporations (GC II) & Dividends / CG I in Private Business Sphere		
tax base	100%	50%	60%
deductions	100%	50%	60%
tax rate	PIT	PIT	PIT
income source	*business*	*business*	*business*
tcorp(%)	30%	25%	15%

Notes: D_{gross}: gross dividend before corporate taxation; INT: interest income; CG I: capital gains from stock shares; CG II: capital gains from closely held corporations; deductions always refer to expenses that directly relate to the tax base. [a]specific cases: CG I were only taxable if the assets had been held less than one year. [b]comprehensive: all CG I are taxable if the assets were acquired in 2009 or later. Otherwise, CG I are still tax exempt.
Source: German income tax law (ESTG)

2001/2002-2008: 50% Rule

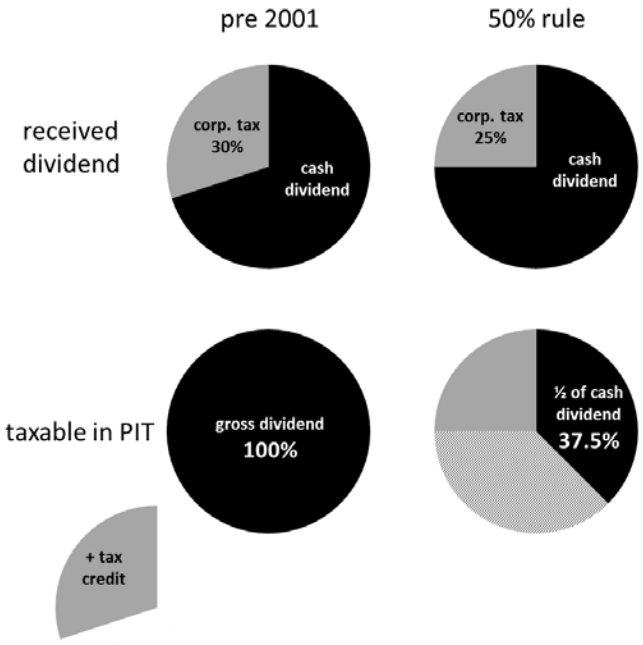
- The definition of taxable dividend income in the PIT changed in 2001/2002.[33] Instead of gross dividends, the new taxable income definition was half the cash dividend (50% rule; 35 € in the example above). At the same time, the corporate level taxes could not be credited against the PIT any more. The resulting effective tax rate on the gross dividend was comparable to the tax rate before 2001/2002,

[33]For dividends issued by German corporations, legislative changes started to apply in 2002 in most cases. This was the case for the largest share of dividends.

but GTI observed in the income tax data was considerably reduced. In addition, the 50% rule also applied to capital gains from corporation shares (if taxable), which similarly reduced GTI if capital gains were positive (see section 2.1).

- Interest income remained fully taxable at the personal PIT rate.
- Only half of the capital income related expenses could be deducted, as far as the expenses were related to dividends. Capital income related expenses that stemmed from interest income remained fully deductible.

Figure D.2: Changes in definition of taxable dividends



Notes: Pre 2001: 100% of the gross dividend before corporate taxation entered GTI. The 50% rule reduced the share to 37.5%. Effective tax rate changed only to a little extent, as the tax credit was abolished at the same time.
Source: German income tax law.

Post 2009: Dual Tariff

Since 2009, capital income is not included in the PIT schedule any more and thus in PIT files neither. Capital income from dividends, interest income, and capital gains from stock shares are taxed at a flat withholding tax rate of 25% instead (see Jenderny, 2015 for a detailed description of the reform components).[34] At the

[34]This reform also broadened the tax base, since capital gains from stock shares were typically not taxable before 2008. Before 2008, capital gains from stock shares were only taxable if the shares had been held less than one year. However, the base broadening only applies to stock shares that have been obtained after 2008. We therefore do not expect any effect of the tax base broadening in 2009, but an increasing effect on taxable capital income since 2010.

same time, negative capital income and capital income related expenses cannot be deducted from taxable income any more. However, it is still possible to report capital income in the PIT and is favorable for the tax unit in the following cases:

(i) If the personal tax rate undercuts the withholding tax rate, the personal tax rate is applied. In these cases, the reported capital income is also included in the tax units' GTI.

(ii) Capital income is only taxable as far as it exceeds the saver's allowance of 810 €. Some tax units do not claim the full allowance towards the institutions that withhold the tax (e.g. banks, corporations). Then, the allowance can be obtained by reporting capital income in the PIT file. Capital income above the allowance is then taxed at the withholding tax rate (or with the personal tax rate in case (i)). In these cases, the reported capital income is not included in the tax units' GTI.

(iii) If capital income is realized in the private business sphere instead of the private sphere, the former 50% rule is changed to a new 60% rule: 60% of cash dividends and capital gains from stocks are taxable at the personal PIT rate, and 100% of interest income. In turn, the same share (60% or 100%) of capital related expenses is deductable again. Therefore, shifting capital income from the private to the business sphere is favorable for tax units with high capital related expenses. Before the introduction of the reform, this type of shifting was indeed recommended by the tax adviser literature (Maier and Wengenroth, 2007, Worgulla and Söffing, 2007). The 60% rule also applies (in any case) to capital gains from closely held corporations' shares (see Section 2.1). If capital income has been shifted to the business sphere, it is reported in the PIT records again, albeit only 60% of dividends and capital gains from corporation shares enter the GTI definition. In addition, this capital income is reported as business income.

The tariff dualization reduced the capital income observed in the PIT to zero in most cases. Only capital income that is taxed at the personal tax rate is still included in GTI and reported in tax statistics (case (i)). If the savers' allowance was not fully claimed, capital income is still reported, but not included in GTI and not necessarily reported in income tax statistics (case (ii)). Last, a portion of capital income is likely to have been realized in the private business sphere reported as business income in the PIT files. Consequently, in the first post-reform year 2009, the capital income share in positive GTI as reported in tax statistics dropped from 3.3% in 2008 to 1.1% in 2009.[35]

[35] Table D.4 shows the share of capital incomes in GTI since 1992.

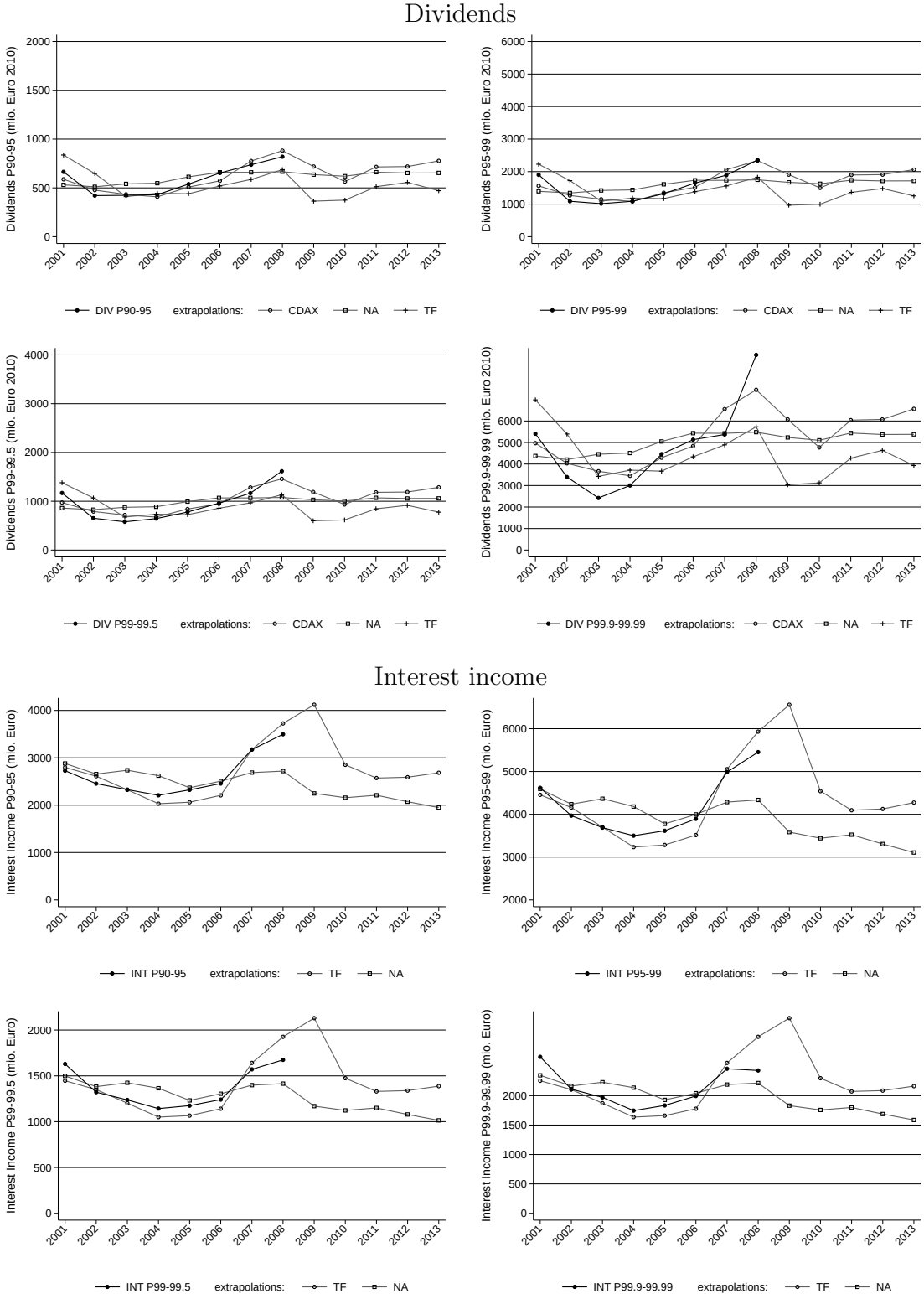
Table D.4: Taxable income composition by fractile

Fractile	GTI (€)	Composition of GTI (% of GTI)								CG (% of GTI)	
		GTI	a&f	bus	self	wage	cap	r&l	other	business	private
						2001					
0.01	5,740,096	100.00	0.30	60.67	2.38	9.22	23.81	0.37	0.75	11.96	-0.17
P99.9–99.99	873,837	100.00	0.83	32.22	15.92	27.15	19.84	1.22	0.70	6.19	-0.50
P99.5–99.9	291,011	100.00	0.85	15.45	27.33	42.79	9.96	0.21	0.69	2.25	-0.27
P99–99.5	171,040	100.00	0.89	11.53	22.07	58.52	5.26	-0.38	0.68	0.80	-0.17
P95–99	100,026	100.00	0.83	7.59	8.38	80.59	2.28	-0.45	0.53	0.27	-0.04
P90–95	67,605	100.00	0.68	5.05	2.95	89.87	1.27	-0.35	0.48	0.11	-0.04
						2002					
0.01	4,879,585	100.00	0.53	72.17	4.05	9.66	11.05	1.03	0.89	23.14	0.14
P99.9–99.99	717,663	100.00	0.91	29.60	21.51	30.90	9.88	2.28	0.78	7.03	-0.07
P99.5–99.9	265,366	100.00	0.79	16.16	29.26	46.14	5.14	0.75	0.68	2.08	0.06
P99–99.5	162,995	100.00	0.83	11.42	21.49	61.96	2.92	0.10	0.66	0.82	0.05
P95–99	97,855	100.00	0.73	7.12	7.87	82.37	1.44	-0.20	0.52	0.24	0.03
P90–95	66,615	100.00	0.62	4.87	2.93	90.35	0.94	-0.21	0.49	0.10	0.01
						2003					
0.01	4,566,071	100.00	0.49	73.56	4.05	9.33	9.32	1.36	1.31	13.11	0.46
P99.9–99.99	672,551	100.00	0.91	33.66	23.06	29.42	8.32	2.76	0.95	5.45	0.41
P99.5–99.9	257,612	100.00	0.79	16.58	29.19	46.47	4.39	1.22	0.74	1.70	0.21
P99–99.5	160,766	100.00	0.84	11.67	20.96	62.56	2.62	0.33	0.71	0.62	0.15
P95–99	97,069	100.00	0.71	7.09	7.72	82.52	1.30	0.03	0.55	0.21	0.08
P90–95	66,016	100.00	0.62	4.90	2.93	90.23	0.87	-0.06	0.53	0.07	0.04
						2004					
0.01	5,060,803	100.00	0.30	75.46	3.42	9.16	9.09	1.42	1.09	14.60	0.50
P99.9–99.99	746,177	100.00	0.91	37.35	21.74	28.36	7.60	3.20	0.88	5.26	0.48
P99.5–99.9	276,635	100.00	0.89	18.50	29.80	44.00	4.28	1.91	0.73	1.80	0.25
P99–99.5	169,073	100.00	0.95	12.99	22.07	59.86	2.54	1.02	0.70	0.62	0.17
P95–99	100,078	100.00	0.82	7.74	8.29	80.99	1.28	0.45	0.56	0.23	0.09
P90–95	67,539	100.00	0.68	5.26	3.12	89.46	0.84	0.26	0.53	0.08	0.04
						2005					
0.01	6,613,365	100.00	0.24	77.93	2.95	9.15	8.30	0.74	0.67	24.33	0.53
P99.9–99.99	817,761	100.00	0.81	38.07	19.93	28.72	8.38	3.05	1.10	6.29	0.65
P99.5–99.9	286,471	100.00	0.88	19.50	28.66	43.62	4.47	2.01	0.96	2.15	0.37
P99–99.5	171,157	100.00	0.99	13.50	21.85	58.93	2.52	1.34	1.00	0.80	0.27
P95–99	99,245	100.00	0.89	7.95	8.30	80.15	1.30	0.69	0.86	0.24	0.14
P90–95	66,041	100.00	0.75	5.41	3.09	88.67	0.88	0.46	0.94	0.09	0.07
						2006					
0.01	6,766,318	100.00	0.33	77.89	2.83	9.84	7.03	0.57	1.51	20.71	1.25
P99.9–99.99	892,534	100.00	0.89	40.66	17.45	28.01	8.86	2.76	1.42	6.24	0.94
P99.5–99.9	302,308	100.00	0.98	21.18	26.82	43.12	4.75	2.17	1.08	2.12	0.48
P99–99.5	178,713	100.00	1.05	14.78	21.77	57.18	2.77	1.54	1.04	0.78	0.30
5P95–99	101,462	100.00	0.99	8.97	8.80	78.20	1.43	0.85	0.89	0.24	0.15
P90–95	66,735	100.00	0.80	5.98	3.28	87.70	0.94	0.55	0.95	0.08	0.08
						2007					
0.01	7,416,255	100.00	0.36	78.21	3.04	8.79	7.75	0.53	1.30	19.66	0.98
P99.9–99.99	940,272	100.00	0.95	41.28	17.00	27.45	9.38	2.42	1.57	6.61	1.03
P99.5–99.9	318,904	100.00	1.16	21.13	26.36	42.08	5.94	2.31	1.12	2.19	0.48
P99–99.5	186,618	100.00	1.29	14.95	22.71	54.64	3.74	1.76	1.05	0.83	0.25
P95–99	103,895	100.00	1.18	9.24	9.12	76.46	2.11	1.10	0.93	0.26	0.14
P90–95	67,406	100.00	0.88	6.17	3.37	86.58	1.45	0.76	0.99	0.09	0.07
						2008					
0.01	7,261,580	100.00	0.35	74.92	2.93	8.75	11.46	0.66	0.93	13.33	-0.12
P99.9–99.99	976,117	100.00	0.92	41.87	15.94	25.85	11.96	2.52	0.99	5.80	-0.46
P99.5–99.9	331,312	100.00	1.07	22.69	26.18	39.59	7.30	2.38	0.90	2.01	-0.38
P99–99.5	191,375	100.00	1.18	16.41	22.95	52.39	4.47	1.76	0.97	0.74	-0.24
P95–99	105,034	100.00	1.09	9.79	9.42	75.33	2.43	1.19	0.90	0.23	-0.13
P90–95	67,475	100.00	0.81	6.11	3.44	86.35	1.65	0.82	1.02	0.08	-0.08

Notes: Fractiles defined including capital gains. Average GTI in prices of 2010.
Source: PIT microdata, own calculations.

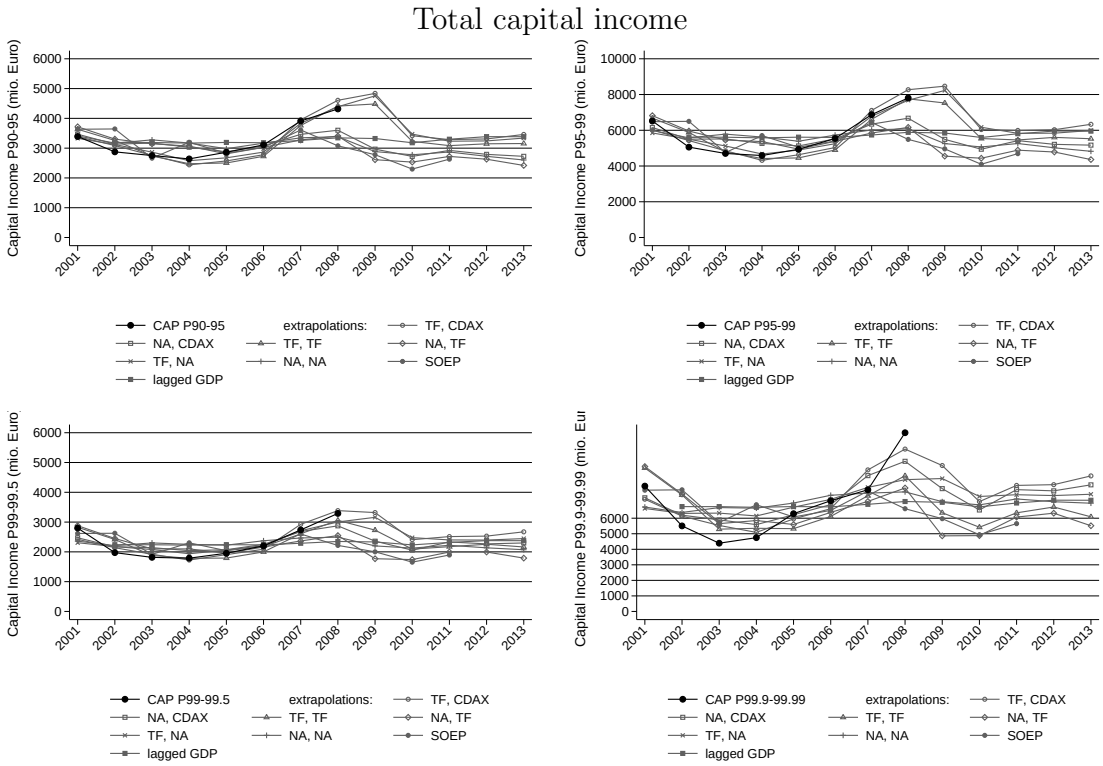
Appendix E Imputing Missing Capital Income, 2009–2010

Figure E.1: PIT Fractile Totals and Extrapolations



Notes: Real values in 2010 prices.
Source: Own calculations using PIT Microdata, tax flow statistics, PIT Statistics, stock market indices (CDAX), and German national accounts.

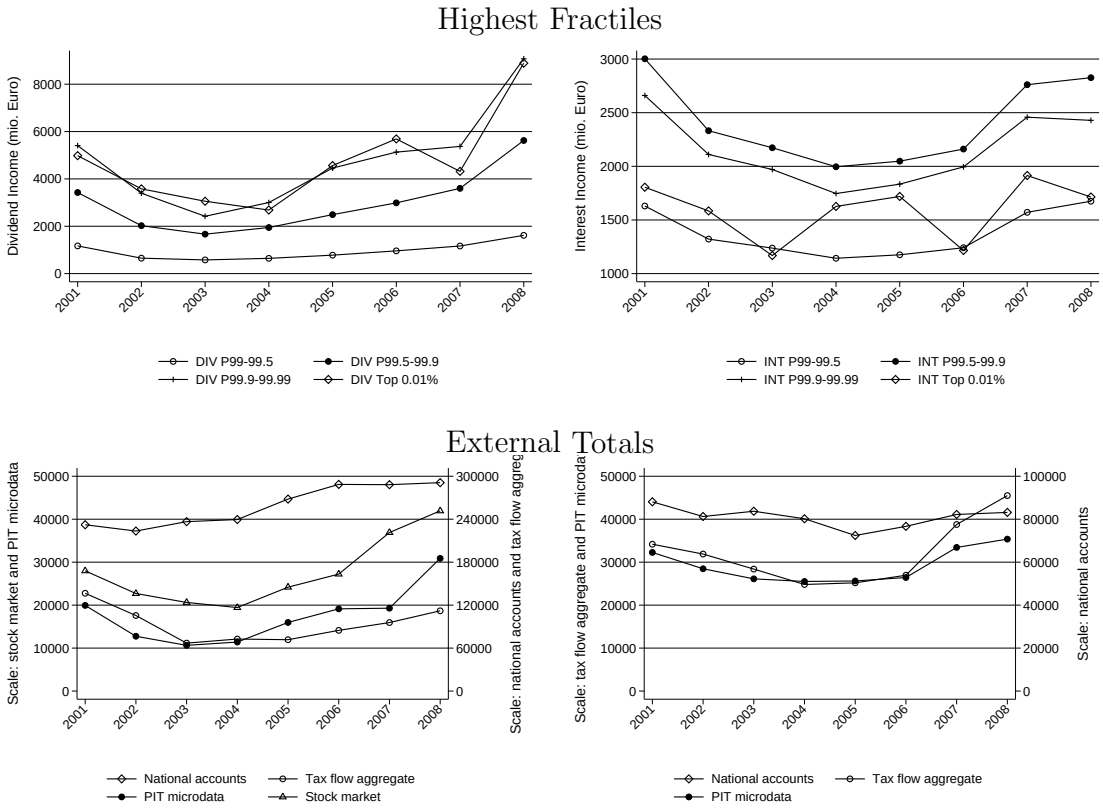
Figure E.2: PIT Fractile Totals and Extrapolations



Notes: Real values in 2010 prices. Extrapolations combine the sources given in Figure E.1. Sources give interest income source first and dividends source second. In addition, total capital income is extrapolated using SOEP survey data (capital income of P90–99 fractile) and lagged GDP.

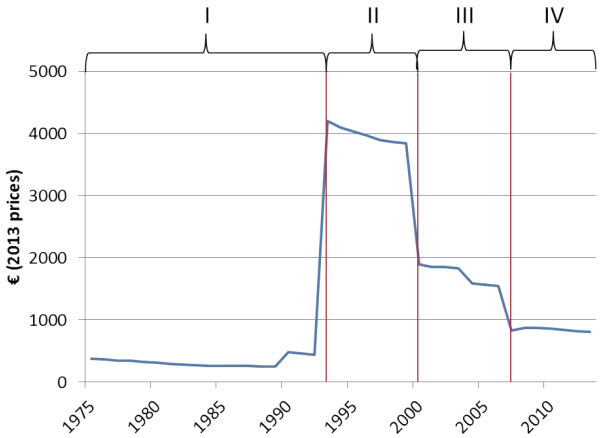
Source: Own calculations using PIT Microdata, tax flow statistics, PIT Statistics, stock market indices (CDAX), and German national accounts.

Figure E.3: Highest Fractiles: Correlation with External Totals



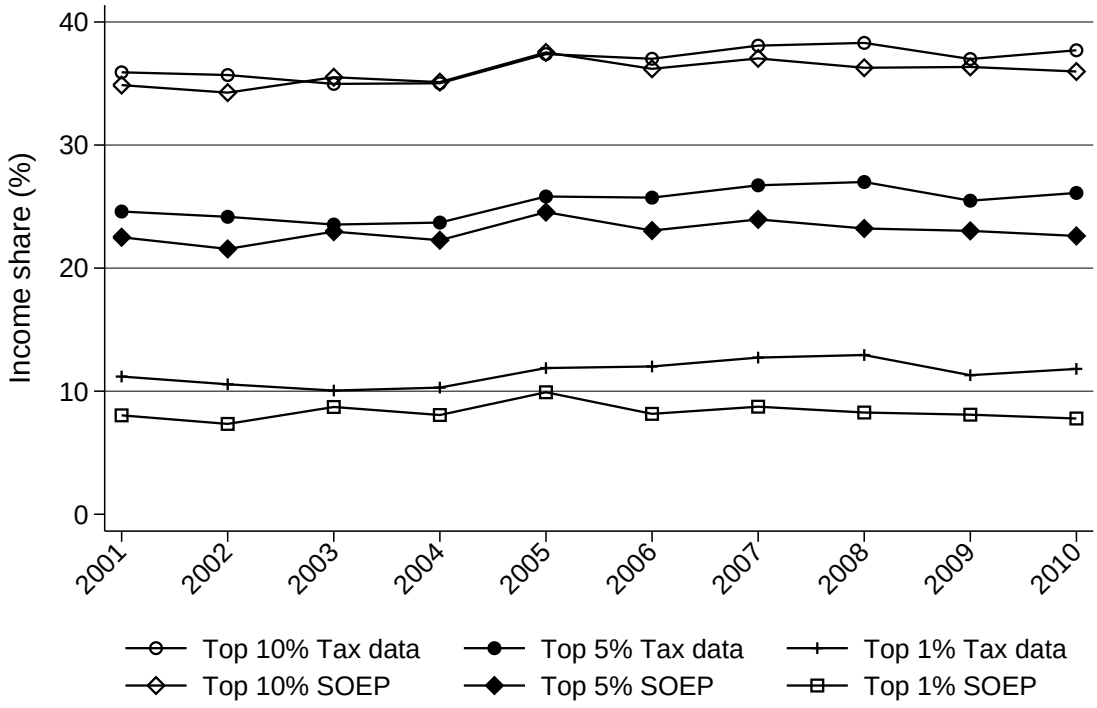
Notes: Real values in 2010 prices. Dashed lines are 95% confidence intervals for forecasts. Capital Income extrapolations include all combinations of the interest and dividend extrapolations, as well as extrapolations of total capital income based on capital income in the SOEP survey (P90–99 average capital income) and lagged GDP.
Source: Own calculations using PIT Microdata, Tax flow statistics, Tabulated Income Tax Statistics, stock market indices (CDAX), and German national accounts.

Figure E.4: Evolution of Real Saver's Allowance, 1975–2013



Notes: All figures in real prices 2013. Phases I to IV separate phases of comparable levels of the savers' allowance
Source: Own calculations using German income tax law and German consumer price index.

Figure E.5: Top income shares using SOEP data, 2001-2011



Notes: Fractile thresholds are obtained from PIT statistics using mean-split histogram method.
Source: PIT statistics, SOEP data, own calculations.