

Schächtele, Simeon

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Deduction Responses to the Income Tax: Bunching Evidence from Germany

Simeon Schächtele*

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Preliminary – comments are welcome

This paper uses German tax administration to study deduction behavior in response to the income tax. Analyzing the bunching patterns at the personal allowance threshold, it documents that (i) there is no bunching for taxpayers who do not file a tax declaration, (ii) bunching increases with the importance of non-wage income, (iii) there is no bunching in tax income measures gross of deductions and (iv) deductions increase with ex-post proximity to the allowance threshold and are particularly large right at that threshold. Applying Saez' (2010) estimator, the estimated bunching mass translates into an observed taxable income elasticity in the order of 0.1. It is argued that this bunching mass is unlikely to arise from labor supply responses and instead due to deduction behavior. Because the economic implications of these response margins differ and observed overall elasticities may well depend on deduction and enforcement rules, this reinforces the need to quantify the welfare impacts of deduction policies and to exercise caution in interpreting the taxable income elasticity as a structural parameter that determines optimal tax rates independent of other policy instruments. (*JEL* H21, H24, H26)

Keywords: income tax; bunching; deductions; tax avoidance; elasticity of taxable income; administrative data; Germany

*University of Erlangen-Nuremberg (simeon.schaechtele@fau.de). I am grateful for valuable advice from Ulrich Glogowsky, Dominik Fischer, Gergely Horvath, Florian Auferoth, Florian Englmaier, Carina Woodage, Britta Kohlbrecher, and seminar participants at the University of Erlangen-Nuremberg (FAU), the University of Munich (LMU) and the Evidence-Based Economics Summer Meeting 2016, as well for support from the Research Data Centre of the Federal Statistical Office and the Statistical Offices of the Länder. I also gratefully acknowledge funding through the International Doctoral Program 'Evidence-Based Economics' of the Elite Network of Bavaria.

1 Introduction

In industrialized countries, the personal income tax is among the most important sources of government revenue and is often ascribed a key role in redistribution. Like most other forms of taxation it changes relative prices, thereby creating incentives to change economic behavior and entailing the possibility of efficiency losses. Whether for tax revenue, excess burden or equity-efficiency trade-off calculations, the size of the reaction of the tax base is of crucial importance. This reaction size is summarized in the elasticity of taxable income with respect to the net-of-tax rate (ETI), rendering this behavioral measure a key parameter in optimal taxation. While the importance of the ETI for optimal taxation is undisputed, its sufficiency property for efficiency calculations derived by Feldstein (1999) is compromised if the taxable income response generates externalities (Chetty, 2009a), fiscal (Slemrod, 1998) or otherwise. Because the availability of deduction possibilities is at least partially motivated precisely by the existence of interpersonal or intertemporal externalities, deductions constitute an important response margin category with potentially different welfare implications than e.g. a labor supply response (Doerrenberg et al., 2015). Moreover, if the elasticity is a function of non-tax rate policy instruments such as the availability of deductions or the strength of enforcement, interpreting the ETI as an immutable structural parameter could lead to wrong policy conclusions (Slemrod and Kopczuk, 2002; Kopczuk, 2005).

Using German tax administration data from 2007, the present paper analyses the behavioral reactions of taxpayers to the personal income tax through the lens of bunching at kink points. Applying Saez' (2010) bunching estimator to the personal allowance threshold in the income tax schedule yields local ETI estimates in the order of 0.1. If there are adjustment frictions, this 'observed elasticity' may differ from the 'structural elasticity' that governs longer-term labor supply reactions (Chetty et al., 2011; Chetty, 2012). The amount of bunching found at the personal allowance threshold, however, appears difficult to reconcile with a labor supply response given evidence of nontrivial frictions in adjusting earnings (e.g. Gelber et al., 2015). While the German income tax schedule and data is not ideally suited to separately identify the size of adjustment frictions and the ETI, it lends itself almost perfectly to studying what seems to be a plausible alternative response channel, namely tax deduction and filing behavior. In this respect I observe that (i) there is no bunching for taxpayers who do not file tax declaration; (ii) bunching increases with the importance of non-wage income, (iii) there is no bunching at the allowance threshold for income gross of deductions and (iv) mean and median deductions increase with proximity to the taxable income allowance threshold and are

especially large right at the kink. Taken together, these findings are strongly suggestive of a key role for deduction behavior in generating the observed bunching patterns. They are also in line with a recent study by Doerrenberg et al. (2015), who also find a strong deduction response using a different method.

The remainder of this article is organized as follows. The next section reviews the bunching approach pioneered by Saez (2010) and the estimation procedure developed by Chetty et al. (2011). Section 3 outlines the German income tax system and introduces the data set used for the present analysis. The results from the bunching estimations and the evidence concerning deduction behavior are presented in section 4. The final section concludes with a discussion of the results and avenues for further research.

2 Bunching theory and estimation

2.1 The bunching model

Building on earlier research on nonlinear budget set estimation, Saez (2010) pioneered an approach to estimate the ETI from bunching in taxable income at discontinuities in the marginal tax rate schedule. His key insights were that (i) bunching at such discontinuities is indicative of a behavioral response to taxation and that (ii) the amount of bunching is related to the ETI. This subsection briefly reviews Saez' well-known model and estimator. An extended model that allows gauging the implications of adjustment frictions (following Gelber et al. (2015)) is relegated to the appendix.

Consider taxpayers whose utility depends positively on after tax-income c and negatively on taxable income z . Taxpayers differ in how costly it is for them to generate taxable income z ; this heterogeneity is captured in the ability parameter n . For concreteness assume the standard utility function in the literature, namely the quasi-linear and isoelastic function $u(c, z) = c - n^{-\frac{1}{e}} \cdot \frac{z^{1+1/e}}{1+1/e}$.¹ In this model e represents the elasticity of taxable income with respect to the net-of-tax rate.² Taxpayers maximize utility subject to the budget constraint $c = z - T(z)$, where $T(z)$ denotes the tax and transfer schedule. The bunching method features a conceptual comparison of the true schedule $T(z)$ with a convex kink at taxable income z_K , with a counterfactual locally linear

¹The quasi-linear specification rules out income effects so that the uncompensated elasticity necessary for revenue calculations and the compensated elasticity required for efficiency calculations coincide. Because income effects appear to be small (Gruber and Saez, 2002) and unlikely to bias elasticity estimates from bunching (Bastani and Selin, 2014), I follow the literature in assuming quasi-linear utility and do not distinguish between compensated and uncompensated elasticities.

² e can be heterogeneous across agents, in which case bunching is related to the average response and the elasticity identified is a local average elasticity.

schedule $T_0(z) = t_0 z + R$. Assuming that the distribution of ability in the population is smooth, the counterfactual taxable income distribution, with density $g_0(z)$, is also smooth and arises directly from the first-order condition $z = [1 - T'(z)]^e \cdot n = (1 - t_0)^e \cdot n$ and the ability distribution. With the marginal tax rate of the true tax schedule rising discretely from t_0 to t_1 at the threshold z_K , in contrast, the observed taxable income distribution features excess mass at the kink, arising from agents for whom the corner solution at the kink is optimal.³ As under the model the ‘bunching’ taxpayers are those with counterfactual taxable incomes in a neighborhood above z_K , the extent of bunching allows to recover the ‘marginal buncher’s’ taxable income response Δz to the marginal tax rate increase from t_0 to t_1 . Specifically, the bunching taxpayers are those with $n \in [\frac{z_K}{(1-t_0)^e}, \frac{z_K}{(1-t_1)^e}] \equiv [\underline{n}, \bar{n}]$, or equivalently, those with counterfactual taxable income $z_0 \in [z_K, (\frac{1-t_0}{1-t_1})^e z_K] \equiv [z_K, z_K + \Delta z]$, while all others prefer interior solutions either below ($n < \underline{n}$) or above ($n > \bar{n}$) the kink.⁴ The mass of bunching individuals B is hence $\int_{z_K}^{z_K + \Delta z} g_0(z) dz$, or approximately $g_0(z_K) \cdot \Delta z$. In other words, the excess mass relative to the counterfactual density at the kink, $b \equiv \frac{B}{g_0(z_K)}$, is approximately equal to the response $\Delta z = (\frac{1-t_0}{1-t_1})^e - 1 \cdot z_K$, from which the ‘observed’ elasticity follows as $e \approx \ln(\frac{b}{z_K} + 1) / \ln(\frac{1-t_0}{1-t_1})$.

2.2 Estimation

For estimating the counterfactual taxable income distribution and the standard errors for the associated estimate of b , I rely on Chetty et al.’s (2011) procedure. That is, I first collapse taxable income frequencies into bins of taxable income centered at the kink using the available sampling weights and then estimate the following regression on these taxable income bin counts:

$$c_j = \sum_{i=0}^p \alpha_i^0 (z_j)^i + \sum_{i=z_L}^{z_U} \beta_i^0 \mathbb{1}[z_j = i] + v_j^0,$$

where the dependent variable c_j is the number of observations in bin j , p denotes the order of the taxable income polynomial, z_L and z_U the lower and upper bounds of the bunching window and v_j the error term. The superscript 0 indicates that this

³In practice, due to uncertainty and imprecise control over final taxable income, bunching does not occur sharply at the kink, but also in some neighborhood around it. There may also be fixed adjustment costs so large that fewer or even no individuals find it profitable to bunch. This is more likely the smaller the change in marginal incentives from t_0 to t_1 and hence provides a rationalization for the fact that no bunching is observed at the kink at the top of the taxable income distribution (see Figure 2 below).

⁴In other words, \underline{n} is the upper limit for interior solutions weakly smaller than z_K , i.e. $z_K = (1 - t_0)^e \cdot \underline{n}$, and \bar{n} is the lower limit for interior solutions weakly larger than z_K , i.e. $z_K = (1 - t_1)^e \cdot \bar{n}$.

regression is only a first pass because the resulting estimated counterfactual distribution $\hat{c}_j^0 = \sum_{i=0}^p \hat{\alpha}_i^0(z_j)^i$ fails to abide by the integration constraint that the area under the empirical distribution should equal the area under the counterfactual distribution. For this reason, the counterfactual density to the right of the kink is shifted upwards by the initially estimated excess mass $\hat{B}_0 = \sum_{i=z_L}^{z_U} \hat{\beta}_i^0$ and the estimation repeated until the integration constraint is met.⁵ The thus corrected counterfactual $\hat{c}_j = \sum_{i=0}^p \hat{\alpha}_i(z_j)^i$ and estimated number of bunchers $\hat{B} = \sum_{i=z_L}^{z_U} \hat{\beta}_i$ yields an estimate of the excess mass relative to the average counterfactual density in the bunching window as $\hat{b} = \hat{B} \cdot (z_U - z_L + 1) / \sum_{i=z_L}^{z_U} \hat{c}_i$. Standard errors are obtained via bootstrapping, i.e. by adding random draws from the error vector to the predicted count data and repeating the estimation procedure (cf. Chetty et al., 2011).

Bunching analysis is to a large extent a graphical technique. In the empirical application reported below the bin width employed around the personal allowance kink is 100 € Euro and the bunching windows $[z_L, z_U]$ are chosen in accordance with visual fit. Due to institutional features (see section 3, in particular subsection), the estimation range is restricted to taxable incomes above 5000 € (10000 € in the case of joint taxpayers) and below 12000 € (24000 € for joint taxpayers). Because of this restricted range, the default specification employs taxable income polynomials of degree $p = 5$, unlike the degree $p = 7$ typically used in the literature (e.g. Chetty et al., 2011). Appendix B contains robustness results from specifications that address potential missing data or confounding incentives concerns (discussed below) by restricting the counterfactual estimation range to observations to the right of the kink and further reducing the polynomial degree to $p = 2$. The results obtained are similar.

3 Institutional background and data

3.1 The German personal income tax schedule

All natural persons residing in Germany are subject to the German personal income tax. The tax is levied on taxable income, i.e. on the sum of income from seven different legal categories minus a number of potential allowances and exemptions, as outlined below. The seven income types can broadly be classified into selfemployment income, wage income, and capital income. The German income tax schedule comes in two versions, one for individual taxpayers and one for married couples that opt for joint tax liability.

⁵See Chetty et al. (2011) for details. Note that this iterative correction procedure is approximative at any rate, so no attempt is made to fine-tune it to the peculiarity of the German income tax schedule that features linearly increasing marginal tax rates above the personal allowance threshold kink.

The following description of the income tax schedule focuses on individual taxpayers; the tax schedule for jointly liable taxpayers is a simple function of it.⁶

The German personal income tax schedule defines statutory income tax liability (T) as a function of taxable income (TI) over several segments.⁷ In its 2007 version, the tax schedule for individual taxpayers reads (for a graphical representation, see Figure 1):

$$T(TI) = \begin{cases} 0 & TI \leq 7,664 \\ (883.74 \cdot \frac{TI-7,664}{10,000} + 1,500) \cdot \frac{TI-7,664}{10,000} & 7,665 \leq TI \leq 12,739 \\ (228.74 \cdot \frac{TI-12,739}{10,000} + 2,397) \cdot \frac{TI-12,739}{10,000} + 989 & 12,740 \leq TI \leq 52,151 \\ 0.42 \cdot TI - 7,914 & 52,152 \leq TI \leq 250,000 \\ 0.45 \cdot TI - 15,414 & 250,001 \leq TI \end{cases}$$

Income tax liability starts at a marginal tax rate of 15% at a personal allowance threshold of 7664€ in taxable income (2·7664€=15328€ for joint taxpayers). This allowance threshold introduces a convex kink in the taxpayer's budget set that will be referred to as the bottom kink. The German schedule is unusual in that the two following segments are quadratic functions of taxable income, i.e. the marginal tax rate increases linearly over these segments, up to a marginal tax rate of 42%.⁸ Previously, the marginal tax rate remained constant once it surpassed the threshold value of 52151€ for this top rate but in 2007, a reform introducing a second kink took effect: a discrete increase in the marginal tax rate from 42% to 45% at 250000€. This will be referred to as the top kink. In addition to the income tax, a 'solidarity surcharge' of 5.5% of the tax liability is levied on taxable income exceeding 12672€ or more.⁹, increasing the solidarity-surcharge inclusive increase in marginal tax rates at the top kink by 5.5% (from 44.3% to 47.5%).

3.2 Filing rules and other incentives

The German income tax law is complex and the rules for the obligation to file a tax declaration after the tax year are no exception. In general, they are a function of the

⁶The tax liability of joint taxpayers is computed by taking the average of individual taxable incomes, applying the tax schedule for individual taxpayers and then doubling the resulting tax liability.

⁷Actual tax liability can differ due to tax credits and debits that are subtracted from the statutory liability.

⁸This feature distinguishes the tax schedule from the standard piece-wise constant marginal tax rate schedules considered in Saez' (2010) bunching model. It does not, however, affect the location of bunching individuals under the counterfactual tax schedule. In other words, the relevant increase in marginal tax rates at the bottom kink is 15 percentage points, despite the fact that the marginal tax rate increases beyond the allowance threshold.

⁹12672€ refers to taxpayers without children. With children, the threshold will be at higher taxable income levels.

type and amount of income as well as other tax-relevant personal circumstances. Three points deserve particular attention in the present context.¹⁰ First, many taxpayers with mainly wage income – for which taxes are withheld by the employers – are exempt from the obligation to file a tax declaration, but are still covered in the tax administration data set used here. Second, if not obliged, a taxpayer can always voluntarily file a tax declaration, in particular to claim the itemized deductions described in the next subsection. Third, a concern may be that the dependence of filing rules and data coverage on income might spuriously create bunching at the allowance threshold. In particular it is the case that taxpayers with only non-wage income are not required to file a tax declaration if a tax-measure of their income known as ‘total amount of net income’¹¹ (*TANI*) falls below the personal allowance threshold. Unless they voluntarily file a tax declaration, these cases are not covered in the tax administration data. Taxable income, however, is less than the TANI such that the filing obligation threshold in such cases lies below the taxable income allowance threshold. Moreover, wage earnings from so-called ‘mini-jobs’ (with annual gross wages below 4800 €) are also not covered if a special flat tax rate is chosen for such employment arrangements. Two measures are taken to address these potential missing data concerns. First, the estimation range for the counterfactual taxable income distribution always excludes observations below 5000 € (10000 € in the case of joint taxpayers). Second, robustness specifications further exclude all observations to the right of the kink in estimating the counterfactual taxable income distribution and yield very similar results (see Appendix B). Finally, there is no such concern for married taxpayers when both earn wage income and desire to be effectively taxed according to the (usually beneficial) joint tax schedule (as filing a tax declaration is then mandatory).

Besides tax filing rules, there are three other issues that deserve mentioning. First, the solidarity surcharge law introduces two further kink points above the allowance threshold.¹² It is for this reason that the estimation range is restricted from above to taxable incomes below 12000 € (24000 € in the case of joint taxpayers), although the solidarity surcharge kinks are very unsalient and I do not find evidence for taxable income mass disruptions in their neighborhood. Second, other incentive thresholds, e.g. from government transfer programs, might interfere with the personal allowance kink or otherwise

¹⁰See Figure A10 in Appendix E) for the proportions of filing individual taxpayers around the bottom kink.

¹¹In German: *Gesamtbetrag der Einkünfte*.

¹²To prevent a notch in the budget set from the solidarity surcharge threshold value, there is a ceiling rule that limits the solidarity surcharge to a maximum of 20% of the amount that the tax liability exceeds a certain threshold (972 € for individual taxpayers). As a result of these rules, the solidarity surcharge creates a plateau in the solidarity-surcharge inclusive marginal tax rates, with a convex kink point at 12672 € and a nonconvex kink point at 14186 € (or further above for taxpayers with children). The location of these kink points is not explicitly mentioned in the solidarity surcharge rule.

be responsible for some of the taxable income bunching mass in its neighborhood. While this cannot be completely ruled out, notice that other incentive thresholds typically have a different base (e.g. a function of family income and needs, but notably not tax deductions) and the location of their thresholds in terms of taxable income will differ according to individual circumstances. Hence it is highly unlikely that they are responsible for bunching *right* at the allowance threshold.¹³ Moreover, transfer withdrawal end kinks are nonconvex and the literature is void of any evidence for holes which such kinks theoretically might create in the relevant distribution.¹⁴ Third, for a subset of taxpayers employed under ‘mini-job’ arrangements, the gross wage threshold of 4800€ constitutes an upward ‘notch’ and the reactions to it might create missing mass below the personal allowance threshold.¹⁵ The difference in the incentive base variable (due to tax deductions) and the similarity between the results from the main specification and the specifications restricted to the right of the allowance threshold again suggest that the potential for confounding is limited.

3.3 Allowances, exemptions and itemized deductions

As mentioned above, the tax base for the income tax is taxable income, i.e. gross income minus costs for income generation, allowances and exemptions (cf. Table 1 for a schematic overview). The entirety of the difference between gross incomes and taxable income can be generally classified as ‘deductions in a broader sense’, but some distinctions are in order. The first step in calculating taxable income consists of deducting expenses for generating that income, separately for each of the seven income categories. For wage income and income from savings, taxpayers can choose between a fixed allowance and itemizing the deductible expenses.¹⁶ For selfemployment incomes, no such standard allowances are available and the rules for calculating net selfemployment income are believed to entail more scope for tax planning (or evasion) than in the case of wage income. The resulting sum of differences between revenues and expenses for each income category is called ‘adjusted gross income’ (*AGI*). From adjusted gross income, if

¹³Or as Saez(2010, p.189), put it, “*any bunching they generate should be smoothed out in the aggregate*”.

¹⁴Compare Kleven’s (2016) review of the bunching literature, in which he writes that “*no research has found evidence of holes around such kinks*”.

¹⁵Notice that even with a labor supply elasticity as large as 1 (which many microeconometricians consider an upper bound of the plausible range for the intensive-margin elasticity), the marginal bunching individual at an upward notch at 4800€ in yearly gross wages would have counterfactual gross wage earnings below 9200€ (cf. the notch model solution in Kleven and Waseem, 2013) and hence taxable income below the allowance threshold due to standard tax deductions outlined in the next subsection.

¹⁶In 2007, the individual taxpayer allowance for wage income was 920€ and 801€ Euro for income from savings. For savings, the option to itemize expenses was abolished from 2009 onward.

applicable exemptions for the elderly, single parents and income from agriculture and forestry are applied to yield the ‘total amount of net income’ (TANI). Next, if applicable, losses from other periods may be deducted before a number of other items subsumed primarily under the legal categories of ‘special expenses’ and ‘extraordinary burden’. Pension savings and insurance costs constitute the largest category of deductions at this stage. For wage-income a standard wage-dependent allowance for mandatory social security contributions is automatically granted at this stage. Additional or actual pension savings and insurances and a number of further items (including church tax, donations, certain costs for training and education, real-estate related expenses, alimony and medical care) can be deducted only by filing a tax declaration.¹⁷ Taxable income is what remains after all deductions recognized as legitimate by the tax administration authorities have been applied.

3.4 The German Wage and Income Tax Statistics

The German Wage and Income Tax Statistics are compiled from taxpayers’ actual tax records by the sub-federal and Federal Statistical Offices and cover all natural persons subject to the German income tax.¹⁸ A taxpayer is either an individual or a married couple that does not opt out of joint taxation. The present paper relies on a stratified 10% random sample of the total taxpayer population in 2007.¹⁹ Because individual and joint taxpayers have different tax schedules and represent different entities, I analyze them separately.²⁰ I restrict attention to taxpayers in prime working age (30-59).²¹ Taxpayers whose income tax liability has in all likelihood been estimated by the tax authorities because they failed to abide by their filing obligations are also excluded.²²

¹⁷ Allowances for children are automatically granted if they exceed child benefits.

¹⁸ In particular, this cross-sectional data set also covers the ca. 1/3 of the taxpayer population who do not file a tax declaration (but are included through the payroll tax).

¹⁹ The following analyses take account of the sampling process by reweighing the observations with the respective sampling weights. Taxpayers with high income (individual taxpayers with more than 75000€ and joint taxpayers with more than 150000€ in TANI) are fully included in the data set, but some demographic characteristics and individual deduction components are classified for them (see Schwabacher, 2013, for details).

²⁰ Individual here refers to non-married persons and does not include married taxpayers that opt for separate taxation (explicitly ex-ante or implicitly ex-post by failing to file a tax declaration in cases of so-called ‘Lohnsteuerklasse IV’). Recently widowed or divorced taxpayers that are granted joint taxation until the year after their spouse’s death or separation are excluded from the joint taxpayer sample.

²¹ Younger taxpayers may have a strong confounding incentive to bunch in the vicinity of the allowance threshold because their parents lose child benefits when the child’s relevant income exceeds 7680 Euro.

²² This concerns ca. 13000 individual taxpayer and ca. 4000 joint taxpayer observations who have only non-wage income and whose reaction is apparently not consistent with the standard model described above. These observations are identified by the fact that their adjusted gross income is a round number (2500€, 7500€ or a positive multiple of 1000€) and their only deduction from TANI is the standard allowance

This leaves a sample of ca. 1.1 million individual taxpayer and ca. 1.0 million joint taxpayer observations, where in the latter case, the observations comprise two million persons. Table 2 displays summary statistics for both overall samples as well as for subsamples that are used in the analyses in subsection 4.3.²³ Because gross income from all income categories is not available in the data, from now on unless otherwise noted, deductions will refer to the difference between adjusted gross income and taxable income, i.e. deductions in the more narrow sense (excluding the first stage of deductible expenses for income generation).

4 Results

4.1 No bunching at the top kink

Figure 2 shows the distribution of taxable income around the top kink for individual and joint taxpayers. As can be seen visually, there is no discernible bunching at the thresholds of 250,000 € and 500,000 € respectively.²⁴ The same zero bunching picture obtains if the samples are restricted to taxpayers with no (Figure 3) or not mainly (Figure 4) self-employment income (recall that the top rate kink only applies to non-selfemployment income). There is only weak indication that taxpayers may have avoided the top rate by shifting income into selfemployment categories.²⁵ Returning to the lack of bunching in taxable income, this would seem to imply that the ‘structural’ local elasticity approaches zero if there are no adjustment frictions. However, high income taxpayers have previously been found to be more responsive to taxation than low-income taxpayers (Gruber and Saez, 2002). The friction-augmented model in Appendix B reveals that given the small increase in marginal tax rates at the top kink, fixed adjustment costs of 0.3% of utility would be enough to preclude a bunching response. Hence the taxable income top

for special expenses (36 € for individual/72 € for joint taxpayers). Without excluding those taxpayers, the income distributions exhibit round-number spikes. Alternatively, one could include round-number dummies in the bunching estimations, which yields similar results (available upon request).

²³Notice that for non-filing taxpayers –all of which have only wage income– the original data set erroneously features gross wages as adjusted gross income, total amount of net income and taxable income. The variables are corrected by deducting the standard allowances (for wage income, single parents, old-age, mandatory social security contributions, and special expenses) as applicable.

²⁴Formal bunching estimations are therefore omitted. They return estimates of b that are statistically indistinguishable from zero. Note that the spike in taxable income visible for individual taxpayers at around 220000 € stems from heaping in gross wages at 225000 €.

²⁵See Figures A1 (for individual) and A2 (for joint taxpayers). They display the mean and median shares of profit income in adjusted gross income (the base variable for the exemption) separately for taxpayers with nonnegative and negative shares. There are drops at the relevant top rate kink, in particular for joint taxpayers, but the limited number of observations and data classification issues make it difficult to judge if the apparent drop in profit income share reflects a true reaction or noise.

tax rate kink itself contains little information about potential reactions to larger tax rate changes.

4.2 Bunching at the bottom kink

In contrast to the top tax rate kink, there is clear evidence for bunching at the personal allowance threshold. The corresponding taxable income histograms for individual and joint taxpayers are displayed in Figure 5.²⁶ The relative excesses mass measures are estimated at $\hat{b} = 0.7$ for individual and $\hat{b} = 2.5$ for joint taxpayers (cf. Figure 6). These translate into ‘observed’ (Saez-type estimates) elasticities of 0.06 and 0.10 respectively. While it is difficult to credibly take frictions into account to obtain an estimate of the ‘structural’ elasticity²⁷, it is worth noting that the available evidence for wage earnings adjustment frictions puts them so high that a wage earnings response is unlikely to underlie any observed bunching at the allowance threshold.²⁸ The evidence presented in the next subsection suggests deduction behavior as a more likely explanation for the observed bunching pattern at the personal allowance threshold.

4.3 Evidence on the importance of deductions

No bunching for non-filers

The fact that the present data set includes non-filing taxpayers allows for an interesting comparison between taxpayers who do and who do not file a tax declaration. The taxable income histograms in Figure 7 provide this comparison for individual taxpayers and reveals that the bunching pattern emerges exclusively from and for taxpayers who – by obligation or voluntary decision – file a tax declaration. Not surprisingly then, as

²⁶The spike at around 3300 € in the distribution of individual taxpayers taxable income stems from bunching in gross wages at 4800 €, the threshold for ‘mini-jobs’.

²⁷The friction-augmented model in Appendix A puts the implied elasticities at 0.53 for individual and 0.54 for joint taxpayers if there are fixed adjustment costs of 1% of baseline utility of the marginal buncher.

²⁸Gelber et al. (2015) have identified fixed earnings adjustment costs of \$275 (2010 USD, ca. 215 € 2007). In the present context, according to the friction-augmented model in Appendix A, this would preclude bunching even if the wage labor supply elasticity were as large as 1.5 (i.e. much above what micro-econometricians consider plausible). This is because the adjustment costs would exceed the marginal buncher’s gain from re-optimizing (and amount to more than 5% of her baseline utility). Notice, however, that while Gelber et al. (2015) employ the same utility form specification and are able to identify adjustment costs quasi-experimentally, their result comes from a very different sample and institutional environment (the elderly in the US). In the present context, there is also for nontrivial wage adjustment frictions in the form of taxpayers locating in the dominated gross-wage income region above an upward notch induced by the combination of mini-job and family insurance regulations (see Figure A3). However, this evidence must be interpreted with caution because of potentially missing observations below the notch.

the bunching mass for non-filing taxpayers is statistically indistinguishable from zero (Figure 8 left panel), the estimated bunching mass for filing taxpayers (Figure 8 right panel) exceeds the bunching mass for all individual taxpayers. Because non-filers have only wage income, it is important to also condition the comparison sample of filers on having only wage-income. Figure 9 presents the histogram and corresponding bunching estimations for taxfilers with only wage income. These taxpayers' taxable income distribution also displays bunching, unlike the non-filing taxpayers. Clearly what distinguishes the subsamples in terms of observables is that non-filing taxpayers cannot file deduction claims. While it cannot be ruled out that unobservables (e.g. the costs of adjusting labor supply) also differ, the fact that non-filers do not bunch strongly hints at an important role for itemized deductions.

Bunching decreases with the importance of wage income

We can further partition the subsamples of filing taxpayers by sources of income. This reveals heterogeneity in bunching that is interesting in its own right, but may also be interpreted as evidence consistent with the deduction hypothesis. Figure 10 visualizes the bunching estimates separately for filing taxpayers with (i) only wage income, (ii) both wage and non-wage income and (iii) those with only non-wage income.²⁹ For individual and joint taxpayers alike, the estimated bunching mass is smallest for the first subsample, slightly larger for the second and by far largest for the third. An alternative subsample split based on the main source of income (wage, selfemployment or capital income) is displayed in Figure 11.³⁰ Again the estimated bunching mass is smallest for those with mainly wage income and considerably larger for those with either selfemployment or capital as main source of income. Because taxpayers with only wage income are believed to have less scope for legal tax avoidance via deductions (cf. e.g. Tipke and Lang, 2008, p. 233), illegal under-reporting given third-party involvement (Slemrod, 2007) and adjusting working hours (Chetty et al., 2011), the bunching estimate ordering of both subsample splits is consistent with an important role for deduction and reporting effects as well as with different degrees of freedom in adjusting labor supply.

²⁹The underlying histograms are available as Figure A4 in Appendix B. This classification is necessarily based on incomes net of costs (except in the case of wage income, where data availability allows basing it on gross wages).

³⁰The underlying histograms are available as Figure A5 in Appendix B. This classification provided by the Statistical Offices is based on the highest sum of adjusted gross incomes from the income categories that constitute a main source of income category. This means that negative adjusted gross incomes count against being classified in the overarching main source of income category such that the subsample 'mainly wage income' will include some taxpayers with potentially large losses from selfemployment or capital. In that sense it understates the differences by income source.

At any rate, this subsample analysis reveals that bunching reactions are heterogeneous across income source.

No bunching without deductions

Another way of gauging the role of deductions consists of inspecting the distributions of income *gross* of deductions in comparison with taxable income distributions around the kink, as in Chetty et al. (2011) or Bastani and Selin (2014). Figure 12 shows the distributions of adjusted gross income for individual and joint taxpayers. Apparently there is no excess mass at the taxable income allowance threshold nor further above.³¹ The same holds for the subsample splits of taxfilers by source of income (only wage, only non-wage, or mixed), perhaps with the exception of individually filing pure wage earners (Figure 15).³² Finally, Figure 14 contrasts individual taxfilers true taxable income distribution with their counterfactual distribution had they not claimed itemized deductions. Evidently the bunching in taxable income disappears when itemized deductions are grossed in. While these contrast patterns do not rule out that the reaction to the allowance threshold is a combination of a deduction and real earnings response, they indicate that itemizing behavior plays an important role and might even seem rather suggestive of a pure deduction response.

Large deductions at the bottom kink

A final piece of evidence for the role of deductions in generating the bunching patterns emerges from the distribution of deductions around the bottom kink. Figures 16 and 17 display the mean and median deductions over bins of taxable income for individual and joint taxfilers respectively. The first point that stands out is that mean deductions of taxpayers who end up locating precisely at the allowance threshold are considerably larger than those in their neighborhood, implying that some taxpayers arrived at the kink from high levels of adjusted gross income and hence via deductions. The comparison with median deductions –which are generally smaller and for which the anomaly at the kink is much less pronounced– reveals that the high level of mean deductions at the bottom kink is driven to a substantial extent by ‘outliers’ with very high adjusted gross income.³³ For individual taxpayers, however, we can go one step further and

³¹In the case of individual taxpayers, we may also view the AGI distributions separately for filers and non-filers (Figure 13).

³²The diffuse hump between roughly 10000€ and 17500€ could result from the first stage of deduction costs for income generation.

³³The three highest values of adjusted gross income for taxpayers who end up at the allowance threshold are 1,234,436€, 426,824€ and 228,379€ for individual, and 762,817€, 641,122€ and 592,533€ for

restrict attention to *itemized* deductions (computed as all deductions minus standard allowances and exemptions). These are necessarily smaller than overall deductions, but what is interesting to note is that *median* itemized deductions are also unusually large right at the kink. Hence the pattern is not exclusively driven by few outliers with very large deductions.³⁴ Secondly, it may also be of interest to note that decreasing distance to the kink in terms of taxable income is associated with higher deductions (itemized deductions in the case of individual taxpayers) as shown by the linear fit lines in blue.³⁵ Beyond the anomalously large deductions right at the bottom kink, this reflects a trace of deduction usage and underlines their importance in generating the overall bunching response.

5 Conclusion

The present paper has analyzed behavioral reactions to the personal income tax in Germany through the lens of bunching at kink points, with a particular emphasis on the role of deduction and reporting behavior. While the small top tax rate kink applying to non-selfemployment income did not induce a discernible bunching response (and only weak indications for income shifting into exempt selfemployment income), there is clear evidence for bunching at the personal allowance threshold at the bottom of the taxable income distribution. The observed local taxable income elasticity in the order of 0.1 is broadly in line with the results from other studies that apply the Saez-type estimator. More research will be needed to identify the elasticity that would seem to govern longer-term responses or responses to even larger tax rate changes, in particular the size of potential adjustment frictions that may drive a wedge between the latter quantity of

joint taxpayers.

³⁴What appears somewhat odd is that itemized deductions below the personal allowance threshold are positive or that they do not decrease more quickly towards zero. Possible explanations include: (i) even itemized deductions may come in fixed amounts, making it impossible to stop right when it does not pay anymore; (ii) taxfilers have imprecise control over final (recognized) itemized deductions or find it too tedious to keep account of the exact amounts; (iii) (some) taxpayers might fear that stopping right at the personal allowance threshold may seem suspicious; (iv) there is no or little additional cost to filing additional (true) deductions; (v) (some) taxpayers have a preference for filing true (exact) amounts rather than just deducting as long as it pays.

³⁵The linear fits exclude the kink bin. In all cases, the slope of the regression line to the left of the kink is statistically different from the slope to the right of the kink at ($p < 0.000001$). The slopes to the left (ranging from 0.03 for median itemized deductions to 0.23 for individual taxfilers' median deductions) are in all cases significantly larger than zero ($p < 0.01$, one-sided). The slopes to the right (ranging from -0.12 for median itemized deductions to 0.04 for mean overall deductions of individual taxfilers) are significantly larger than -1 ($p < 0.0000001$, one-sided), indicating that rank reversals between adjusted gross income and taxable income do not occur at the level of means or medians off the kink (but may of course occur at the individual level).

interest and the Saez-type ETI estimates. By highlighting the role of deduction behavior, however, this study has gathered further evidence that cautions against interpreting ‘the’ elasticity of taxable income as an immutable ‘structural’ parameter that determines optimal tax rates independent of other policy instruments (Slemrod and Kopczuk, 2002). Because the rules for deduction possibilities and their enforcement strength are policy choices that may change, the taxable income response to a given tax rate change may also vary. Obviously these rules also have distributional implications (cf. e.g. Lang et al., 1997) that may deserve further attention. As for efficiency, the ETI has initially been conceptualized in order to capture the implications of response margins such as deduction behavior; but, as Chetty (2009b) has highlighted, the existence of externalities dilutes the property of the ETI as a sufficient statistic in that respect. More research is needed to quantify the economic implications of particular deductions and other non-tax rate characteristics of the tax system in order to characterize optimal tax policy more completely. What would seem particularly interesting and challenging alike is to incorporate the multifaceted role and myriad ramifications of rule complexity for compliance costs and noncompliance, efficiency and equity of the tax system.

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Table 1: From gross income to the tax base taxable income

	Sum of gross income from seven legal categories: selfemployment (3 types), wages, capital (3 types)
–	Deductible expenses for the costs of income generation for each income category
=	Adjusted gross income ^a (AGI)
–	Exemptions for the elderly, single parents, agriculture and forestry income
=	Total amount of net income ^b (TANI)
–	Losses from other periods
–	Special expenses <ul style="list-style-type: none"> · Pension savings and insurances · Church tax, donations, alimony, training, real estate related expenses, ...
–	Extraordinary burden: medical care, disability, alimony, ...
–	Other deductions incl. child allowances if applicable
=	Taxable income (TI)

Notes:

^a German: *Summe der Einkünfte*.

^b German: *Gesamtbetrag der Einkünfte*.

Table 2: Sample summary statistics

	<i>N</i>	Age ^a	TI	TANI	AGI	Item. Ded ^b
Individual taxpayers	1088467	42.6	49716	55529	55679	4034
nonfiler ^c	104731	41.8	20321	22011	22198	0
filer	983736	42.8	52846	59098	59244	4469
only wage income	301220	41.2	31682	35652	35818	1831
wage and non-wage income	310742	43.8	82036	89364	89501	4464
only non-wage income	371774	43.6	45595	52797	52933	6620
mainly wage income	566225	42.0	51597	56827	56974	2839
mainly selfemployment income	343826	42.5	61757	69688	69817	7041
mainly capital income	73685	47.6	20863	27132	27348	5062
Joint taxpayers	1015611	46.1	106634	120834	120816	n.a.
filer	1015611	46.1	106634	120834	120816	n.a.
only wage income	302543	45.0	46218	53524	53526	n.a.
wage and non-wage income	527803	47.2	142177	159307	159348	n.a.
only non-wage income	185265	46.8	104033	121149	120932	n.a.
mainly wage income	650631	45.9	86954	97886	97907	n.a.
mainly selfemployment income	324066	45.9	151437	171832	171719	n.a.
mainly capital income	40914	51.4	64707	81842	81938	n.a.

Notes:

- ^a All entries (except the number of observations *N*) refer to sample means.
- ^b The samples are restricted to taxpayers in prime working age (30-59) and exclude married taxpayers that opt for separate taxation (from the individual taxpayer sample) and recently widowed or divorced taxpayers (from the joint taxpayer sample).
- ^c Each indented sample is a subsample of the preceding non-indented sample.
- ^d TI=Taxable income, TANI=Total amount of net income, AGI=adjusted gross income, Item. Ded=Itemized deductions (obtained as (TANI-TI) minus standard allowances and exemptions). Please refer to the main text for further details.
- ^a Age in years is missing for 357,493 individual and 454,656 joint taxpayer observations. The displayed age means are therefore based on the nonmissing entries only.
- ^b Itemized deductions are subject to data classification for very high incomes (top 0.05 TANI percentile). The displayed means are therefore exclusive of the classified 3,524 individual and 9,635 joint taxpayer observations.
- ^c All nonfilers have only wage income. For nonfilers, TI, TANI and AGI have been computed by deducting the pertinent standard allowances and exemptions from gross wages to correct for the fact that the original data set erroneously duplicates their gross wages as TI, TANI and AGI.

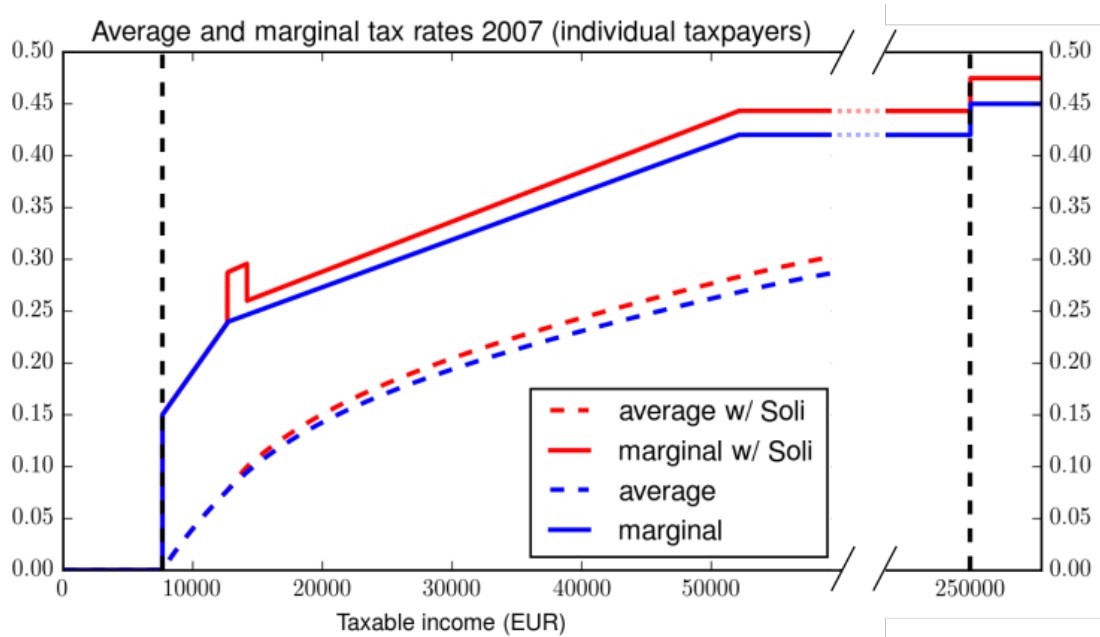


Fig. 1: The Personal Income Tax Schedule 2007 (individual taxpayers).

The dashed blue line shows the average tax rate and the solid blue line the marginal tax rate without the solidarity surcharge. The corresponding red lines show the tax rate schedule inclusive of the solidarity surcharge. The two kink points considered in this paper are marked with dashed black vertical lines. At the personal allowance threshold of 7 664 Euro, the marginal tax rate increases from 0% to 15%. At the top marginal tax rate kink at 250 000 Euro, the marginal tax rate increases from 42% to 45% (or from 44.3% to 47.5% considering the solidarity surcharge).

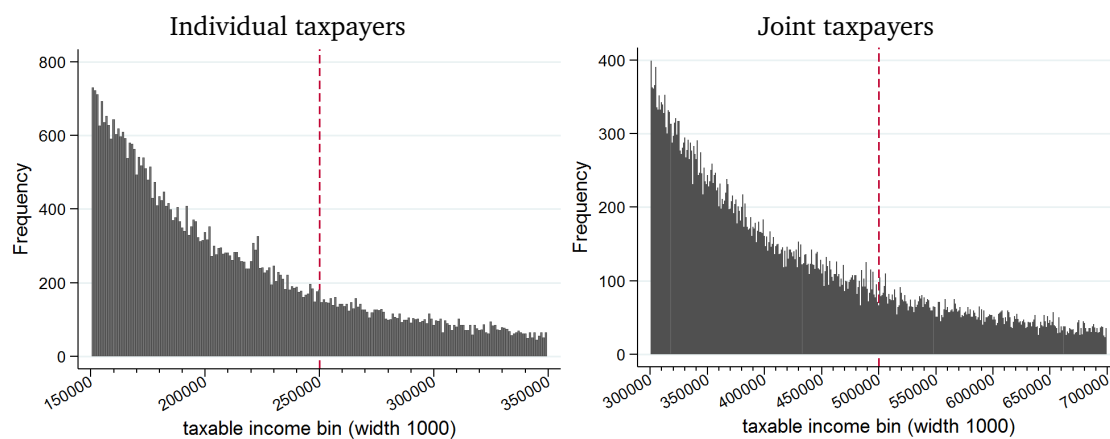


Fig. 2: Distribution of taxable income around the top kink.

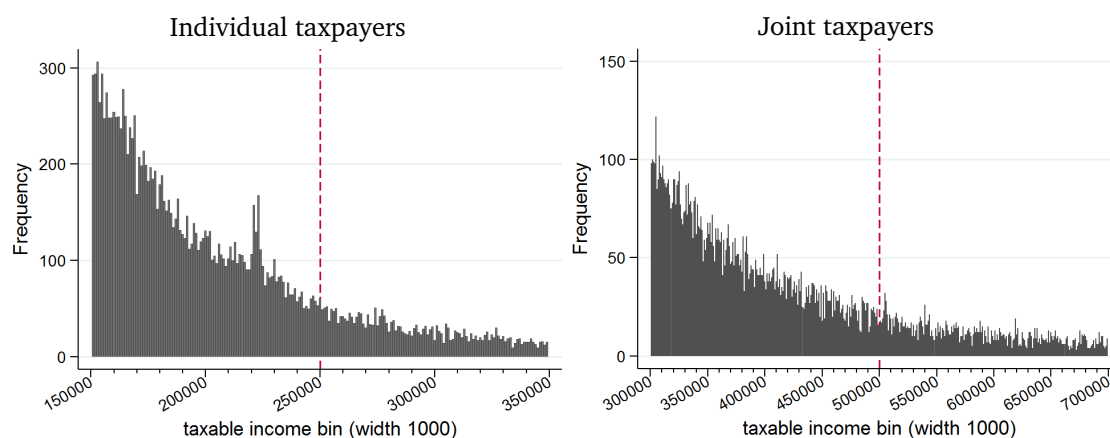


Fig. 3: Distribution of taxable income around the top kink for taxpayers with only non-selfemployment income.

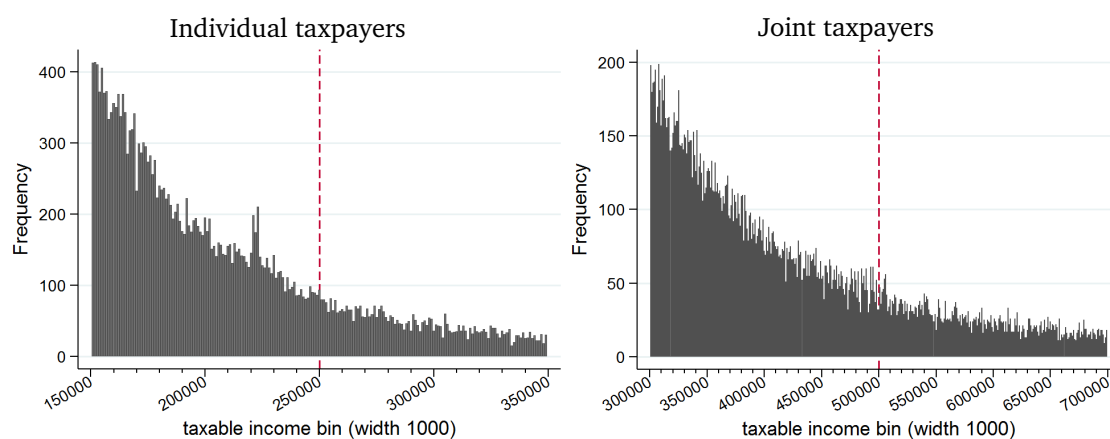


Fig. 4: Distribution of taxable income around the top kink for taxpayers with mainly wage or mainly capital income.

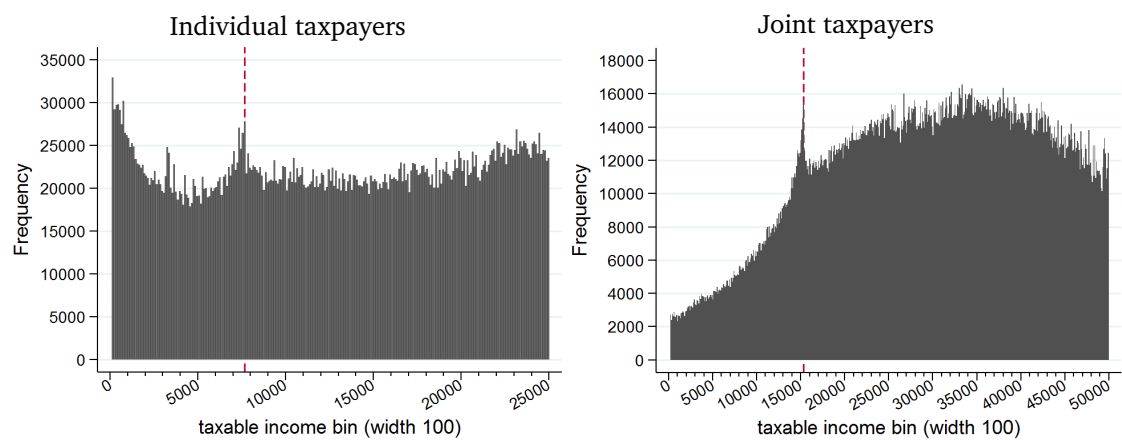


Fig. 5: Distribution of taxable income around the bottom kink.

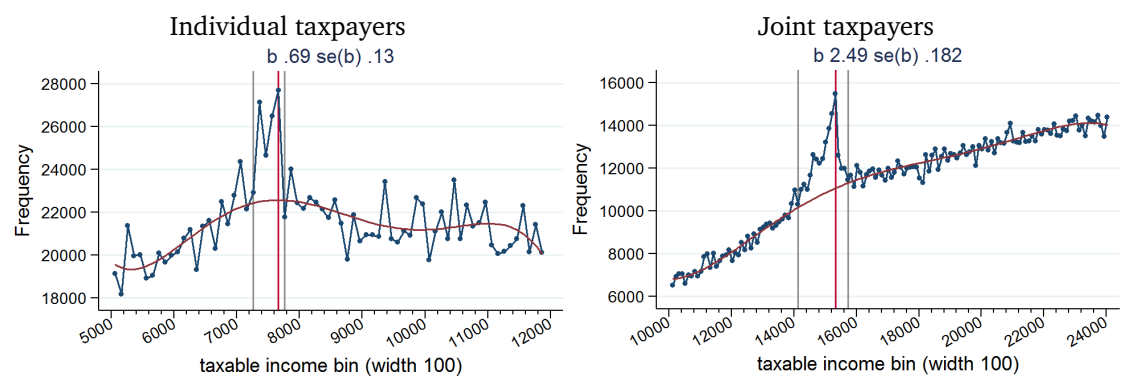


Fig. 6: Bunching estimations bottom kink.

See subsection 2.2 for specification and estimation details.

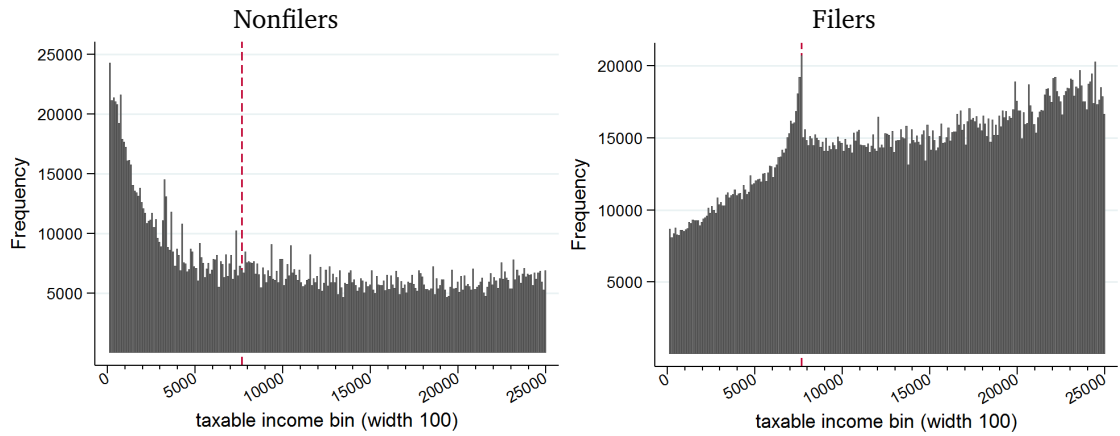


Fig. 7: Individual taxpayers' distribution of taxable income around the bottom kink.

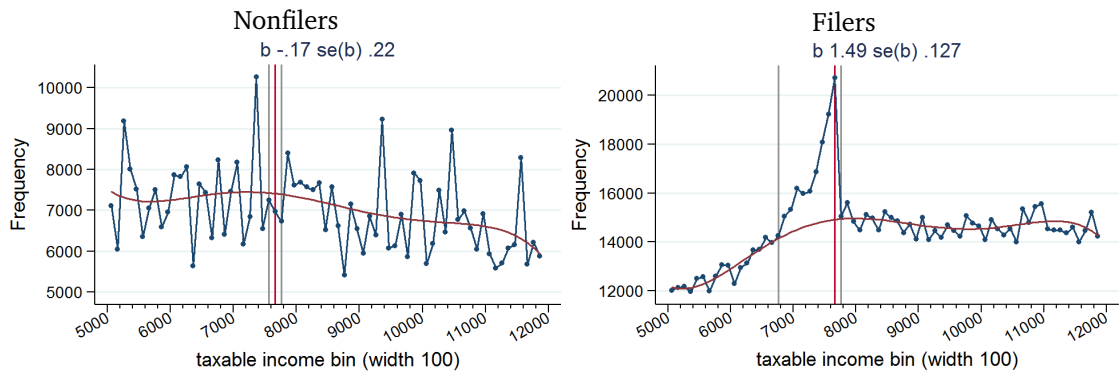


Fig. 8: Bunching estimations bottom kink.

See subsection 2.2 for specification and estimation details.

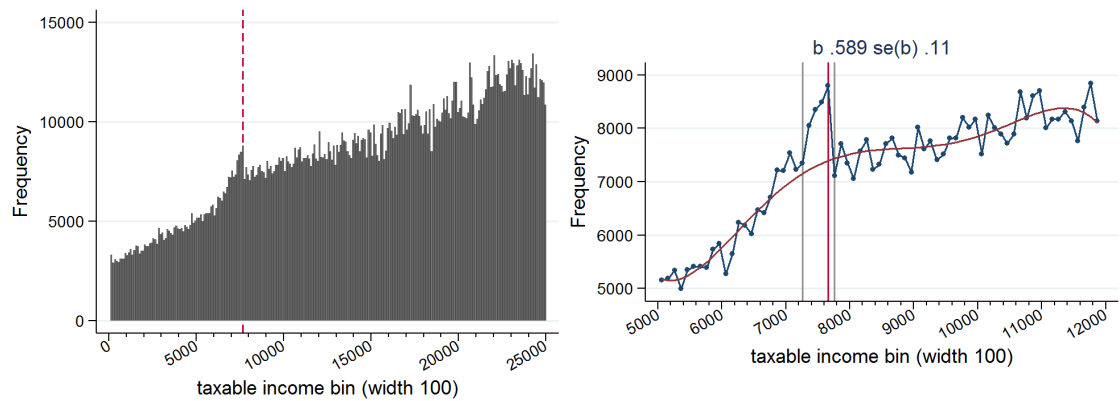


Fig. 9: Taxable income distribution and bunching estimation (bottom kink) for individual taxfilers with only wage income.

See subsection 2.2 for specification and estimation details.

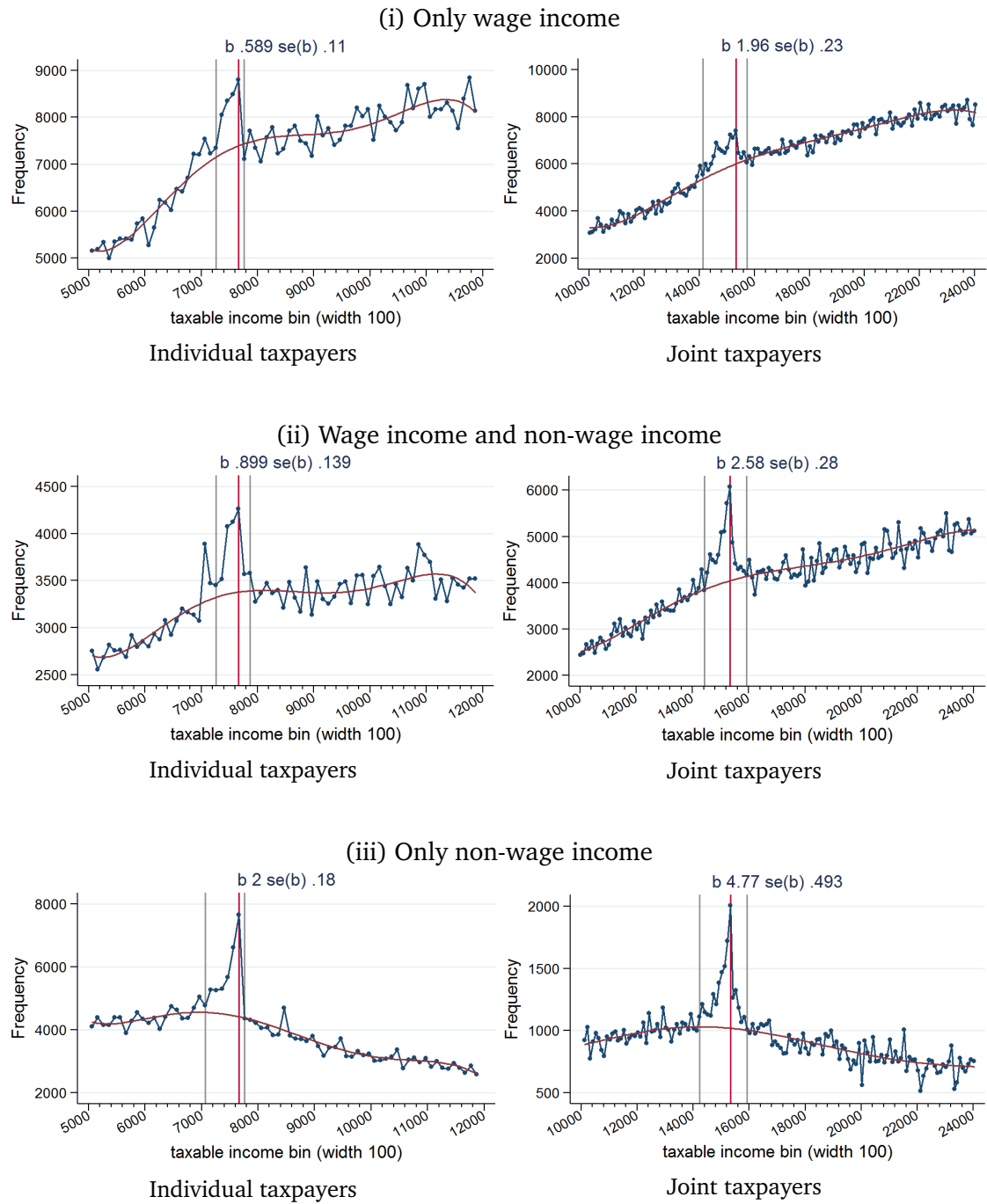


Fig. 10: Bottom kink bunching estimations for taxfilers with only wage income (top), wage income and non-wage income (middle) and only non-wage income (bottom).

See subsection 2.2 for specification and estimation details.

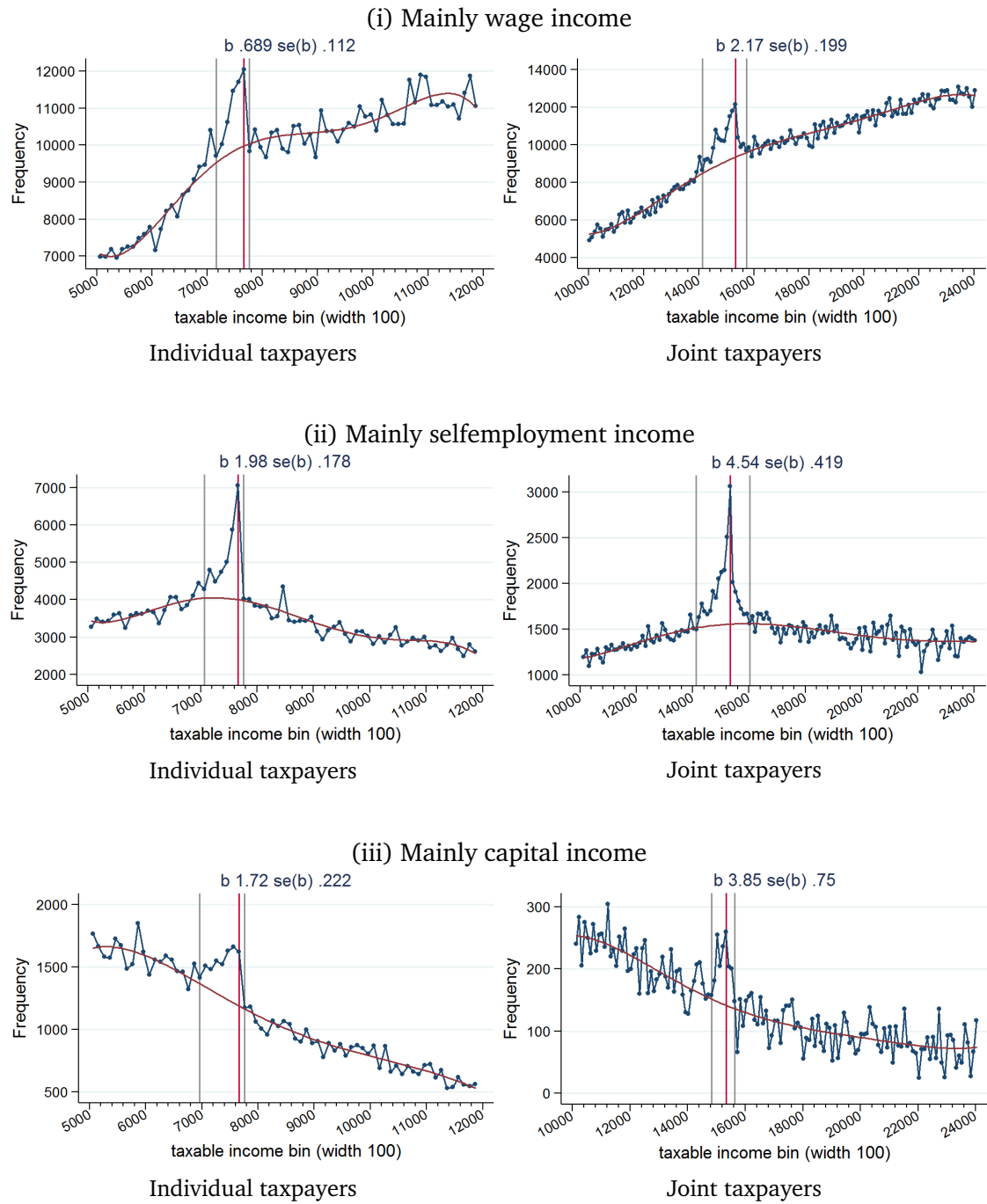


Fig. 11: Bottom kink bunching estimations for taxfilers with mainly wage income (top), mainly selfemployment income (middle) and mainly capital income (bottom).

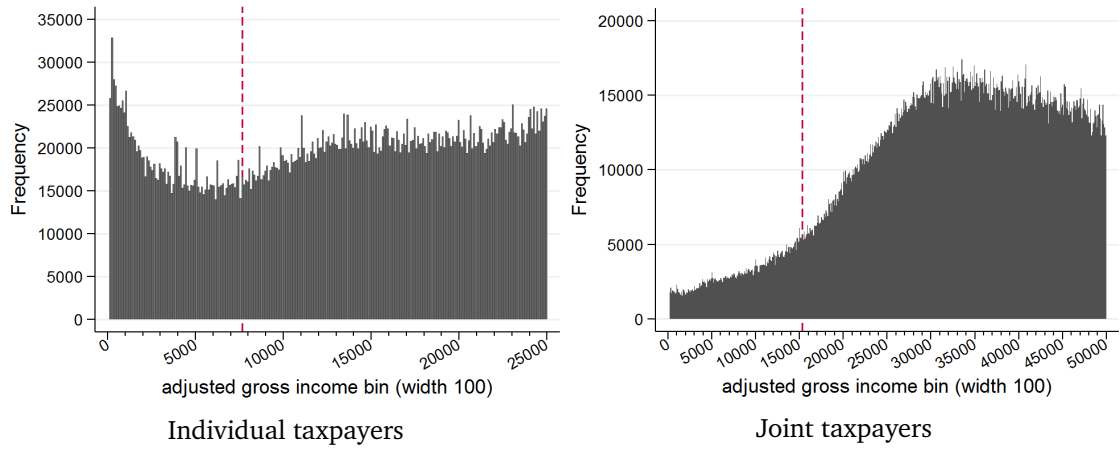


Fig. 12: Distribution of taxpayers' adjusted gross income around the bottom kink.

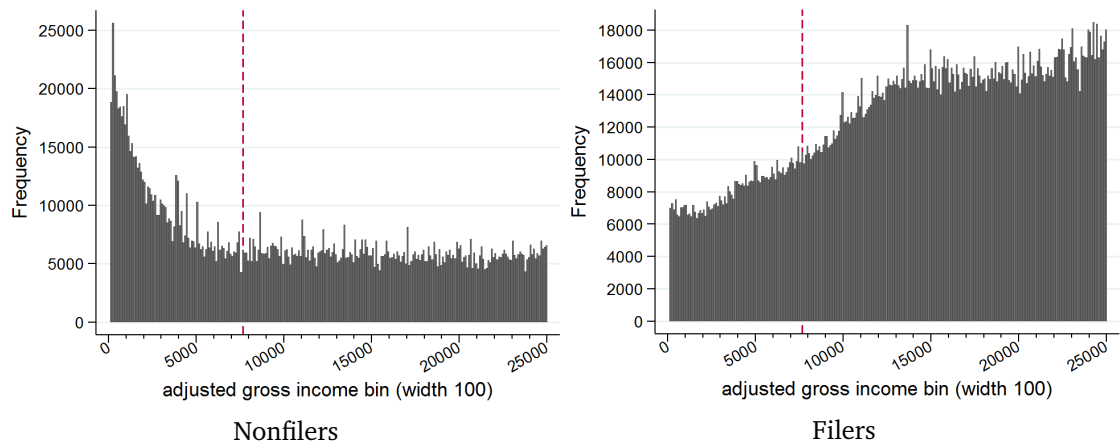


Fig. 13: Distribution of individual nonfilers' and filers' adjusted gross income around the bottom kink.

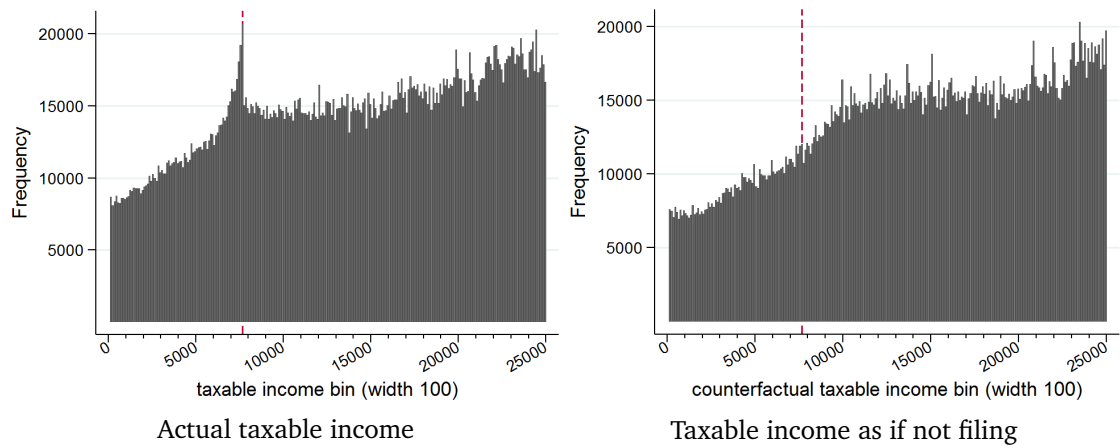
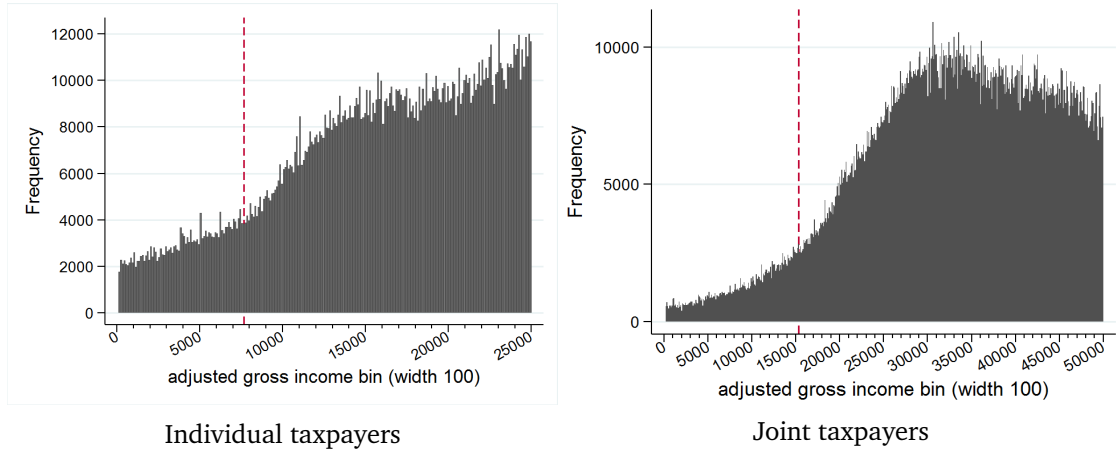
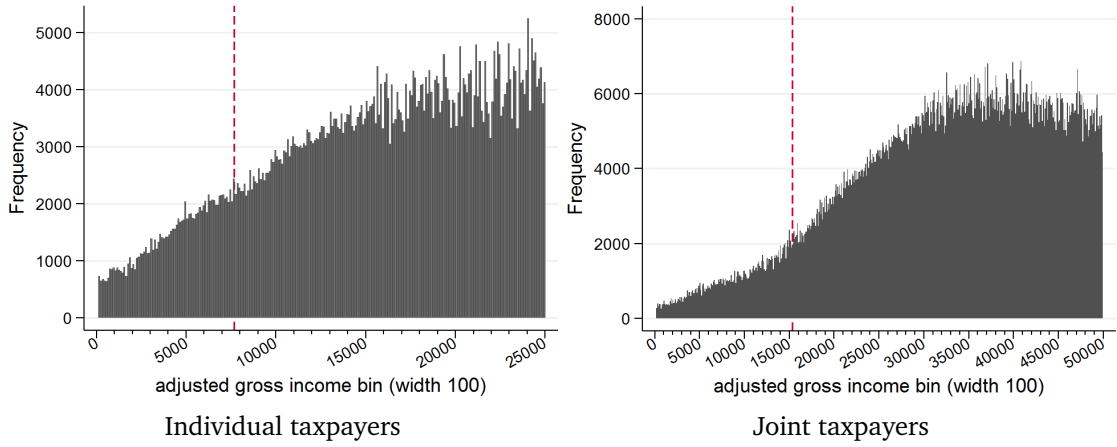


Fig. 14: Distribution of individual taxfilers' actual taxable income (left) and taxable income gross of itemized deductions (right) around the bottom kink.

(i) Only wage income



(ii) Wage income and non-wage income



(iii) Only non-wage income

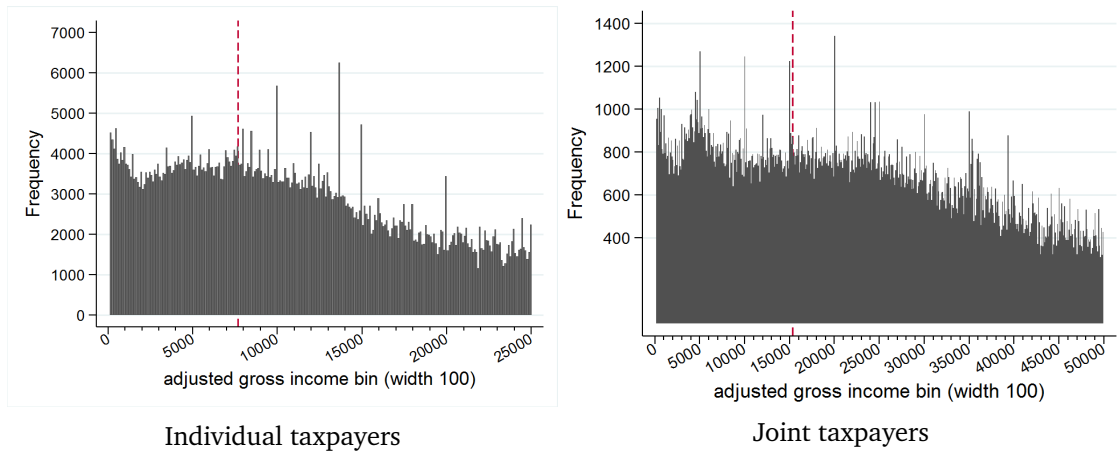


Fig. 15: Distribution of adjusted gross income around the bottom kink for taxfilers with only wage income (top), wage and non-wage income (middle) and only non-wage income (bottom).

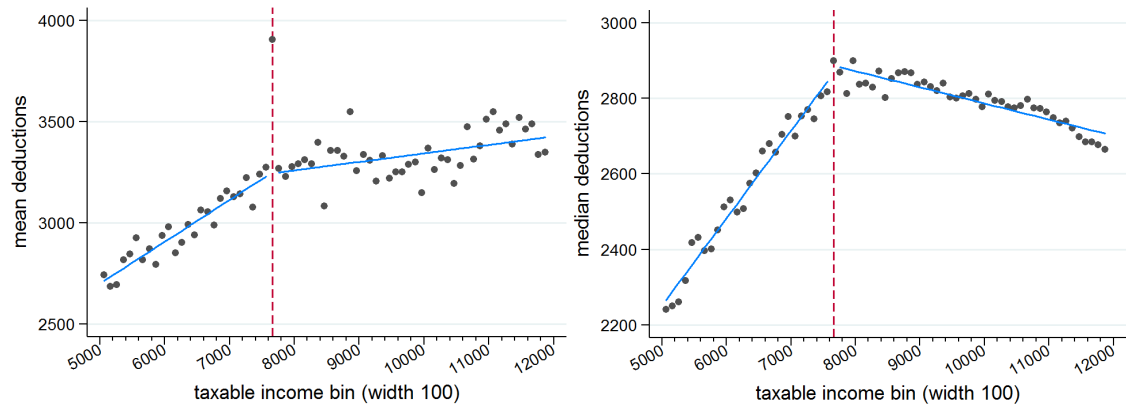


Fig. 16: Individual taxpayers' mean and median deductions around the bottom kink.

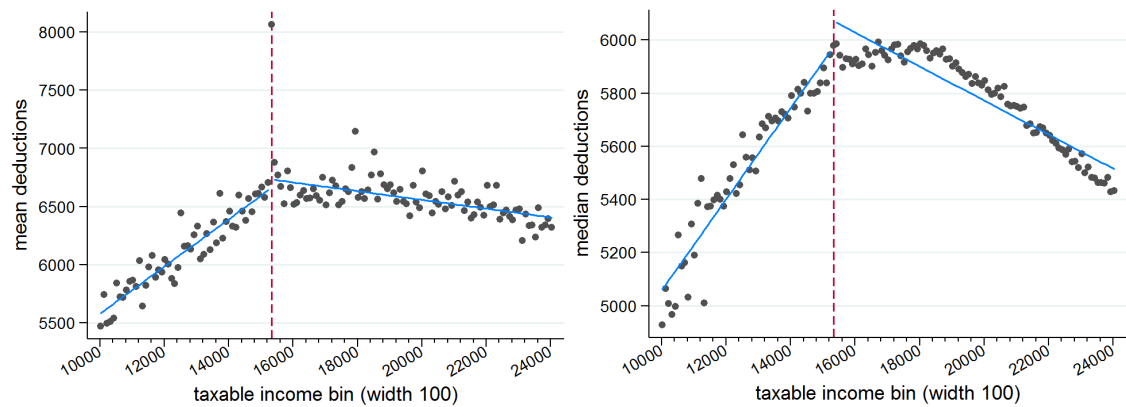


Fig. 17: Joint taxpayers' mean and median deductions around the bottom kink.

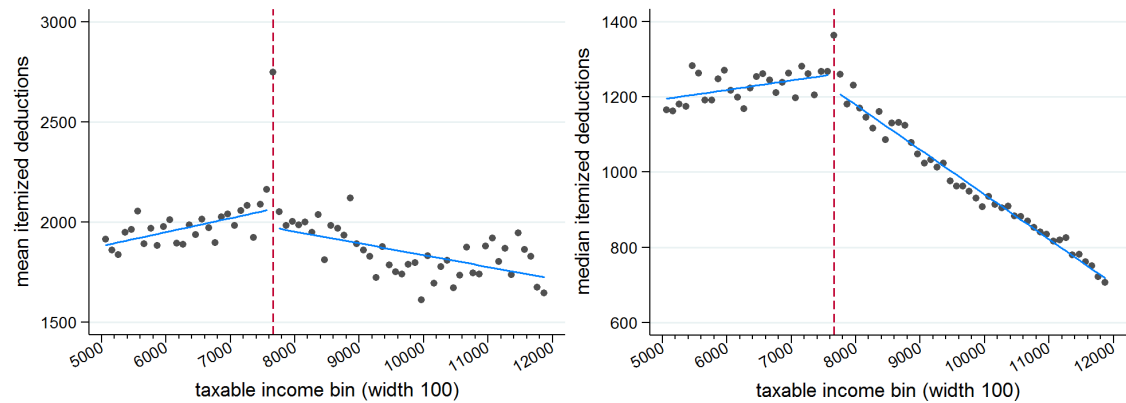


Fig. 18: Individual taxpayers' mean and median itemized deductions.

Notes: Deductions displayed refer to the difference between TANI ('total amount of net income') minus taxable income (i.e. they exclude deductible expenses for income generation and the standard exemptions for the elderly, single parents and agriculture and forestry income). The left panel shows mean deductions over bins of taxable income. The right panel shows median deductions over bins taxable income. The blue lines represent linear regression fits on the binned data (with the kink bin excluded), where slope and constant are allowed to vary between the two sides of the kink. Itemized deductions displayed in Figure 18 (bottom) are obtained as all (non-income related) deductions minus standard allowances and exemptions.

Appendix A: The bunching model with frictions

With frictions the structural elasticity may differ from the one obtained from the Saez model. Given the evidence for the role of frictions elsewhere (e.g. Chetty et al., 2011; Chetty, 2012; Gelber et al., 2015) and in this paper, I incorporate these into the model as fixed adjustment costs a , similarly to Chetty et al. (2011) and Gelber et al. (2015). This parameter could represent any type of optimization friction, ranging from uncertainty or ignorance about the tax schedule, the costs of attention to the accrual of income over the tax year or the difficulty of adjusting working hours to the costs of filing a tax declaration. Specifically, I assume that these costs arise if the taxpayer optimizes against the true tax function instead of ignoring the kink and pretending the tax rate above the kink is the same as below, i.e. if taxable income differs from the choice $z_0 = (1 - t_0)^e \cdot n$ under the linear schedule: $u = c - n^{-\frac{1}{e}} \cdot \frac{z^{1+1/e}}{1+1/e} - a \cdot \mathbb{1}(z \neq z_0)$. As for potential bunchers the benefit of reacting as opposed to ignoring the kink starts at zero and is increasing in n , with nonzero adjustment costs those counter-factually closely above the kink do no longer bunch and the lower bound for profitable bunching increases from \underline{n} to \tilde{n} implicitly defined by the indifference condition (cf. Gelber et al., 2015):

$$u(c(z = z_K), z_K) - u(c(z = z_0), z_0) = a. \quad (1)$$

If the adjustment costs exceed the maximal benefit of bunching, i.e. if $a > u(c(z = z_K), z_K) - u(c(z = z_0), z_0)$ for $z_0 = (1 - t_0)^e \cdot \bar{n}$, no bunching is observed. If instead $\tilde{n} < \bar{n}$, and with $\tilde{z}_0 = (1 - t_0)^e \cdot \tilde{n}$ denoting the counterfactual taxable income of the individual with $n = \tilde{n}$, the amount of bunching is reduced to $B = \int_{\tilde{z}_0}^{z_K + \Delta z} g_0(z) dz$, or approximately $z_K + \Delta z - \tilde{z}_0$ in terms of relative excess mass $b \equiv \frac{B}{g_0(z_K)}$. As \tilde{n} decreases in t_1 and increases in t_0 ceteris paribus, one may predict that the attenuation in bunching – and the likelihood of observing zero bunching – is larger the smaller the change in marginal tax rates at the kink. Besides this qualitative prediction, the indifference condition (1) can be solved numerically to back out the combinations of elasticities and adjustment costs that are compatible with an observed amount of bunching. For lack of an additional quasi-experimental source of identification for a , I resort to computing the implied elasticities for a benchmark value of frictions a in the amount of 1% of baseline utility $u(c(z = \tilde{z}_0), \tilde{z}_0)$ and to gauging the effect of an existing estimate of the size of earnings adjustment frictions (Gelber et al., 2015).

Appendix B: Evidence regarding income shifting and frictions

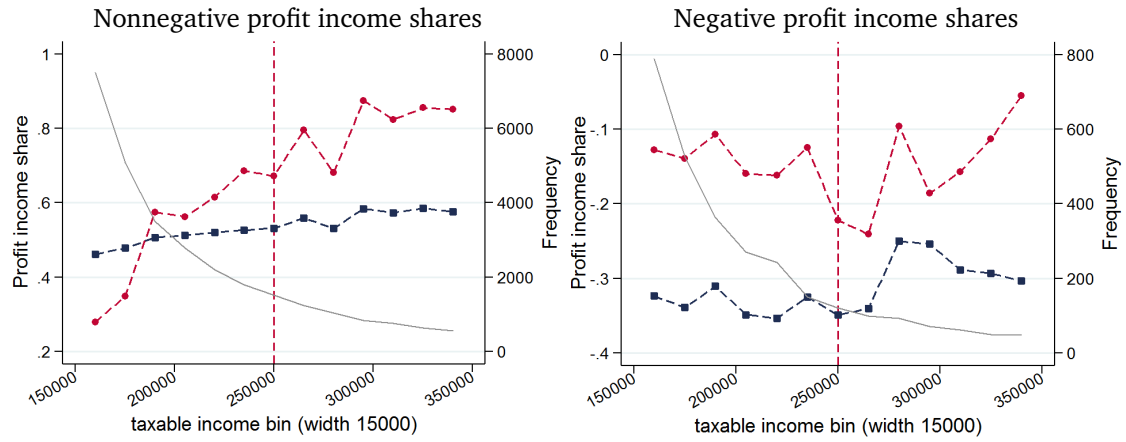


Fig. A1: Individual taxpayers' mean (blue) and median (red) selfemployment income shares around the top rate kink.

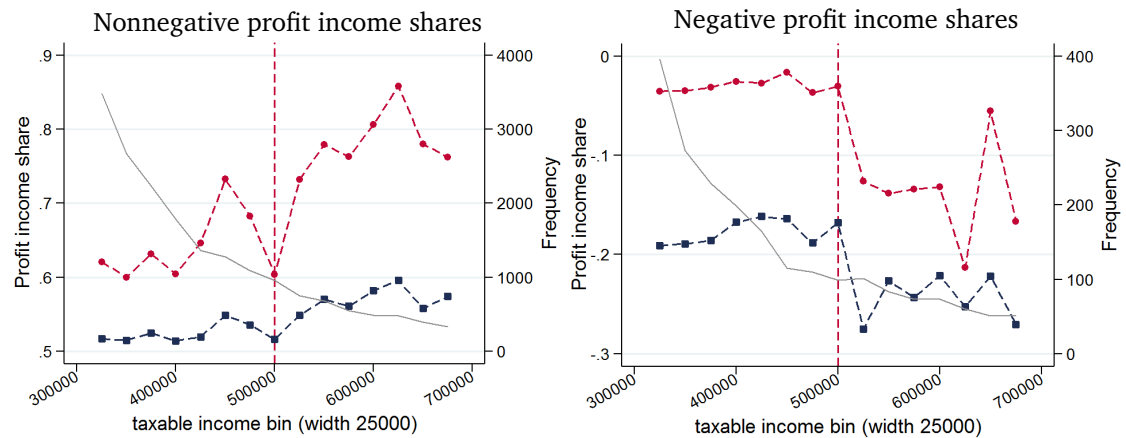


Fig. A2: Joint taxpayers' mean (blue) and median (red) selfemployment income shares around the top rate kink.

Notes: Blue dashed lines show the mean selfemployment ('profit') income shares in adjusted gross income. Red dashed lines show the median selfemployment income shares in adjusted gross income. The samples are split into taxpayers with nonnegative shares (left) and those with negative shares (right). The light gray lines show the number of observations (right axes). The samples exclude those for whom the exemption does not apply (taxpayers with 'progressivity proviso income') or for whom alternative exemption rules may apply (taxpayers older than 54 years of age). Due to data classification, the exemption base cannot be adequately measured for taxpayers with TANI in the top 0.05 percentile (which starts at around 920000 €). Hence these cases were also excluded.

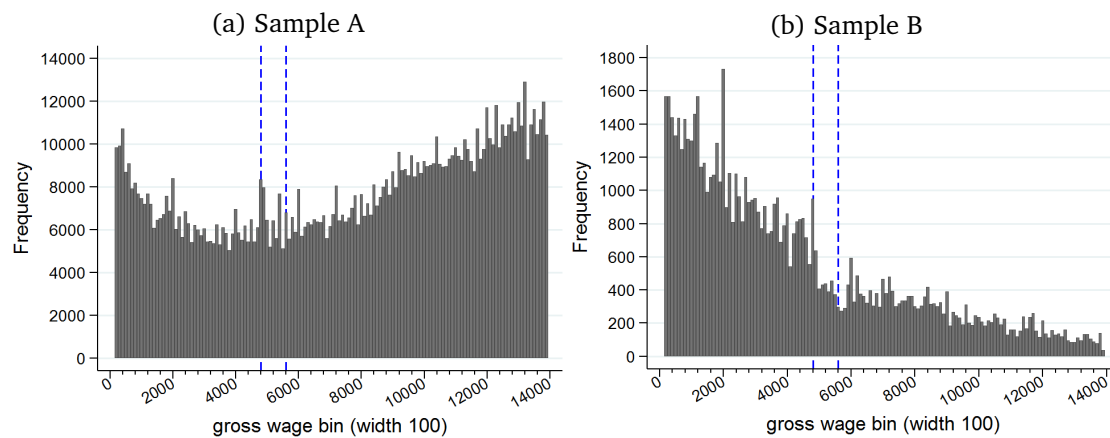


Fig. A3: Gross wage distributions about the mini-job threshold for taxpayers for whom this threshold represents an upward notch.

Notes: The subfigures display the distribution of annual gross wages for taxpayers who are entitled to free family health insurance via their spouse and for whom the ‘mini-job’ threshold hence represents an upward notch. The left dashed blue vertical line marks the location of the mini-job threshold; the right dashed blue vertical line the approximate upper limit of the dominated range induced by the notch (which increases mandatory social security contributions from 0€ to ca. 550€ Euro per year, or approximately 12 percentage points). Notice that income from ‘mini-jobs’ is missing in the data if a special flat rate tax for this employment type is chosen (instead of the regular income tax schedule). The subfigure to the right (Sample B) is restricted to taxpayers for whom the regular tax schedule is very likely beneficial because the resulting tax liability is below the tax liability induced by the flat tax rate scheme. Because of these potential missing data issues below 4800 € in gross wages, the fact that agents locate in the dominated range can only be interpreted as evidence for substantial wage earnings adjustment frictions with caution and tentativeness. With the present data, it is unfortunately not possible to obtain a credible quantitative estimate of adjustment frictions via the share of agents locating in the dominated region.

Appendix C: Taxable income histograms by income sources

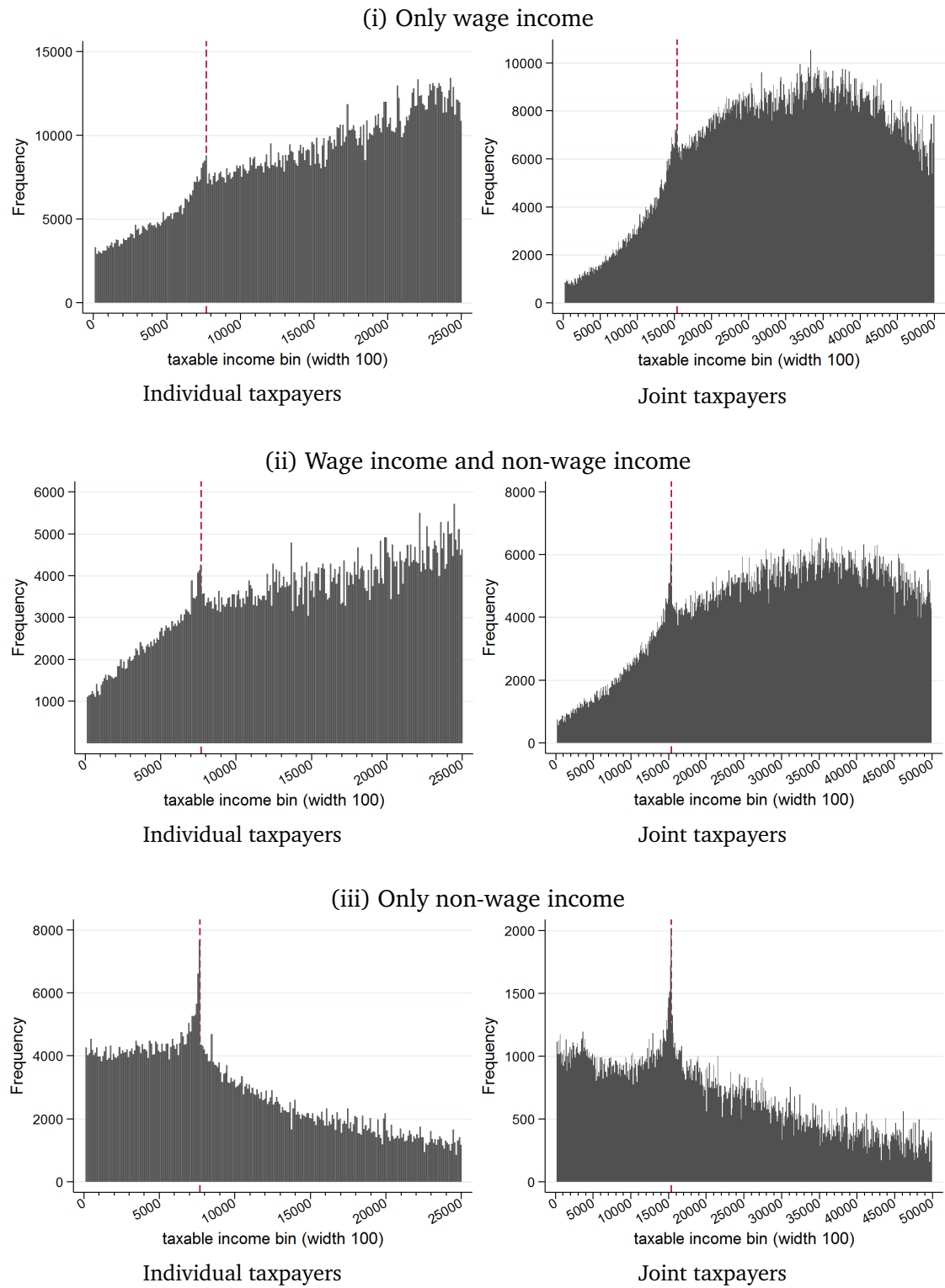


Fig. A4: Distribution of taxable income around the bottom kink for taxfilers with only wage income (top), wage and non-wage income (middle) and only non-wage income (bottom).

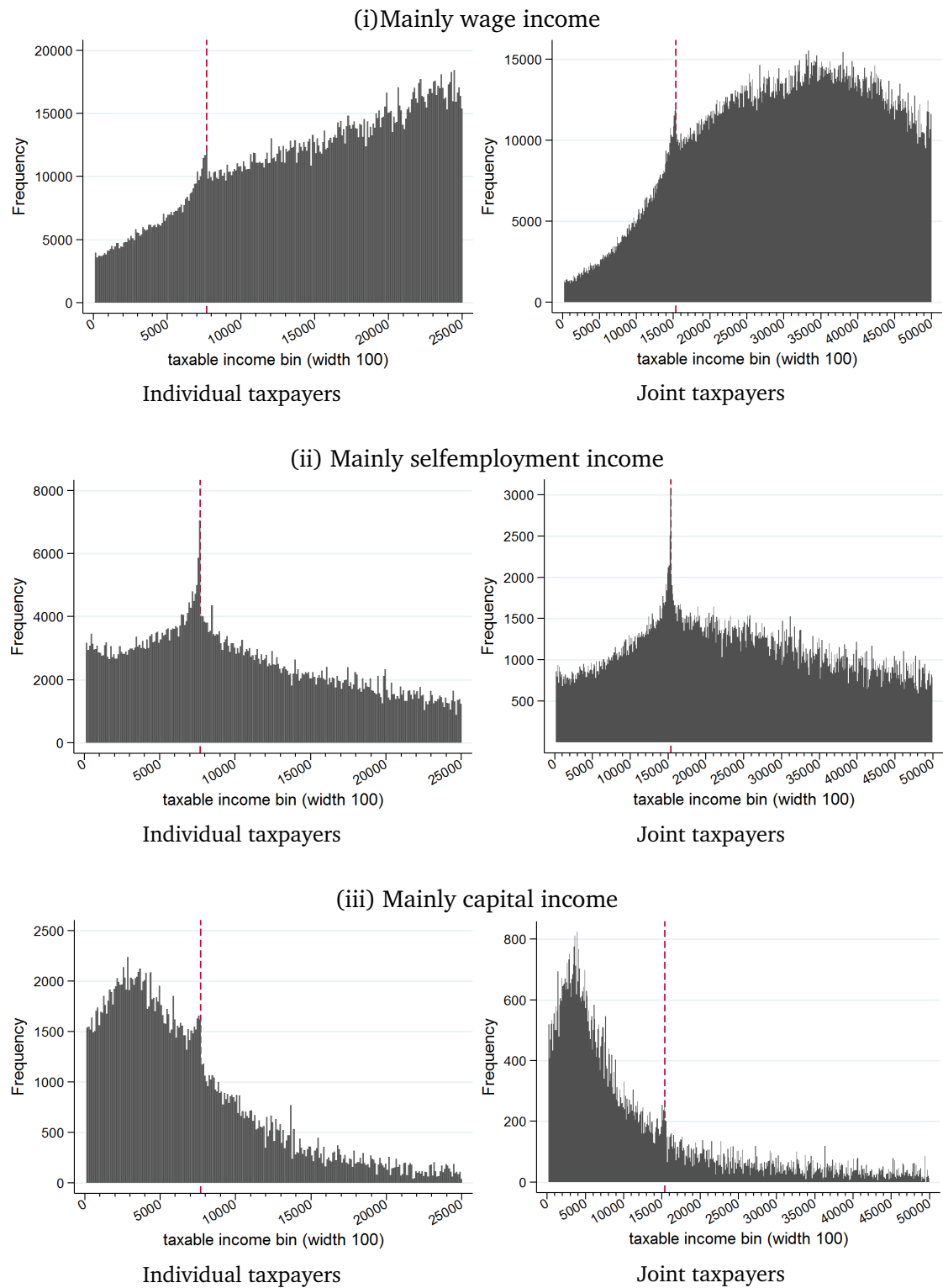


Fig. A5: Distribution of taxable income around the bottom kink for taxfilers with mainly wage income (top), mainly selfemployment income (middle) and mainly capital income (bottom).

Appendix D: Constrained bunching estimations (robustness)

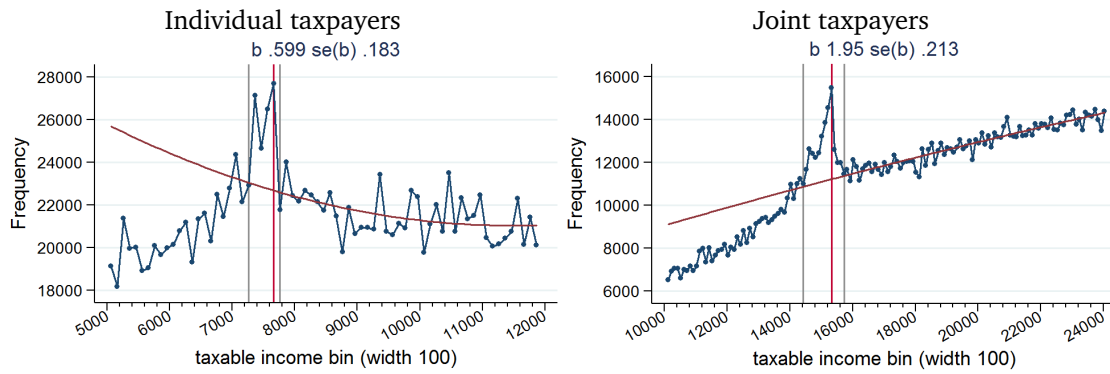


Fig. A6: Bunching estimations with estimation range constrained to the right of the bottom kink (polynomial degree 2).

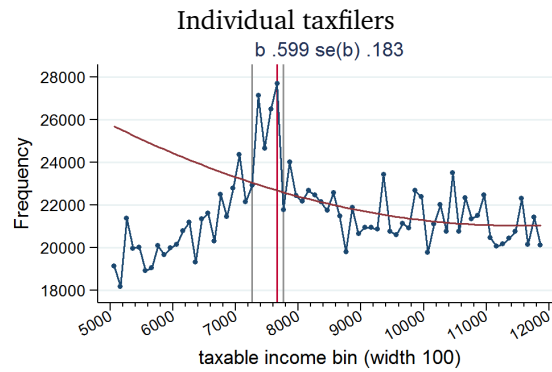
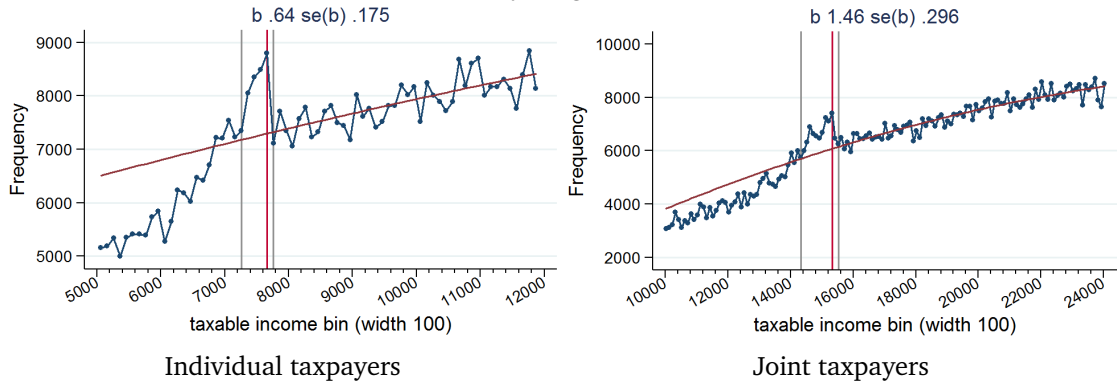
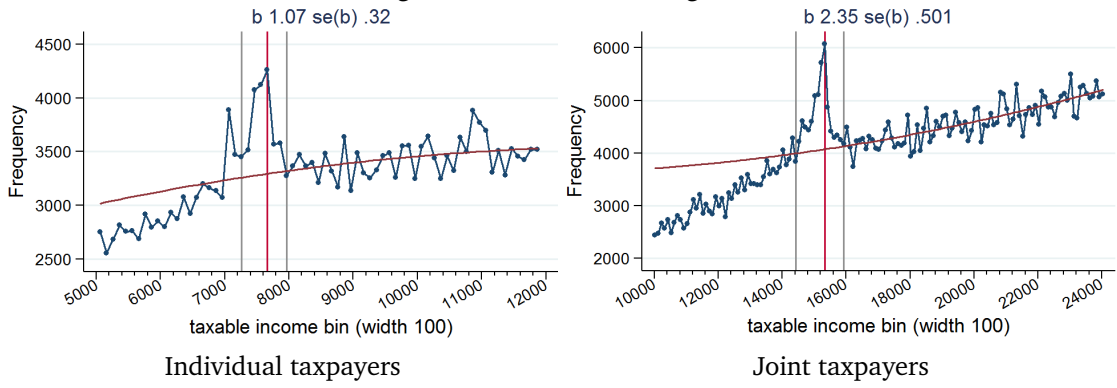


Fig. A7: Bunching estimations with estimation range constrained to the right of the bottom kink (polynomial degree 2).

(i) Only wage income



(ii) Wage income and non-wage income



(iii) Only non-wage income

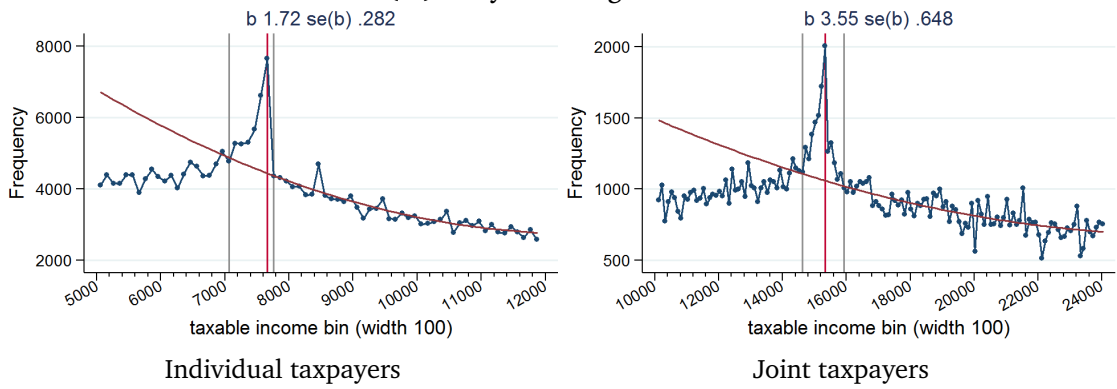


Fig. A8: Bunching estimations with estimation range constrained to the right of the bottom kink (polynomial degree 2).

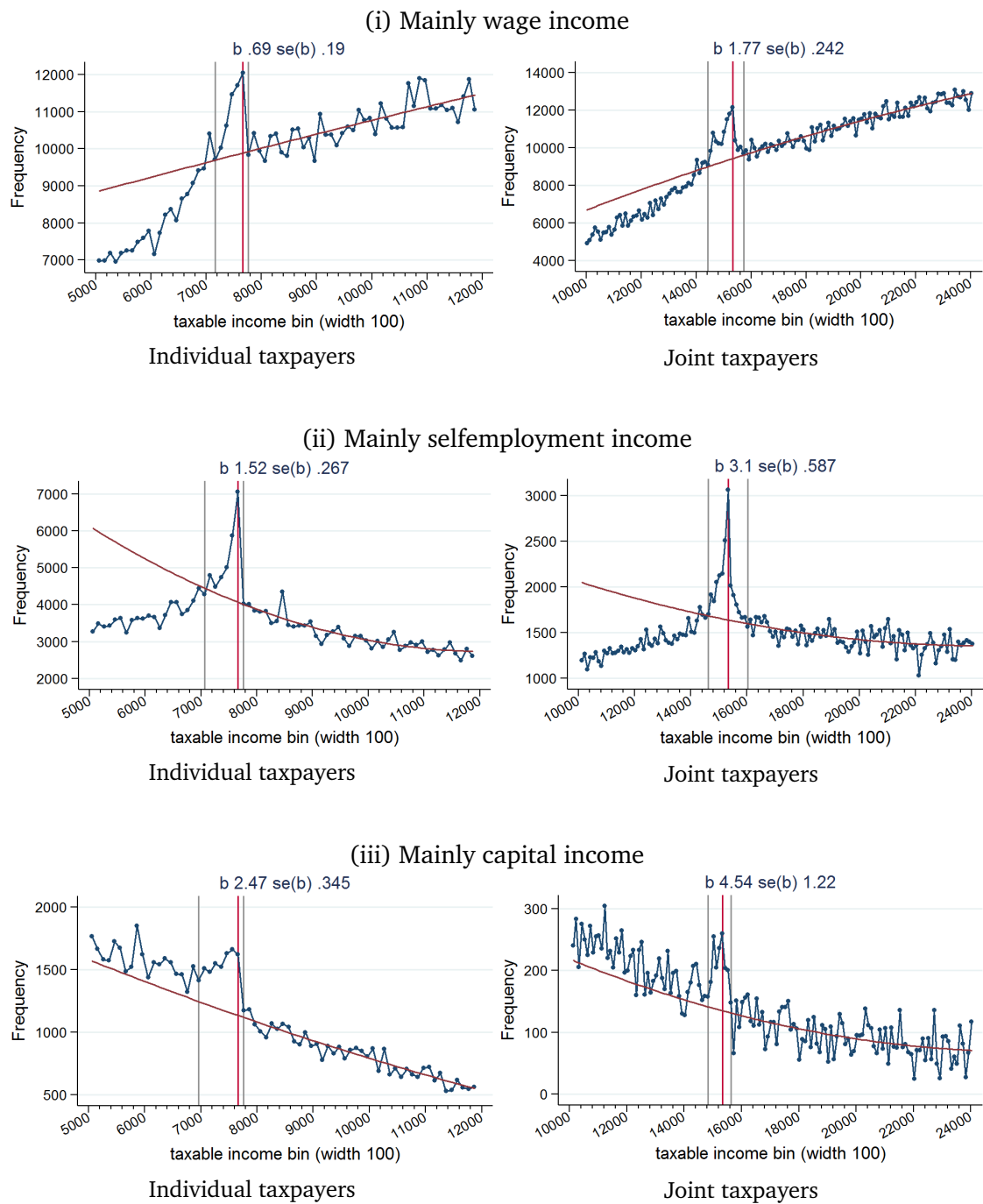


Fig. A9: Bunching estimations with estimation range constrained to the right of the bottom kink (polynomial degree 2).

Appendix E: Proportion filing a tax declaration



Fig. A10: Proportion filing a tax declaration (individual taxpayers).