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How do wage earners respond to a large kink? Evidence on earnings and deduction behavior from Austria

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WORKING PAPERS
IN ECONOMICS

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Jörg Paetzold*

Abstract

This paper contributes to recent literature emphasizing the importance to identify the different channels along which taxable income responses occur. Using bunching techniques and exploiting a large first kink point where marginal tax rates increase by as much as 38 percentage points, we recover modest gross wage earnings responses of Austrian employees. Next, we show that when accounting for deduction behavior, the additional mass of wage earners at the kink increases by around 50%. We find direct evidence for wage earners targeting the kink with their deduction claiming. Finally, we use a novel estimation strategy to show evidence that the probability of claiming a deduction depends on its (net-of-tax) cash value, and we provide a new estimate for the deduction elasticity. In sum, our results suggest that distinguishing between earnings and deduction responses matters even for taxpayers with only limited possibilities to shelter taxable income.

Keywords: Bunching, elasticity of wage earnings and deductions, tax expenditures, deduction behavior, administrative data

JEL codes: H21, H24, J22

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1 Introduction

Following the seminal contributions by Feldstein (1995, 1999), the elasticity of taxable income (ETI) occupied a critical place in the economic analysis of taxation. This has been built on premises that all types of behavioral responses to income taxation, such as labor supply adjustments, charitable giving, or illegal evasion, can accurately summarize the efficiency costs of taxation. However, the use of the ETI as the one single number to which all behavioral responses to income taxation can be boiled down has increasingly been questioned in recent years. For instance, Chetty (2009) argues theoretically that the channel along which taxable income responses occur makes a difference for the efficiency losses induced by income taxes, and stresses the importance to study (gross) earned income and taxable income responses separately. In a similar vein, Doerrenberg et al. (2016) show that the ETI is not sufficient for welfare analysis if deductions are responsive to tax-rate changes and generate externalities.

Our paper contributes to this recent strand of literature, examining the effect of taxes on individual deduction behavior. Previous studies have mostly found the deduction response to be concentrated among the self-employed (see, e.g., Bastani and Selin 2014), or did not distinguish between wage earners and self-employed taxpayers (Doerrenberg et al. 2016). However, this distinction seems crucial since self-employed taxpayers are much less constrained by third-party reporting when filing their taxes, which makes it difficult to cleanly separate between their (gross) earnings supply and deduction response (Saez et al. 2012). In addition, self-employed have much easier access to extensive tax planning compared to wage earners, for instance via retained earnings, income-shifting or the claiming of income-related deductions (Schjerning and le Maire 2013, LaLumia et al. 2015, Harju and Matikka 2016). Hence, self-employed taxpayers may use both (gross) income underreporting and tax planning (e.g. via deductions) as important channels to shelter their taxable income. It has been shown that varying access to the different channels through which taxpayers can respond to taxes are inter-related, with easier access to one channel affecting the use of other channels (Doerrenberg and Duncan 2014). This means that for self-employed taxpayers, the observed deduction responsiveness may be less informative since it also depends on other channels, most importantly the reporting of (gross) income to tax authorities.¹ In order to sidestep this problem, our setting focuses on taxpayers with only third-party reported earnings but access to a set of deduction possibilities, which allows us to distinguish between the gross earnings supply and deduction response more rigorously. In other words, using only wage earners enables us to better control for other channels of sheltering to recover a cleaner estimate of the channel of our interest, that is tax deduction behavior.

Our study employs an identification strategy well-suited to provide direct evidence of the effect of taxes on deduction behavior. Specifically, we apply bunching techniques and exploit a large and salient kink point in the Austrian income tax schedule. Hence, we do not have to rely on instru-

¹It is extremely difficult for researchers to gauge the degree of (gross) income underreporting of the self-employed on an individual level using tax return data. However, studies using survey or audit data suggest that the share of underreported gross income for self-employed taxpayers is considerable, with estimates of around 40% (see, e.g., Pissarides and Weber 1989, Kleven et al. 2011).

ments constructed from tax reforms to identify behavioral responses. This avoids the mechanical effect induced by simultaneous tax-rate and tax-base changes inherent in many tax reforms, which can make identification of a deduction response a difficult task (Saez et al. 2012, Doerrenberg et al. 2016).² In fact, our study focuses on a period without major changes in tax base definitions or reforms, which makes our results much more robust to this challenge. Furthermore, we use changes in the compensation scheme of the most popular deduction item of Austrian wage earners and a novel methodology to provide a new estimate for the deduction elasticity. Finally, while many empirical studies have found short-term behavioral responses to tax reforms, longer term adjustments are usually more difficult but also more policy-relevant to recover (Saez et al. 2012). Studying changes in the earnings distribution over years after a major tax reform, our results document how a change in the tax schedule can distort the earnings distribution over a longer time horizon.

To reveal earnings supply and deduction responses of wage earners, we exploit the introduction of a large first kink point in Austria. In 2005, an income tax reform created a first tax bracket where the marginal tax rate (and hence, the marginal price of claiming a deduction) increases by as much as 38.33 percentage points. This is a substantially bigger change in marginal tax rates compared to most other tax schedules found elsewhere and thus, represents a promising laboratory to study behavioral responses of taxpayers. By using this kink for identification, we follow the advice of Chetty (2012) to study large and salient features of a tax code to obtain the most credible estimates of behavioral responses to taxation.³ For our study we employ high-quality administrative data comprising the universe of Austrian payslips (comparable to W-2 forms in the U.S.), which entail third-party reported earnings of all wage earners. We can then link this data to individual tax returns, which provides us with information regarding claimed deductions as well as final taxable earnings.⁴

Turning towards our results, we first present evidence of diffuse bunching in gross wage earnings (before any deductions) as well as of sharp bunching in taxable earnings after accounting for deductions. Bunching in both earnings measures significantly increased over time since the introduction of the kink. Using only workers at large firms, we find almost identical amounts of bunching, suggesting that the bunching of gross earnings is not driven by wage misreporting but rather represents an earnings supply response.⁵ For the most recent year in our data, we observe 60% more taxpayers reporting gross wage earnings at the kink than predicted by the counterfactual distribution. We find this excess mass at the kink to become ca. 1.5 times larger when analysing taxable earnings (after deductions), providing a first indication that taxpayers partly respond with deduction claiming to the large change in marginal tax rates. The observed excess mass trans-

²Related to this, Kopczuk (2005) shows that changes in the tax base and the definition of taxable income can significantly affect ETI estimates.

³In particular, Chetty (2012) shows that large changes in net-of-tax rates are better suited to recover behavioral responses in the presence of optimization frictions.

⁴Since we focus on wage earners with zero self-employed income, we use the term taxable earnings instead of taxable income. Please note that taxable earnings determine the final tax liability (see Table 1).

⁵It has been frequently shown that underreporting of wages and collusive behavior significantly declines with increasing firm size (Kleven et al. 2011, Kumler et al. 2015).

lates into a small but non-negligible earnings elasticity: We estimate a compensated elasticity of 0.1 for taxable earnings, which is in the range of previous studies focusing on wage earners only (e.g., Chetty 2012, Saez et al. 2012, Kleven and Schulz 2014). Corroborating previous research, we also observe the bunching response to be much more widespread among female employees. In addition, we perform tests suggested by the literature (see, e.g., Best 2015 and Tazhitdinova 2015) to uncover aggregate bunching responses driven by firms or unions, but do not find evidence in this direction (see Appendix A1).⁶

Partitioning our data into groups claiming different levels of deductions, we show further evidence that employees respond strategically to the kink with both their wage earnings and deductions. More precisely, we find individuals with larger deductions to bunch no more at the statutory (=zero deduction) cutoff point with their *gross earnings*. Instead, we observe those taxpayers to be much more concentrated at the corresponding gross earnings level where, given their level of claimed deductions, their marginal tax rate changes. To assess more directly whether taxpayers target the kink with their deduction claiming, we also track the deduction behavior of wage earners over time. We find a significant increase in deductions once taxpayers cross the kink with their (gross) wage earnings, suggesting that taxpayers are aware of the kink and adjust their deduction behavior accordingly. Finally, we exploit changes in the compensation scheme of the most popular deduction item claimed by Austrian wage earners to derive a deduction elasticity (its a commuter tax break, which one-third of all Austrian wage earners receive). Using a Regression Kink Design, we show evidence that the probability of claiming the deduction discontinuously increases above the kink, paralleling the rise in the (net-of-tax) cash value of the deduction item. Using this novel estimation strategy to estimate a deduction elasticity, we find that when the net-of-tax cash value of the deduction increases by 1EUR, individuals increase their claims by 39 Cents. This implies that a 10% change in the net-of-tax rate is associated with a 6% change in additional claimed deductions.

Our results contribute to existing literature in several ways. First of all, recent studies document that the elasticity of taxable income (ETI) may not be a sufficient statistic for the welfare costs of taxation but emphasize the importance to distinguish reporting responses from changes in earnings supply (e.g., Chetty 2009). Our findings indicate that this distinction matters even for lower-income earners with less possibilities to shelter taxable income compared to high-income or self-employed individuals. Furthermore, our study also adds to the literature on taxpayers' responsiveness via personal allowances and deductions.⁷ Specifically, we corroborate research that deductions do respond positively to changes in marginal tax rates and employ a novel estimation strategy to provide a new estimate for the deduction elasticity (Matikka 2016, Doerrenberg et al. 2016). Our results also relate to recent literature which finds that taxpayers who owe taxes at the end of the year file for deductions to a greater extent (Engström et al. 2015, Rees-Jones 2016).

Furthermore, our paper relates to the literature examining bunching responses of taxpayers at

⁶It is important to note that the cutoff point of the kink is not annually adjusted to inflation, making it not a suitable yardstick for unions and employer associations when conducting wage negotiations.

⁷Our paper is also related to literature showing that charitable donations are responsive to tax incentives (see, e.g., Fack and Landais 2010, Scharf and Smith 2015, Duquette 2016 for recent contributions).

kink points (e.g., Saez 2010, Kleven 2016). Studies focusing on self-employed usually observe large bunching, mainly driven by reporting effects such as retained earnings or income-shifting (e.g., Schjerning and le Maire 2013, Bastani and Selin 2014). In contrast, studies looking at wage earners mostly found only very limited bunching, pointing at optimization frictions for workers.⁸ By documenting a slow but gradual rise in bunching after the introduction of the kink, our paper relates to this literature analyzing such frictions (Chetty et al. 2011, Gelber et al. 2016, Kosonen and Matikka 2016, Mortenson and Whitten 2016). Moreover, our findings underpin that also wage earners seek to respond along other margins than labor income where they are potentially less constrained, for instance via tax deductions.

Finally, our study provides new earnings and deduction elasticities for Austria. There are practically no earlier Austrian studies for taxable earnings elasticities available. The case of Austria is interesting due to the very large kink point at the lower middle part of the income distribution. This is in sharp contrast to most other advanced economies which usually set much lower rates at the bottom of the tax schedule to attenuate disincentives to work.

The paper proceeds as follows. In Section 2, we present details on the institutional setting and the Austrian income tax reform of 2005. Section 3 provides information regarding the data we use as well as some summary statistics. In Section 4, we briefly describe the bunching formula and estimation framework. Section 5 presents the main empirical analysis using bunching estimations. Section 6 provides estimates on the deduction elasticity using the commuter tax break. Finally, Section 7 concludes.

2 Institutional background and the income tax reform of 2005

2.1 The personal income tax in Austria

The individual is the taxing unit in the Austrian personal income tax code. Hence, there is no taxation of married couples or households. Table 1 depicts the basic steps for the calculation of the personal income tax for wage earners as defined by the Austrian tax law.⁹

In a first step, earnings from all employment relationships during a fiscal year are added up to determine an individual's sum of annual gross earnings.¹⁰ Note that annual gross earnings are already adjusted by mandatory social security contributions such as pension, health and unemployment insurance, which are not subject to income taxation. The gross earnings can then be reduced by claiming (itemized) deductions when filing a tax return at the end of the year. Austria makes extensive use of monthly income tax withholding via the employer and thus, does not re-

⁸Bunching of wage earners tend to be small even when based on notch points that create much stronger incentives than kinks (Kleven and Waseem 2013).

⁹Since the focus of our study relies on wage earners and their earnings supply as well as deduction responses, we desist from illustrating the calculation of tax liability for taxpayers with business income.

¹⁰Please note that welfare transfers such as unemployment benefits are tax exempt and hence, not part of calculating the personal tax liability. Further, capital income in Austria is taxed at the source to a favorable rate of 25% and thus, usually absent when filing personal income taxes.

Table 1: Calculation of tax liability (2011)

Sum of annual gross earnings
– Deductions for income-related expenses
= Adjusted gross earnings
– Deductions for special expenses
= Taxable earnings
⇒ Applying kinked tax schedule to taxable earnings
= Tax liability
– Tax credits
Tax due

quire wage earners to file a tax return. However, a majority (ca. 75%) of all wage earners file a tax return since the Austrian tax code allows for a set of deduction possibilities.¹¹ When a taxpayer decides to file taxes at the end of the year, the tax return will come pre-filled with the gross earnings reported by the employer. Furthermore, employers are required to issue a monthly payslip to their workers stating their monthly gross earnings as well as any taxes withheld, which gives wage earners a good sense of how much taxes they already paid and whether claiming deductions at the end of the year might result in a tax refund. It is important to note that for wage earners who do not file a tax return, the gross earnings become taxable earnings which will then be used as the tax base to calculate the tax liability.

As illustrated by Table 1, deduction possibilities fall broadly into two categories. The first one are income-related deductions, which comprise expenses necessary to acquire, maintain or preserve the income. Examples for such expenses are costs for professional training & education, expenses for work equipment (e.g., technical literature or work clothes), work-related travel or commuting costs and any fees for mandatory membership in certain organizations such as the Austrian Chamber of Labor. Non-itemizing taxpayers receive a small general allowance of EUR 132. The second category are deductions for special expenses. Those expenses include voluntary premiums for personal insurance (health, accident, life insurance), charitable giving, child care costs, expenses on constructing or maintaining the living accommodation, tax consultant fees and mortgage interest payments. The standard allowance for special expenses when a taxpayer does not itemize is EUR 60. Most of the deductions in both categories are self-reported, and some of the deductible expenses are capped per item or by group of items.

2.2 The Austrian income tax reform of 2005

In 2005, a comprehensive tax reform came into force in Austria. The reform was aimed to make the tax schedule more transparent and easier to understand. Before 2005, the Austrian tax schedule

¹¹For wage earners with income below the first bracket cutoff, a small negative income tax credit is applicable. Since this tax credit requires to file a tax return, even taxpayers not liable for income taxation have an incentive to hand in a tax return.

consisted of five statutory brackets (see Table 2) combined with a large general tax credit for low-income earners, which was phased out with increasing income and depending on the taxpayer’s status (single-earner, single-parent, retiree, individuals with self-employed income, etc.). This resulted in a rather complex tax schedule, with exemption rules and effective marginal tax rates difficult to understand, especially for low-income taxpayers. With the tax reform of 2005, the general tax credit as well as the bottom bracket got removed, which raised the tax-free amount to 10,000 EUR of taxable earnings. This created a large and simple first kink point for all individuals, especially salient for low-income earners and part-time workers. After the reform, marginal tax rates increase by as much as 38.33 percentage points at this new cutoff point (implying a change of 0.483 log points in the net-of-tax rate). Since 2005, the structure of the tax schedule as depicted in Table 2 remained unchanged, except of some small adjustments in 2009 when cutoffs for the first and the top bracket were slightly raised to 11,000 EUR and 60,000 EUR, respectively (with new marginal tax rates of 36.5%, 43.2% and 50%, respectively). Figure 1 graphically illustrates the three income tax brackets of the new tax schedule after the reform of 2005. Finally, it is important to note that there are no other changes at the cutoffs besides the income tax schedule. For instance, employers have to start withholding (and reporting) social security contributions via an employees’ payslip when wage earnings are as low as 375 EUR per month.

Table 2: Marginal tax rates and bracket cutoffs before and after 2005 (in EUR):

Pre-reform brackets	MTR	Post-reform brackets	MTR
0 - 3,640	0%	–	–
3,640 - 7,270	21%	0 - 10,000	0%
7,270 - 21,800	31%	10,000 - 25,000	38.33%
21,800 - 50,870	41%	25,000 - 51,000	43.59%
> 50,870	50%	> 51,000	50%

3 Data and summary statistics

3.1 Data

This project builds on sets of high-quality administrative data covering all Austrian wage earners to study behavioral responses to taxation. The data stems from three different sources which can be linked: First, we have access to the whole population of Austrian payslips (comparable to W-2 forms in the U.S) covering all employees and their gross earnings before deductions. This third-party reported earnings data also includes information regarding social security contributions and taxes withheld by the employer. Since we aim to separate between earnings supply and deduction responses as cleanly as possible, we use taxpayers with only payslip-recorded earnings and exclude

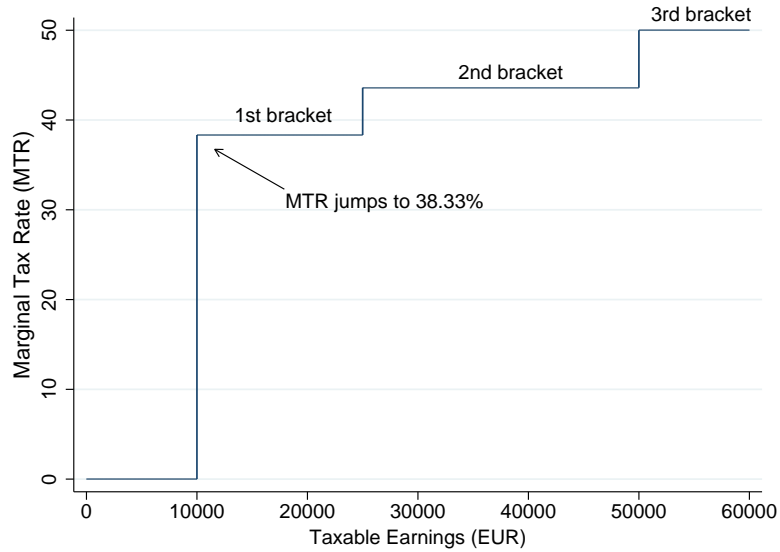


Figure 1: The Austrian income tax schedule after 2005

all individuals with self-employed income.¹² Second, we link this payslip data to the universe of tax returns filed by Austrian wage earners. This tax return data contains information regarding claimed deductions as well as the final taxable earnings. We observe the total amount taxpayers deduct in each of the deduction categories as displayed in Table 1, but not the single line items. Since most items within the two deduction categories are self-reported and represent choices of the individual taxpayer, we usually report the *total* amount of claimed deductions (i.e. the sum of income-related deductions and special expenses).¹³ Focusing on the total amount of claimed deductions is also useful since it is this sum of deductions which determines a taxpayer's final taxable earnings, the key figure to which the kinked tax schedule is then applied to. Furthermore, we observe the amount claimed for commuting costs separately, which is one of the most common deduction items of Austrian wage earners and part of the income-related deductions (around one-third of all Austrian wage earners request this deduction). Finally, the tax data can then be combined with the Austrian Social Security Database (ASSD), a linked employer-employee dataset that comprises the universe of private sector employment in Austria (Zweimüller et al. 2009). Using the ASSD, we are able to extract additional individual characteristics not covered by the tax data as well as information regarding the employer. Overall, we have access to data from all three sources for the years 2005-2011.

¹²Mis-characterizing self-employed income as wages is generally not practical since wage earnings recorded on a payslip automatically trigger social security contributions. Importantly, our results stay the same when using large firms only (>250 employees), which makes widespread misreporting rather unlikely (see Appendix Figure A.2).

¹³Please note that in Austria, all mandatory social security contributions are fully tax exempt and hence, *not* part of the income-related or special deductions. This is a qualitatively different institutional setting than e.g. in Germany, where income-related deductions also include social security contributions, which are third-party reported and not subject to choice whether to claim them or not on the tax return (see Doerrenberg et al. (2016)).

3.2 Summary statistic

Following standard practice in the literature (e.g., Saez et al., 2012), we put some restrictions to our analysis sample. First, we remove retirees and individuals currently doing an apprenticeship from our sample. Further, we exclude taxpayers working in 'Mini-Jobs' which are subject to a different payroll tax regime, not eligible for any deductions and restricted to gross wage earnings of less than 375 EUR a month (2011). We are finally left with a sample of approximately 21 million observations stemming from around 4 million individuals.

Table 3: Summary statistics of wage earners, 2005-2011

	All Individuals		Tax Filers	
	Mean	S.D.	Mean	S.D.
Age	39.5	10.7	38.9	10.7
Female	0.439	0.496	0.449	0.497
White-collar worker	0.462	0.499	0.447	0.497
Non-native	0.194	0.398	0.199	0.401
Gross earnings	23,084	23,072	21,617	15,750
Taxable earnings	22,277	22,907	20,513	15,308
Total deductions	1,009	1,683	1,255	1,881
Fraction filing tax return	0.731	0.444	1	0
Fraction receiving commuter tax break	0.325	0.468	0.366	0.482
Observations	21,196,743		15,479,775	
Unique individuals	4,105,634		3,399,120	

Table 3 provides descriptive statistics for our whole sample and for tax return filers only. In our whole sample, individuals are on average 39 years old, 44 percent are female and 19 percent hold a foreign citizenship. 73 percent of all wage earners file a tax return at the end of the year. The mean gross earnings are 23,084 EUR and, on average, wage earners claim around 1,000 EUR in total deductions. We observe some degree of variance in the amount of deductions claimed, indicated by a fairly high standard deviation. Further, we want to emphasize that in contrast to other countries such as Germany, all contributions to public pension, health and unemployment insurance are automatically subtracted from gross earnings and *not* part of any deductions. Hence, total deductions cover items which to a large extent represent choices of the individual and might at least partly be motivated by sheltering/deduction behavior serving the purpose of reducing tax liability.

4 Estimation procedure using the bunching formula

Bunching estimations received increasing attention in recent years to study behavioral responses to taxation. Specifically, it has been argued that kink points can provide a viable source of identification to recover credible estimates of behavioral parameters (Kleven 2016). In addition to methodological considerations, we decided to use bunching estimations for the following reasons:

The first one has to do with data availability. While there do exist Austrian payslip- as well as social security data for the years before 2005, we do *not* have access to tax return and deduction information prior to 2005. Hence, we are not in the position to study deduction or taxable earnings responses to the large tax reform of 2005 using other methods such as tax instruments. Second, the tax reform of 2005 created a simple tax schedule with an easy-to-understand tax-free zone not blurred with large phase-in tax credits, making it rather straightforward for taxpayers to understand at which income level marginal tax rates change substantially. Hence, focusing on behavioral responses to the first kink point follows the idea to exploit large and salient features of the tax code to receive the most credible estimates of behavioral responses to taxation (Chetty 2012). Third, mechanical effects induced by simultaneous tax-rate and tax-base reforms can make identification of a deduction response sometimes difficult (see Saez et al. 2012). Since we do not rely on tax reforms to construct instruments but focus on a period without major tax base changes, our results should be much more robust to this challenge.

The estimation procedure used in this study will draw on Chetty et al. (2011), which modify Saez' original formula in two ways: First, their bunching estimation uses the observed densities around the kink to inform *one* counterfactual density, whereas Saez (2010) constructs *two* counterfactual densities for both sides of the kink separately. Second, Saez' procedure assumes that the underlying distribution has a trapezoid shape and uses a parametrized model. In contrast, Chetty et al. (2011) apply a more flexible specification to estimate the counterfactual distribution nonparametrically. More precisely, they fit a polynomial to the income distribution while omitting an income window surrounding the kink and then adjust the mass of the counterfactual distribution so that it integrates to one. Those alterations aim to account better for the curvature of the underlying density function than the original Saez' formula.¹⁴

In what follows we aim to describe the bunching estimation technique used here in the simplest possible way.¹⁵ First, we collapse data into 500EUR wide bins, where each bin j stands for an earnings level Z_j . The earnings level Z_j represents the mean absolute earnings distance between the observations falling within earnings bin j and the kink point. Hence, Z_j measures the distance between bin j and the kink point. In line with previous studies using bunching techniques, we then define a bunching window of $[-R, R]$ by visual inspection of the raw data. We use 4 bins on each side of the kink as the baseline for our bunching window.¹⁶ The number of individuals in earnings bin j is given by the nonparametric regression:

$$C_j = \zeta(Z_j, R) + \eta_j \tag{1}$$

where ζ is a 7th degree polynomial in Z_j including dummy variables for observations in the bunch-

¹⁴Our results remain qualitatively unaffected when we estimate bunching using simpler approximations, for instance in the spirit of Saez (2010).

¹⁵We thank Chetty et al. (2011) for making their code publicly available. For a more detailed description of their estimation procedure, we want to refer the interested reader to this paper.

¹⁶Our main results stay qualitative the same when applying adjustments of the bin width or bunching window. Results are available upon request.

ing window R . The term η_j accounts for errors in the polynomial fit. Bunching is then estimated by relating the (actual) number of taxpayers \hat{B} to the average density of the counterfactual distribution in the bunching window $[-R, R]$. More specifically, bunching responses are paralleled by an excess mass of taxpayers \hat{b} at the kink, which can be calculated as

$$\hat{b} = \frac{\hat{B}}{\sum_{j=-R}^R \binom{\hat{C}_j}{2R+1}}$$

Note that \hat{C}_j denotes the predicted values from regression (1). We use a bootstrap procedure to obtain standard errors for the excess mass \hat{b} by drawing from the estimated errors with replacement and compute \hat{b} repeatedly. The size and significance of the estimated excess mass can then be used to infer taxpayers' responsiveness to the kink.

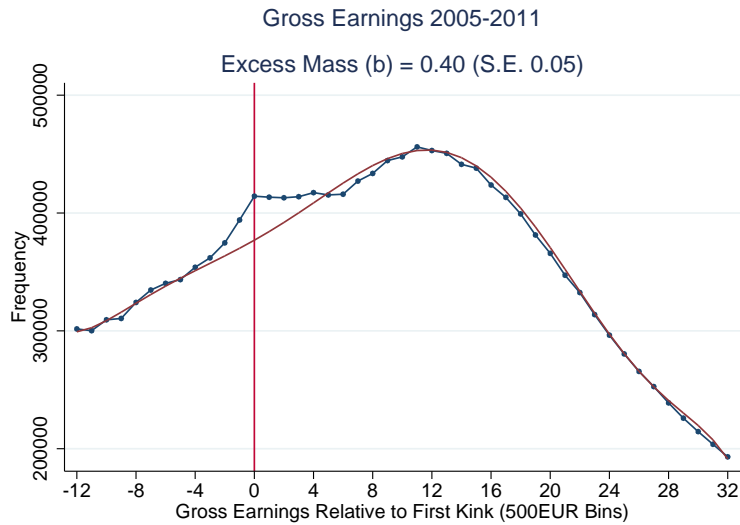
An important identification assumption underlying causal inference using bunching estimation is that the earnings distribution would be smooth in absence of the kink point. We can relax this assumption by studying changes of the earnings distribution since the tax reform of 2005. Given the optimization frictions (such as lack of information or adjustment costs) wage earners are facing when confronted with changing tax incentives, we expect bunching to build up over time (see, e.g., Kleven and Waseem 2013; Chetty et al. 2013). Studying the evolution of the bunching response on a year-by-year basis since the introduction of the kink, we are able to document how the earnings distribution is increasingly deformed since 2005.¹⁷

5 Empirical Analysis

We begin with examining the pattern of bunching in gross earnings (before any deductions) and taxable earnings (after deductions) separately. Therefore, we calculate the distance between the respective earnings measure and the first kink point for each observation. Thus, the computed earnings distance has a value of zero for those exactly at the bracket cutoff. We then put taxpayers into 500EUR wide bins of earnings distance to the kink (-250 to 250, 250 to 750, etc.) and pool data over all years. We plot histograms of bin counts around the kink point, demarcated by the vertical line at zero which represents the kink where marginal tax rates change. Further, we fit the polynomial to the bin counts, excluding the bunching window of $[-R, R]$ (as described in Section 4). The solid red curve in the histogram displays this counterfactual distribution and we report the estimate of the excess mass \hat{b} in each figure.

Panel A of Figure 2 plots gross earnings of all Austrian wage earners from 2005-2011. There is a clearly visible hump around the first kink point in an otherwise smooth and normally shaped

¹⁷Few papers using bunching estimators have accounted for optimization frictions when estimating earnings elasticities (Gelber et al. 2016, Kosonen and Matikka 2016). To successfully account for frictions requires either a notch, differently sized kinks located at different earnings thresholds, or changes in the size of a certain kink over time (Kleven 2016). Since we lack a useful source of variation during the time of our study, we desist from quantifying such optimization frictions but document them qualitatively. Hence, we interpret our taxable earnings elasticity as a lower bound of the underlying structural elasticity. However, frictions are typically less relevant when changes in the tax rate schedule are large, since they induce much bigger utility benefits from changing behavior (Chetty 2012).



Panel A



Panel B

Figure 2: Gross earnings vs. taxable earnings distribution of wage earners (2005-2011)

Notes: Panel A of Figure 2 plots gross earnings (before any deductions) of all Austrian wage earners from 2005-2011. Panel B of Figure 2 plots taxable earnings (after deductions) of all Austrian wage earners from 2005-2011. The series shown in dots is a histogram of gross earnings (or taxable earnings, respectively) relative to the first tax bracket. Each point shows the number of observations in a 500EUR wide bin. The solid line beneath the empirical distribution is a seventh-degree polynomial fitted to the empirical distribution excluding a bunching window of 4 bins on each side of the cutoff, as described in Section 4. The area between the empirical distribution and the polynomial fit represents the estimated excess mass at the kink.

earnings distribution. The calculated excess mass of taxpayers at the kink is 0.40 and highly statistically significant. This translates into an additional mass of wage earners of 40% compared to the (predicted) average mass of the counterfactual gross earnings distribution. One might wonder why the bunching response of gross earnings is not sharp but somewhat diffuse. This

can potentially be attributed to various factors. First, it might prove difficult for wage earners to control their wage earnings perfectly. This seems especially important in the Austrian context where kinks are not regularly adjusted for inflation and strong unions annually negotiate for higher wages for the vast majority of wage earners. Second, much of the sharp bunching responses of the self-employed documented in the literature has been associated with reporting effects such as income shifting rather than a real earnings response (e.g., Schjerning and le Maire 2013, Bastani and Selin 2014). In contrast, the third-party reported gross earnings (before any deductions) we report here should come very close to an actual earnings response.¹⁸ Finally, it could be the case that some wage earners may locate well to the right of the kink with their gross earnings but target the kink with their taxable earnings through deductions. Panel B of Figure 2 gives a first indication that this is indeed the case. This time, we display the taxable earnings distribution of all wage earners. Note that we again plot the entire population of wage earners, i.e. for those who do not file a tax return we use their gross earnings as taxable earnings (because for non-filers, gross earnings form the tax base to calculate tax liability). Hence, we do not select on filing a tax return, which might be endogenous. The taxable earnings distribution plotted in Panel B shows a more concentrated spike around the first kink, with a calculated excess mass of 0.61. This means that after accounting for claimed deductions, the excess mass becomes ca. 50% larger than for the (pre-deduction) gross earnings. The emergence of a spike in the taxable earnings distribution provides first evidence that taxpayers (partly) respond with deduction claiming to the change in marginal tax rates at the kink.

The identifying assumption underlying causal inference using bunching techniques is that the earnings distribution would be smooth in the absence of the kink. We can relax this identifying assumption by exploiting the tax reform of 2005 as a natural experiment. Hence, we can study changes in the earnings distribution after the introduction of this large and salient first kink. First, we start with the gross and taxable earnings distribution of 2005, the year of the reform. Panels A of Figure 3 displays the gross earnings distribution of 2005, and Panel B depicts the taxable earnings distribution of the same year. There is only a tiny distortion visible in either distribution, with an insignificant excess mass for both earnings measures. In the following years, the bunching response is steadily growing. The two lower Panels of Figure 3 display a substantial distortion in both distributions for 2011, with again sharper bunching in taxable earnings.¹⁹ The respective excess mass reaches 0.60 for gross earnings and 1.01 for taxable earnings. Again, the excess mass is found to be ca. 50% larger for taxable than for gross earnings and much more concentrated, suggesting that taxpayers in parts do respond with deduction claiming to target the kink point. Furthermore, it should be noted that the excess masses observed for 2011 translate into small but non-negligible earnings elasticities: Relating the observed excess mass for taxable earnings to the change in the net-of-tax rate at the kink, we receive a compensated elasticity of $\epsilon = 0.1$ ($\epsilon = 0.06$

¹⁸It has been frequently shown that underreporting of wages and collusive behavior declines with increasing firm size (Kleven et al. 2011, Kumler, Verhoogen and Frias 2015). Appendix Figure A.2 replicates Panel A of Figure 2 for wage earners working at firms with more than 250 employees. We find very similar bunching of gross earnings for this sample, suggesting that the bunching response is unlikely to be driven by wage misreporting.

¹⁹Appendix Figure A.3 shows also distributions for every other year in our data.

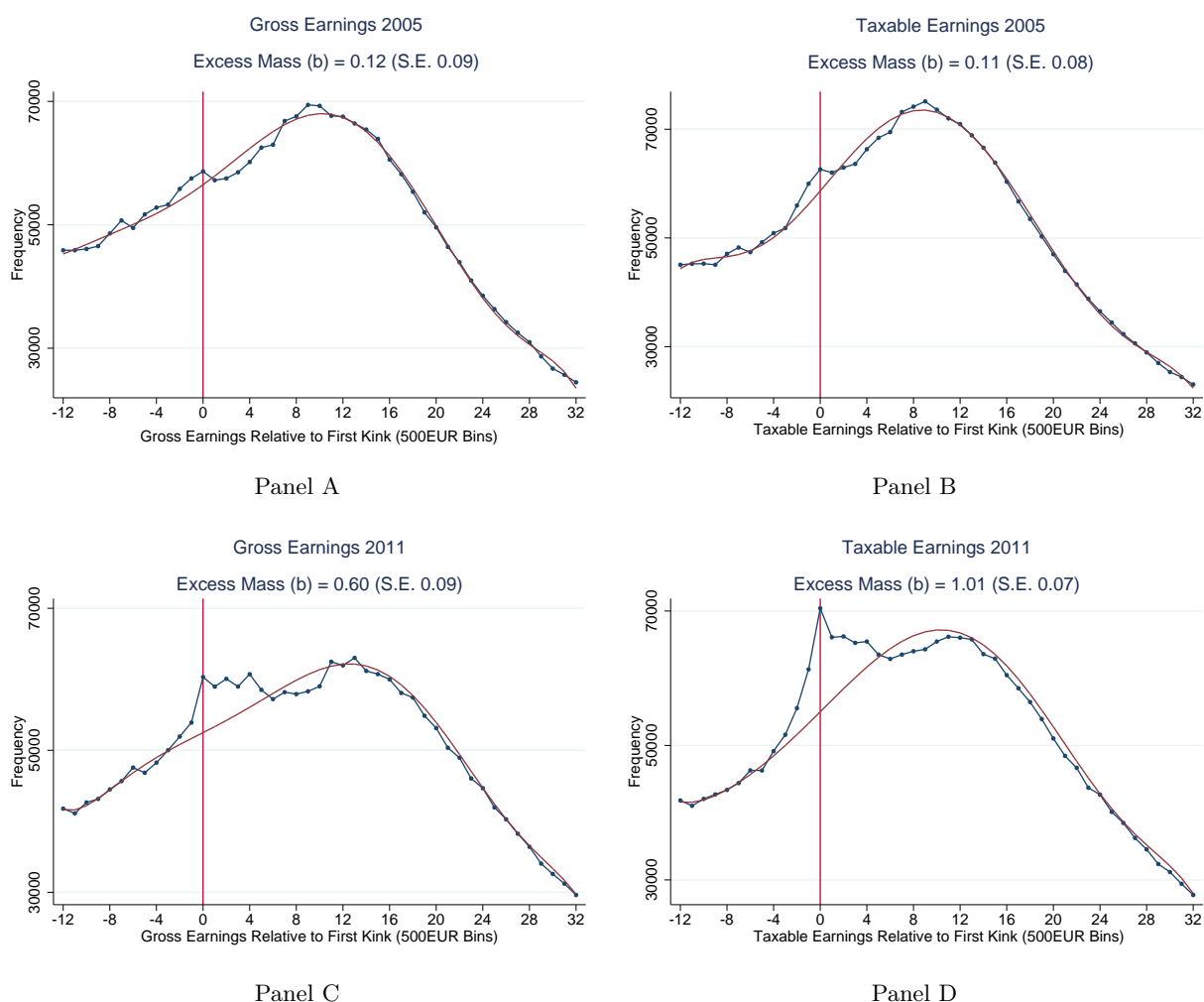


Figure 3: Increase in bunching over time

Notes: These figures plot the empirical distribution of gross earnings and taxable earnings of all wage earners in 2005 and 2011, respectively. The solid vertical lines mark the first kink point in the respective year. Each Panel also displays the counterfactual distribution and excess mass, computed as described in Section 4.

for gross earnings).²⁰ Since long-run responses are most important for policy considerations but usually the hardest to estimate, we treat these results as our preferred estimates.²¹ They are also well in the range of previous studies focusing on wage earners only (see Chetty 2012, Saez et al. 2012, Kleven and Schultz 2014).

In line with the literature we also document much larger responses of women to the tax rate change. The top Panel of Figure A.4 in the Appendix displays the gross earnings distribution for women from 2005-2011. We observe a spike in the distribution exactly around the cutoff. Panel B

²⁰To calculate the elasticities, we relate the excess mass to the change in the net-of-tax rate: $\epsilon = \frac{\hat{b}}{at/(1-t)}$ (Chetty et al. 2011). Bastani and Selin (2014) show via Monte-Carlo simulations that the bunching estimator is largely unaffected by the presence of income effects.

²¹Since we are not in the position to quantify optimization frictions (see Footnote 16), we think of our elasticity estimates as lower bounds of the underlying structural elasticity. However, it is important to note that frictions are typically less relevant when changes in the tax rate schedule are large, since they induce much bigger utility benefits from changing behavior (Chetty 2012).

covering men only displays much less bunching, with a slight hump around the kink point and a only borderline significant excess mass.

The responsiveness of wage earners to the kink is further documented in Figure 4, which displays gross earnings distributions of taxpayers with different amounts of claimed deductions. To construct the figure, we partition the sample of wage earners into groups claiming deductions worth 250 to 750, 750 to 1250, 1250 to 1750, etc. Panel A of Figure 4 depicts the gross earnings distribution (before deductions) of taxpayers claiming between 250 to 750 EUR of deductions on their tax return at the end of the year. These individuals do not begin to pay taxes at the solid line at zero but at the dashed line at bin one. It is evident from the graph that the highest point of the excess mass shifts exactly one 500 EUR wide bin to the right. Panel B plots the gross earnings distribution of taxpayers claiming 750 to 1250 EUR, and we observe a further shift to the right by another gross earnings bin. This pattern continues when displaying taxpayers claiming 1250 to 1750 EUR of deductions, where now the bunching is concentrated around three bins away from the statutory (zero deduction) cutoff point. In sum, Figure 4 presents further evidence about the effect of tax rate changes on deduction behavior. More specifically, it indicates that taxpayers do respond with deduction claiming to target the kink point where tax rates change. It suggests that taxpayers adjust their deduction behavior to bunch at the cutoff point with their taxable earnings in order to avoid paying taxes.

In order to assess more directly the responsiveness of deduction behavior due to the kink, Figure 5 shows mean deduction growth compared to current taxable earnings. The idea is to explore whether individuals in the vicinity of the kink have a stronger increase in their claimed deductions than individuals in other parts of the earnings distribution. For both Panels, we put taxpayers into 1,000EUR wide bins of of taxable earnings at time t and plot it against the percentage change of claimed deductions within each bin from t to $t + 1$.²² Furthermore, we add a quadratic fit of the bin averages (excluding the bin at the cutoff) to approximate the counterfactual mean deduction growth at a certain earnings level. Panel A focuses on taxpayers who experience an increase in annual gross earnings from t to $t + 1$. Thus, taxpayers in Panel A who are close to the kink at time t will be pushed beyond the nominally rigid cutoff point through their earnings growth. However, in order to avoid crossing the kink, gross earnings growth can be offset by claiming higher deductions.²³ We observe a sharp increase in claimed deductions for wage earners located close to the kink point in time t , with a much higher average growth rate in the deduction amount than people to the left- or right-hand side of the kink. Panel B of Figure 5 depicts taxpayers who experience a decrease in annual gross earnings from t to $t + 1$. In contrast to Panel A, we do not find a deviation in deduction growth at the cutoff point for those wage earners. This missing drop

²²Using 500EUR wide bins instead of 1,000EUR bins or using gross earnings instead of taxable earnings as assignment variable do not change the overall pattern of Figure 5. By choosing larger bins we aim to capture taxpayers intertemporally affected by the kink in one bin, as put forward by the literature on dynamic bunching (e.g., Almunia and Lopez-Rodriguez 2015, Marx 2015)

²³Please note that we again do not select on filing a tax return but use the entire population in our sample. This means that for those who do not file a tax return we use the standard deduction for income-related deductions and special expenses, respectively. Our results stay qualitatively the same when using only wage earners who file a tax return.

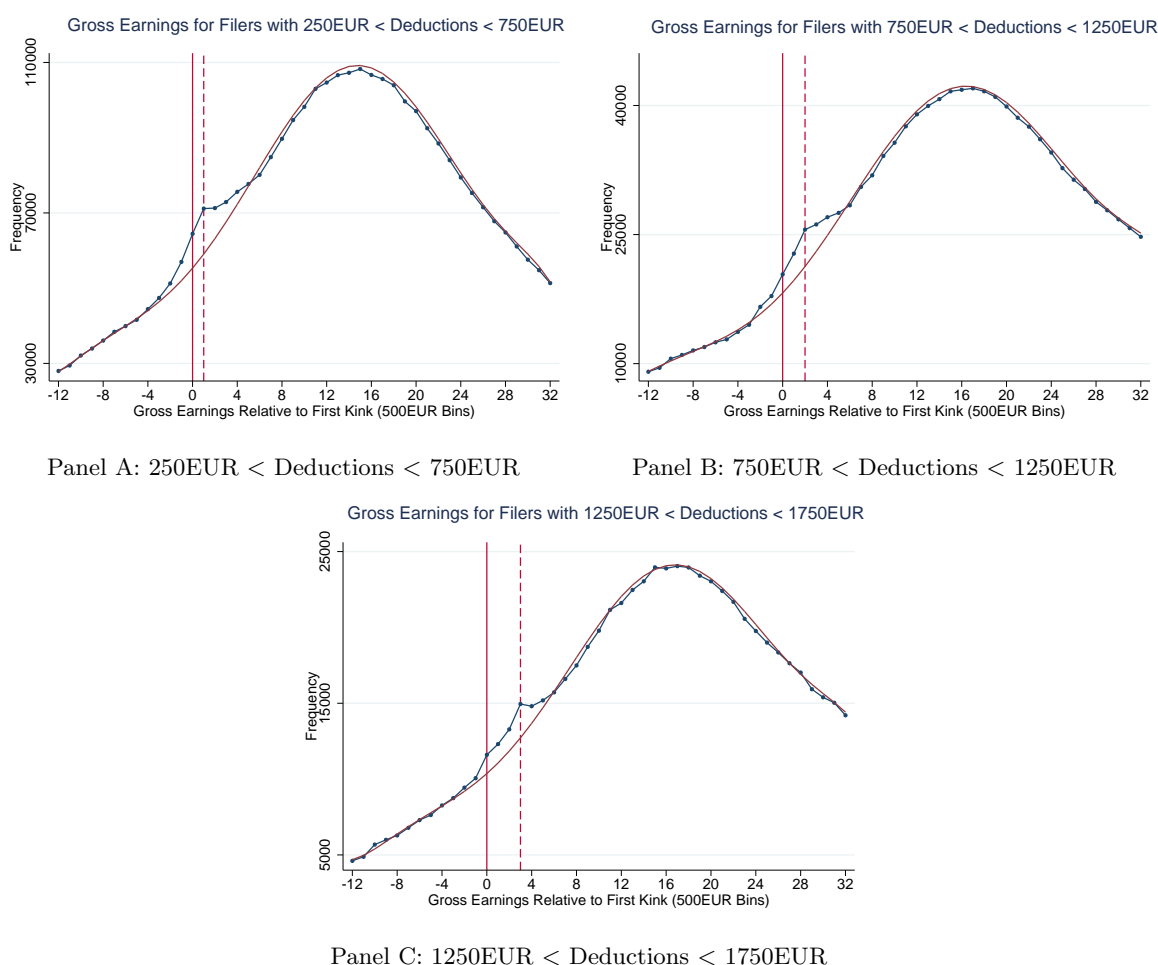
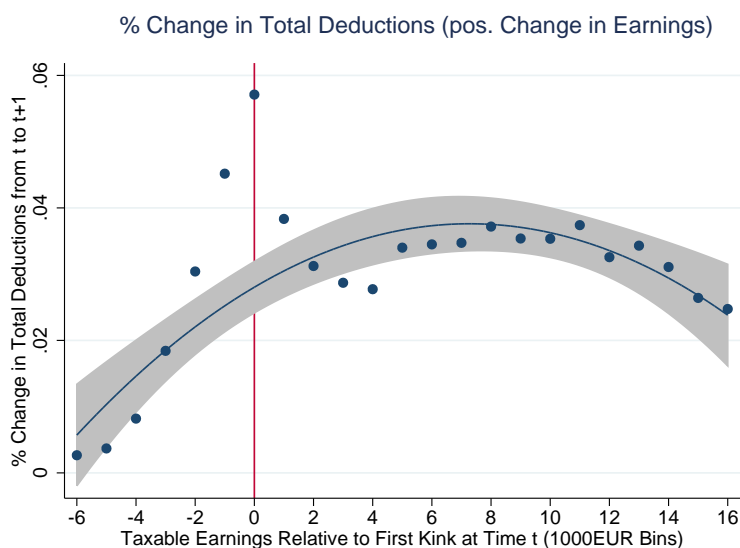


Figure 4: Gross earnings distributions of taxpayers with different levels of deductions (2005-2011)

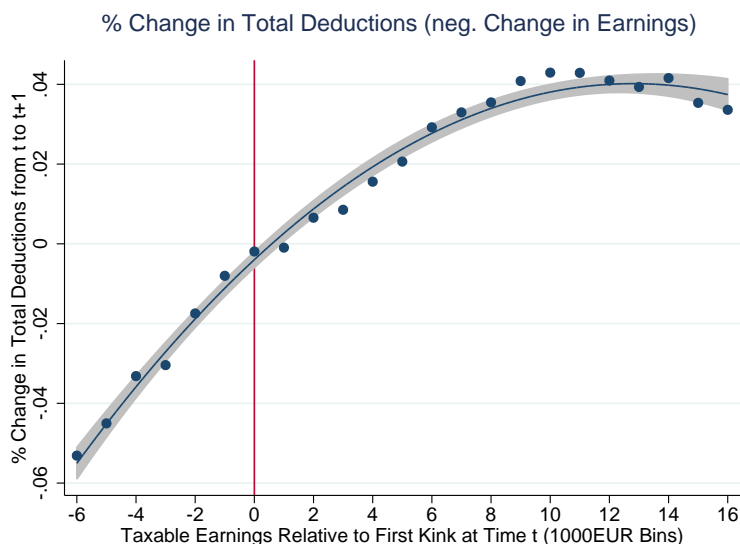
Notes: These figures plot the empirical distribution of gross earnings (before deductions) for taxpayers with different levels of claimed deductions. Panel A plots gross earnings of wage earners claiming between 250EUR and 750EUR, Panel B claiming between 750EUR and 1250EUR and Panel C claiming between 1250EUR and 1750EUR. The solid vertical lines show the statutory cutoff point for individuals with zero deductions. The dashed vertical lines show the corresponding cutoff point where these taxpayers, given their level of claimed deductions, actually start paying the higher tax rate.

in deductions at the cutoff can be reconciled by models of reference-dependent preferences, where taxpayers perceive increases in their tax liability different than decreases (see, e.g., Engström et al. 2015, Rees-Jones 2016).

In sum, the presence of a spike in deduction growth exactly at the cutoff point for taxpayers with a positive change in gross earnings suggests that wage earners are aware of the kink and increase their claimed deductions once they cross it. This pattern is corroborated when analyzing 2008/2009 only, where the cutoff was shifted to 11,000EUR. Importantly, the spike at the previous cutoff point of 2008 disappears, but a new hump emerges at the new 2009-cutoff (see Appendix Figure A.5).



Panel A



Panel B

Figure 5: Patterns of deduction growth around kink point

Notes: Figure 5 shows mean deduction growth compared to current taxable earnings. Both diagrams display the mean growth in claimed deductions, defined as the mean of $[\ln(\text{total deductions}_{t+1}) - \ln(\text{total deductions}_t)]$. The horizontal axis shows taxable earnings for year t in both panels. Panel A (B) focuses on taxpayers with an increase (decrease) of gross earnings from t to $t + 1$ only. The solid blue curve is a quadratic fit of the bin averages. The solid vertical line displays the cutoff point of the first kink.

6 Estimating the Deduction Elasticity using a RK-Design

Our findings presented in Section 5 show evidence that wage earners increase their deductions when becoming liable for income taxation (i.e. when crossing the first kink point). While this result demonstrates that taxpayers' deduction behavior reacts positively to tax rate changes, one objection against this evidence could be that it is based on a somewhat truncated decision: Tax-

payers below the kink might have had the same deductible expenses than those above the kink, but decided not to report them because they had no monetary incentive to do so. Similarly, some taxpayers might only report deductions until their taxable earnings are below the kink, though they actually would have additional deductible expenses to claim. This means that we are not in the position to infer a deduction elasticity from the deduction responsiveness we observe in Figure 5. Fortunately, there exists a (refundable) tax item where both individuals below and above the kink have a monetary incentive to report it but the (net-of-tax) cash value of claiming the deduction changes at the kink: A commuter tax break, the biggest and most important standard deduction for Austrian wage earners (as shown in Table 3, around 30% of all Austrian wage earners receive this deduction).²⁴

For wage earners liable for income taxation, the commuter tax break comes in the form of an allowance which reduces taxable earnings. Hence, the cash value of claiming the commuter allowance increases with the amount of taxable earnings above the first kink (as well as with the commuting distance, see Table 4). In contrast, for individuals with gross earnings below the first kink and no tax liability, the commuter tax break comes in the form of a flat refundable tax credit. Importantly, rules to be eligible for the commuter tax break are the same for individuals on both sides of the kink (e.g. to be eligible for the commuter tax break when commuting less than 20km to work, individuals have to declare that public transport is not in place or unreasonably long). Panel A of Figure 6 illustrates the design by plotting the (net-of-tax) cash-value of the commuter tax break vs. gross earnings relative to the kink. As depicted by the figure, for commuters who earn below the kink the cash-value of claiming the commuter tax break is flat and 130EUR; for commuters who earn above the kink the (net-of-tax) cash-value of the commuter allowance increases with income and driving distance. Thus, the schedule of the commuter tax break creates a discontinuity regarding the benefit of claiming the deduction, with the (net-of-tax) cash-value of the commuter tax break being higher for wage earners above the kink point.

Table 4: Allowance amount as deductible from taxable earnings (EUR)

Commuting distance	Means of transportation	
	Public	Private
2–20 km	–	372
20–40 km	696	1,476
40–60 km	1,356	2,568
More than 60 km	2,016	3,672

To identify changes in claiming the commuter tax break and the corresponding deduction elasticity, we use a Regression Kink Design (RKD). Hence, we exploit the discontinuity in treatment intensity (i.e. in the cash-value of the commuter tax break) as a function of a continuous assignment variable (i.e. the gross earnings). In other words, we use the the change in the slope of the treatment function at the kink to identify changes in deduction behavior when the cash value of claiming

²⁴Tax breaks for commuters exist in many other countries. They are either included in general work-related deductions (e.g., France or Italy), designed as a single deduction item for commuters (e.g., Germany, Netherlands, Denmark, Sweden) or come in the form of tax-free benefits paid by the employer (e.g. in the U.S.).

the item changes. The identification assumption is that unobserved determinants of filing for the commuter tax break evolve smoothly around the kink. Following standard practice (e.g., Card et al. 2015a), this identifying assumption can be evaluated by analyzing whether there is i) a manipulation of the assignment variable, and ii) a discontinuity in covariates around the first kink point. The first point forces us to focus on male wage earners only, since we documented above substantial bunching among females but only small sorting for male wage earners. Panel B of Figure 6 plots the male earnings distribution, zoomed in around the kink point. Again, we do not observe significant bunching of male wage earners, consistent with Figure A.4 in the Appendix. The second identifying assumption of the RKD can be tested by examining whether observable characteristics are smooth around the kink. In the spirit of Card et al. (2015a), we construct a 'covariate index' - the predicted take-up rate of the commuter tax break using all observable characteristics as regressors. In order to make sure that we also control for a variety of firm characteristics as well as the commuting distance, we restrict our sample to wage earners which can be linked to firm information in the ASSD.²⁵ This allows us to build a vector of covariates including information on age, education, occupation, driving distance to work, filing a tax return, working part-time, years of job tenure, firm size, industry, and region. Panel C of Figure 6 plots the mean value of the covariate index against 100EUR bins of gross earnings. The index moves reasonably smooth across the kink point and we find no evidence of discontinuities in these variables.

Figure 7 plots actual observed take-up rates of the commuter tax break against 100EUR bins of gross earnings. We use a binary outcome variable with entry one for take-up, which avoids any mechanical effect stemming from the kinked schedule of the commuter tax break in terms of its (net-of-tax) cash value. The figure shows a clear change of slope occurring exactly at the kink point. The solid lines represent best-fit linear regressions estimated on the microdata separately for observations above and below the kink. The hypothesis that the two slopes are equal is rejected with a p -value smaller than 0.001. The dashed black line plots the counterfactual take-up rate if there would be no change in the schedule of the commuter tax break.²⁶ In sum, the probability of take-up increases discontinuously above the kink, paralleling the rise in the (net-of-tax) cash value of the commuter tax break. This result is also robust to the inclusion of the full set of covariates (see Appendix Table A.1).

To substantiate the claim that it is the discontinuity in the cash-value of the commuter tax break that changes filing behavior, we use variation in the location of the kink over time (see e.g., Landais 2015). In 2009, the location of the kink and hence, the location of the discontinuity in the schedule of the commuter tax break was shifted by 1,000 EUR.²⁷ Appendix Figure A.6 plots the relationship between the take-up of the commuter tax break and gross earnings in 2008 and 2009. There is a clear kink in this relationship in 2008 at the location of the 2008-kink (Panel A). Interestingly, this kink disappears in 2009, but a new kink appears exactly at the location of the shifted 2009-kink

²⁵Since the refundable tax credit was introduced in 2008, we limit our analysis to the years 2008-2011.

²⁶We use the observed take-up rate on the LHS of the kink to linearly predict the take-up rate absent the kink (see Bachas and Soto (2015) for a similar approach in the case of a cost discontinuity).

²⁷Note that this increase of the cutoff point by 10% is much larger than inflation growth in the respective year, which means that the shift was an important change of the schedule in real terms.

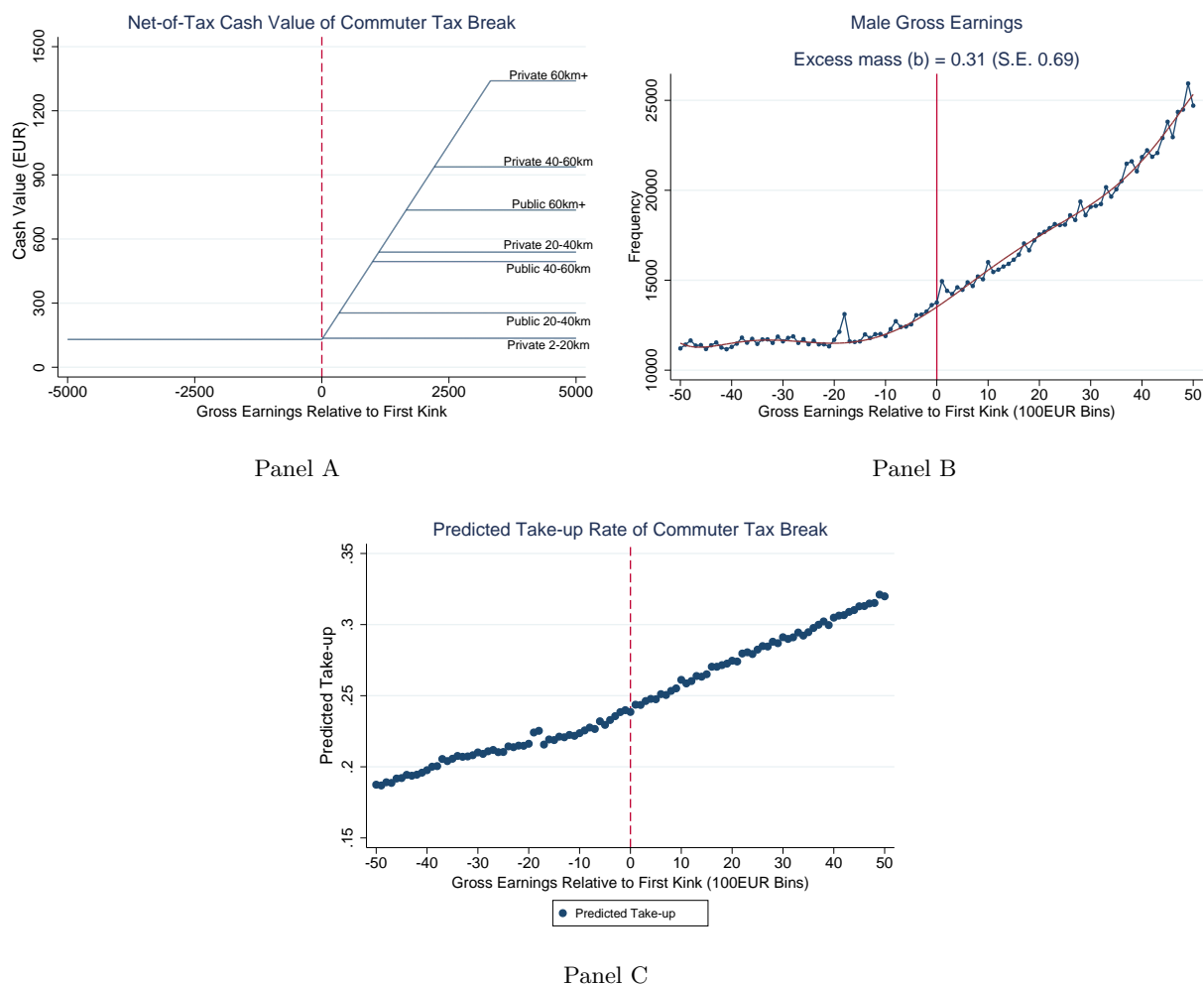


Figure 6: Design of Commuter tax break and assessment of RKD assumptions (men only)

Notes: Panel A depicts the schedule of the commuter tax break, showing its (net-of-tax) cash-value against gross earnings relative to the kink. Panels B and C test the validity of the identifying assumptions of the RK-Design. Data is presented in 100EUR gross earnings bins relative to the kink, plotting bins in the range [-50,50]. In Panel B we apply the same bunching technique as described in Section 4 (using also the same bunching window). Panel C plots the predicted take-up rate of the commuter tax break using all observable characteristics as regressors (following Card et al. 2015a). See text for details.

(Panel B). The fact that the location of the change in slope shifts with the location of the kink is supportive of an effect of the (net-of-tax) cash value of the commuter tax break on taxpayers' decision to claim it.

As a next step, we want to study how this change in take-up rate translates into the cash value claimants received. The solid line in Figure 8 plots the (net-of-tax) cash value commuters received within each bin of gross earnings.²⁸ We observe an extremely clear change of slope at around zero. This clear change in slope is partly mechanical due to the schedule of the commuter tax break, which by construction gives a claimant above the kink a higher cash value than a claimant below (as illustrated in Panel A of Figure 6). Hence, we have to decompose the change in slope into

²⁸Again, we do not select on claiming the commuter tax break but display the entire population.

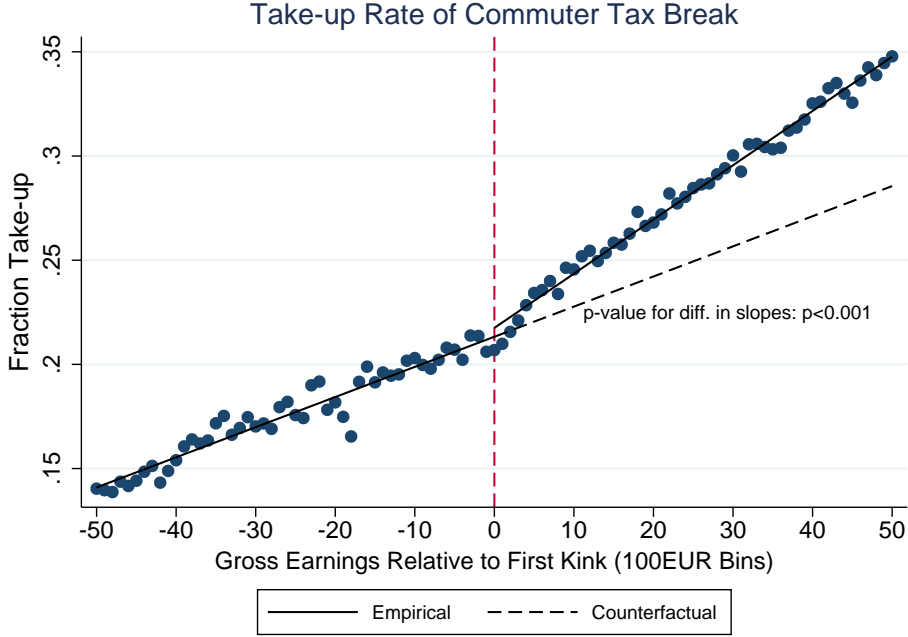


Figure 7: Take-up rate of commuter tax break (men only)

Notes: Figure 7 plots the actual observed take-up rate of the commuter tax break against gross earnings relative to the kink. Data is presented in 100EUR gross earnings bins relative to the kink, plotting bins in the range $[-50, 50]$. The solid lines represent best-fit linear regressions estimated on the microdata separately for observations above and below the kink. The dashed line displays a counterfactual constructed by using the observed take-up rate on the LHS of the kink to linearly predict the take-up rate absent the kink.

a mechanical effect stemming from the pure change in the schedule, and into a behavioral effect stemming from increased take-up. The mechanical effect can then be contrasted with the actually observed one, and the difference between the two gives the behavioral response expressed in terms of the received cash value. To calculate the mechanical effect we multiply the counterfactual take-up rate displayed in Figure 7 (the dashed line) with the mean cash-value commuters received within each bin. This gives us the mechanical effect from the change in the schedule of the commuter tax break, i.e. the counterfactual cash value based on the counterfactual take-up rate. More formally, we compute the counterfactual cash value CC as

$$CC_b = \frac{\sum p_{ib}}{N_b} \cdot \left(\frac{CT_b}{OT_b} \right) \quad (2)$$

where p_{ib} is the cash value of the commuter tax break individual i in the gross earnings bin b received. N_b denotes the total number of individuals in bin b . OT_b stands for the empirically observed take-up rate, and CT_b stands for the counterfactual take-up rate, both depicted in Figure 7.

The dashed line in Figure 8 shows the counterfactual cash value CC_b . It reflects the sole change in cash value due to the schedule of the commuter tax break, absent any behavioral response. This mechanical effect leads to a change in slope at the kink by 1.02. In contrast, the change in slope

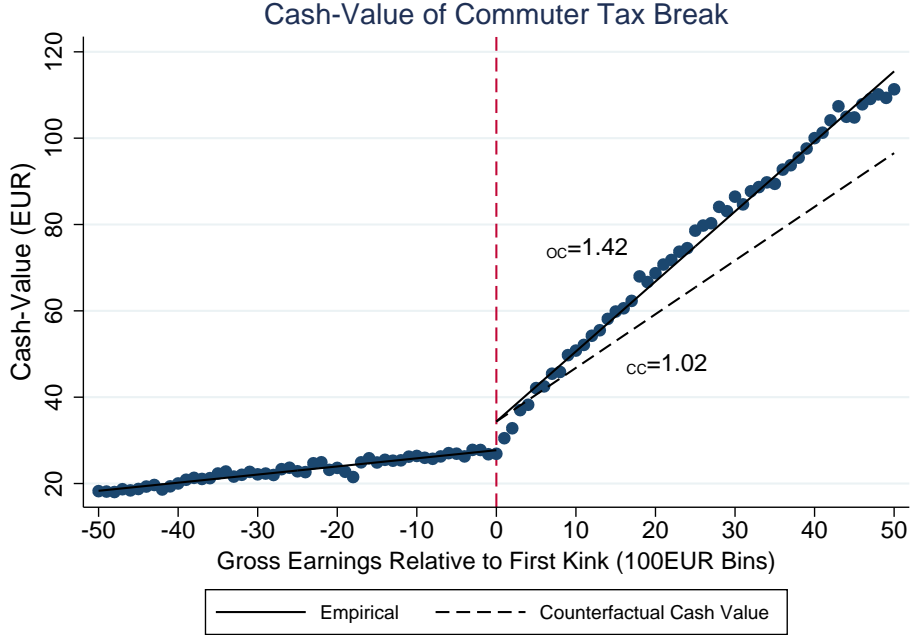


Figure 8: Received (net-of-tax) cash value of commuter tax break (men only)

Notes: This figure plots the mean (net-of-tax) cash value individuals received within each bin of gross earnings. The solid lines show best-fit linear regressions estimated on the microdata separately for observations above and below the kink. $\Delta\beta_{OC}$ represents the observed change in slope of the cash value at the kink. The dashed line is a counterfactual constructed by using the counterfactual take-up rate absent the kink displayed in Figure 7. Hence, $\Delta\beta_{CC}$ represents the mechanical change in cash value due to the schedule of the commuter tax break, absent any behavioral response (i.e. absent the increased take-up documented by Figure 7). The difference between both slopes captures the behavioral response expressed in terms of the (net-of-tax) cash value. See text and Equation (2) for details.

of the actual observed cash value individuals received is 1.42. The difference between the two slopes equals 0.40, which stems from the increased take-up of the commuter tax break beyond the kink. Relating this behavioral effect to the mechanical effect (i.e. $0.40/1.02=0.39$), we obtain an estimate of the magnitude of the deduction response: When the net-of-tax cash value of the tax break increases by 1 EUR, individuals increase their additional claimed deductions by 39 Cents. This estimate based on the RK-Design is of course a local estimate, which might differ from the average effect for the whole population in the presence of heterogeneity (Landais 2015). However, we can use the estimated parameters to infer a local estimate of the deduction elasticity: Given a marginal tax rate of $t = 0.3833$ for individuals in the first tax bracket, a 10% change in the net-of-tax rate is associated with a 6% change in additional claimed deductions. This deduction elasticity is similar to the estimates provided by Doerrenberg et al. (2016). In sum, our analysis based on the RK-Design suggests that the probability of claiming a deduction item depends on the (net-of-tax) cash value of the respective deduction, and provides a new estimate for the deduction elasticity.²⁹

²⁹We interpret the deduction elasticity as a measure which subsumes a range of reporting responses, including both legal and illegal deduction claiming. As shown by Doerrenberg et al. (2016), the non-sufficiency of the ETI holds true even for the extreme, though unlikely, case that all deduction responses are driven by evasion.

7 Conclusion

This study aims to uncover earnings supply and deduction responses of wage earners to a salient kink point in the Austrian tax schedule, contributing to the literature on the effect of taxes on deduction behavior. Exploiting the introduction of a very large first tax bracket for identification, we document modest gross earnings and significantly sharper taxable earnings responses. We observe wage earners targeting the kink with their gross earnings as well as deductions, and find the latter to be very responsive when taxpayers cross into the first tax bracket with their gross earnings. We then use a novel estimation strategy showing that the probability of claiming a deduction item depends on its (net-of-tax) cash value, and provide a new estimate for the deduction elasticity.

Given that most tax systems around the world allow for deduction possibilities, decomposing the overall taxable income response into subcomponents such as earnings supply and tax deductions is important. It gives information on the economic nature of taxpayers' responsiveness, which can affect welfare conclusions and policy recommendations (Slemrod 1995, Chetty 2009, Doerrenberg et al. 2016). Our findings demonstrate that this distinction qualitatively matters even for wage earners in the lower part of the earnings distribution, which usually have only little ability to shelter income compared to high-income or self-employed individuals. In other contexts, this distinction might be even more crucial. Furthermore, our result also calls for some caution when interpreting taxable income responses of wage earners as purely real responses.

Doerrenberg et al. (2016) argue that the ETI is not sufficient for welfare analysis if *(i)* deductions are responsive to tax-rate changes and if *(ii)* deductions generate externalities. While our paper presents evidence on the first condition, the question whether and to which extent deductions generate externalities is yet to be answered. Chetty (2009) proposes a model where losses to overall welfare depend on whether adjustments to taxable income incur transfer vs. real resource costs. Hence, future research may examine whether taxpayers are more responsive via deduction items that are associated with resource costs rather than with transfers. This would help researchers as well as policymakers to decide which income measure to use (taxable income vs. gross income) when evaluating the impact of tax reforms.

Furthermore, our study focuses on lower-income taxpayers with rather limited possibilities to shelter taxable income but traditionally more elastic labor supply (for instance, many individuals around the first tax kink work part-time or are secondary earners). Some studies suggest that sheltering and avoidance behavior increases with income (e.g., Kreiner et al. 2014). Hence, it would be interesting to estimate the deduction elasticity also for high-income earners. Unfortunately, the two other kinks in the Austrian income tax schedule do not provide enough variation in tax rates to generate visible behavioral responses of taxpayers. Thus, analyzing the relationship between income and deduction behavior in different institutional contexts and settings could present a fruitful avenue for future research.

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A Appendix

Aggregate vs. Individual Bunching

In the following we present evidence against the notion that the bunching we observe is driven by aggregate bunching (i.e. bunching created by firms/unions via tailored wage-hour packages) instead of individual bunching. For this purpose, we provide two tests aimed at uncovering such aggregate bunching in the data.

To begin with, we interpret the pattern we document in Figure 4 as suggestive evidence against the presence of aggregate bunching. The pattern in our data is fundamentally different from the findings of aggregate bunching presented by Chetty et al. (2011), who observe bunching at the kink even amongst workers who have no incentive to locate there. Specifically, they observe taxpayers bunching at the statutory (=zero deduction) cutoff point despite claiming large deductions (see Figure VII of their paper). They label this the 'signature of aggregate bunching'. Their result is in sharp contrast to our findings in Figure 4 which shows that taxpayers are much more concentrated at the corresponding gross earnings level where, given the level of deductions they claimed, their marginal tax rate changes. This suggests that individuals target the kink with their deductions.

Second, we execute a test put forward by Best (2015). To be more precise, we examine bunching of gross wage earnings of employees with some self-employed income. The idea is that if aggregate bunching is at play, the aggregate distribution of jobs should locate even those employees at the kink with their gross wage earnings despite having no incentive to bunch there (since they are taxed not only by their gross wage earnings but by their total income, i.e. the sum of wage earnings and self-employed income). Figure A.1 focuses on a subset of workers with income from self-employment and plots the distribution of their *gross wage earnings*. We do not find any evidence of bunching of gross wage earnings for those employees. This is in contrast to Best (2015), who uses sharp bunching of salaries for workers with additional non-salary earnings to demonstrate that firms are placing salary-hours offers around the kinks of the tax schedule.

To sum up, the plausibility checks put forward by the literature to detect aggregate bunching let us conclude that the bunching we observe in our data seems to be rather shaped by individual responses than by firms or unions catering workers' aggregate tax preferences. In fact, this result seems less surprising given that the location of the kink is not adjusted for inflation, making it not a suitable yardstick for unions and employer associations when conducting wage negotiations (as it is the case for Denmark, for example).



Figure A. 1: Gross earnings distribution of wage earners with self-employed income

Notes: The figure shows the distribution of gross wage earnings for employees with significant income from self-employment (defined as having self-employed income of more than 1,000EUR). The series shown in dots is a histogram of gross wage earnings relative to the first tax bracket.

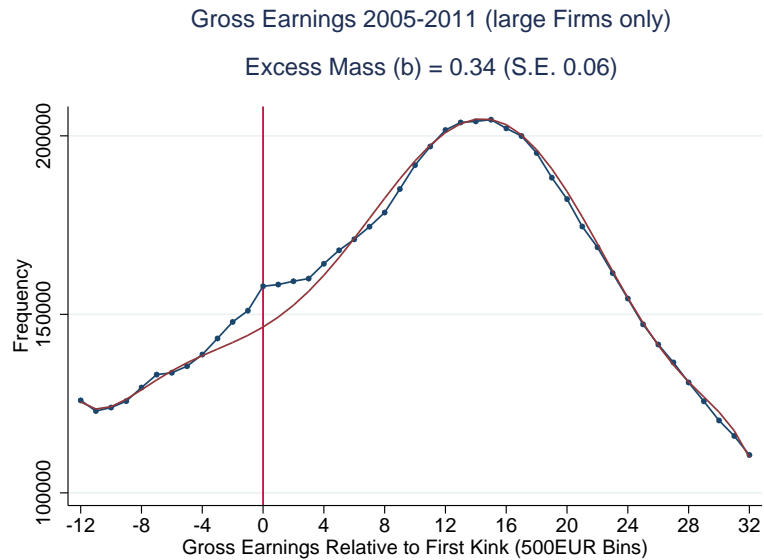


Figure A. 2: Gross earnings distribution of wage earners working in large firms (>250 employees)

Notes: This Figure replicates Panel A of Figure 2 for wage earners working at firms with more than 250 employees.

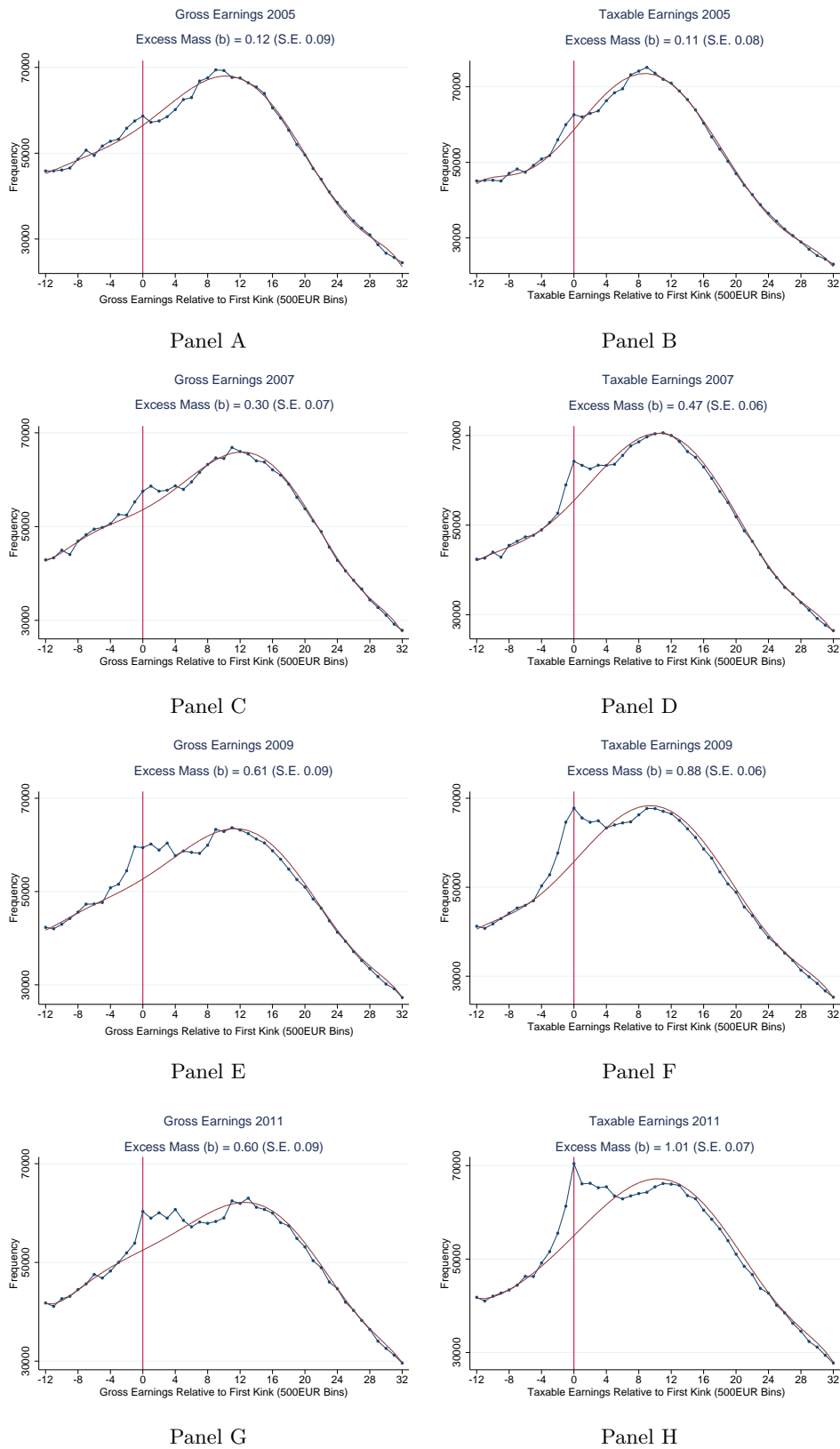


Figure A. 3: Increase in bunching over time

Notes: These figures plot the empirical distributions of gross earnings (left column) as well as taxable earnings (right column) for every other year from 2005-2011. The solid vertical lines mark the first kink point in the respective year. Each Panel also displays the counterfactual distribution and excess mass, computed as described in Section 4.

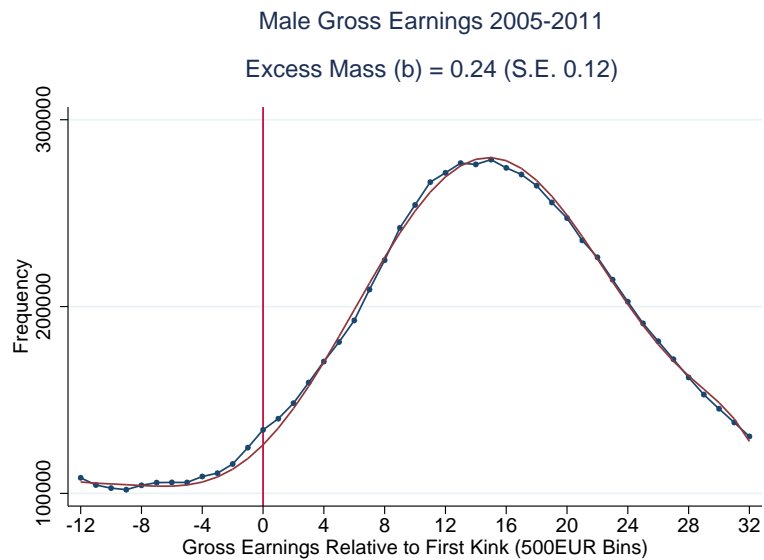
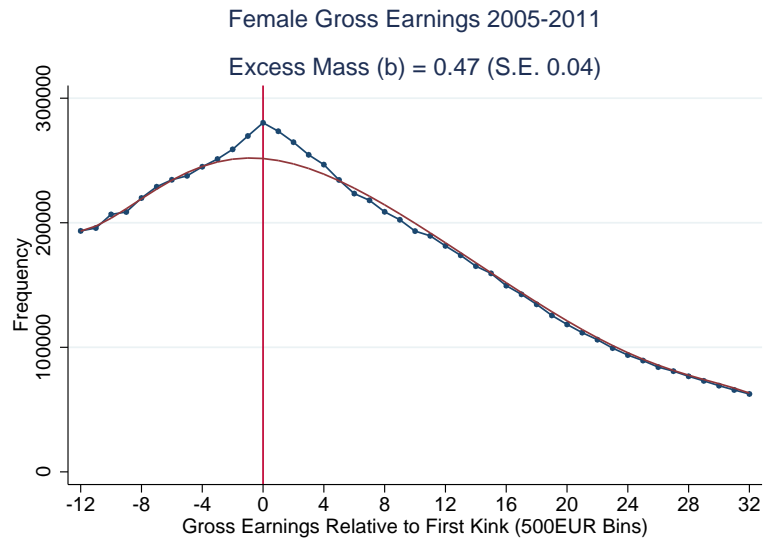


Figure A. 4: Gross earnings of male vs. female wage earners (2005-2011)

Notes: Panel A of the figure plots gross earnings of all female wage earners from 2005-2011. Panel B plots gross earnings of all male wage earners from 2005-2011. The figures also show the counterfactual distributions and excess masses as described in Section 4.

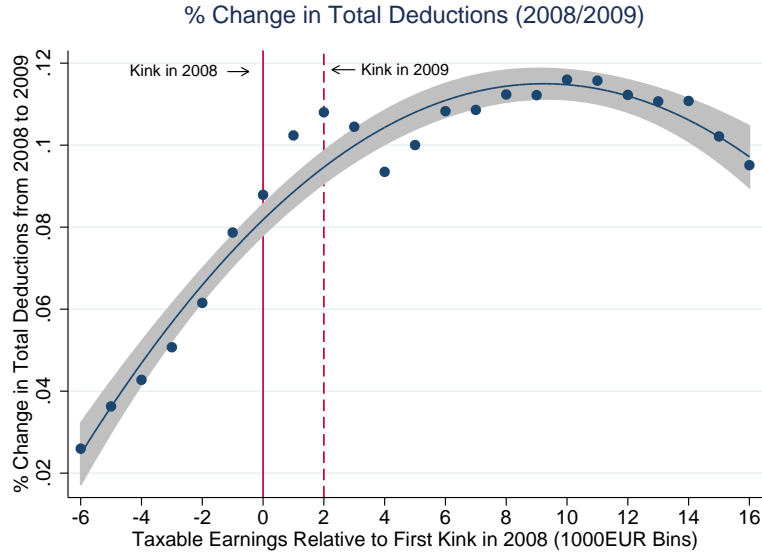


Figure A. 5: Pattern of deduction growth when kink was shifted (2008/2009 only))

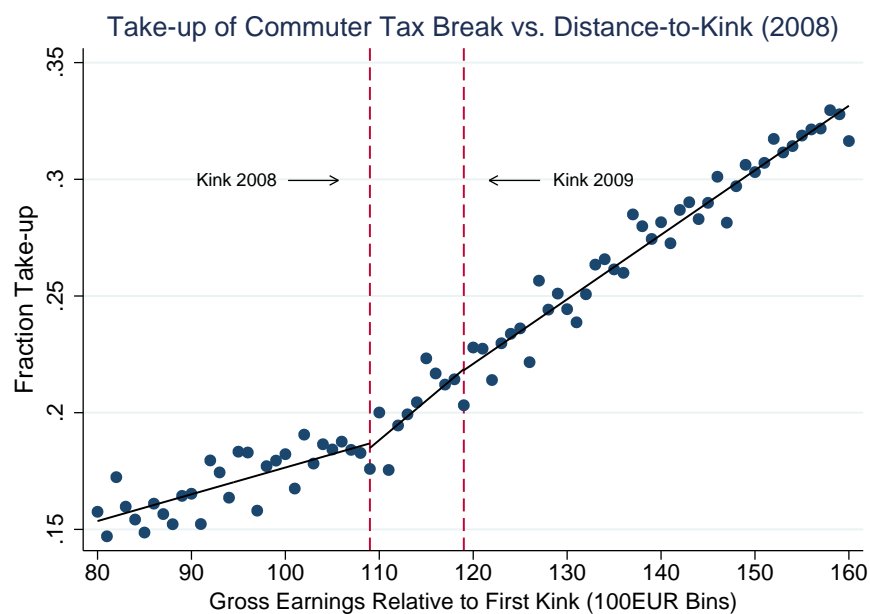
Notes: This Figure replicates Panel A of Figure 5 for 2008/2008, when the cutoff point was shifted by 1,000 EUR. The horizontal axis depicts taxable earnings for 2008. The vertical axis shows mean growth in claimed deductions per taxable earnings bin, defined as the mean of $[\ln(\text{total deductions}_{2009}) - \ln(\text{total deductions}_{2008})]$. The solid line shows the location of the 2008-cutoff, and the dashed line shows the location of the new 2009-cutoff.

Table A. 1: Change in take-up of commuter tax break at the kink

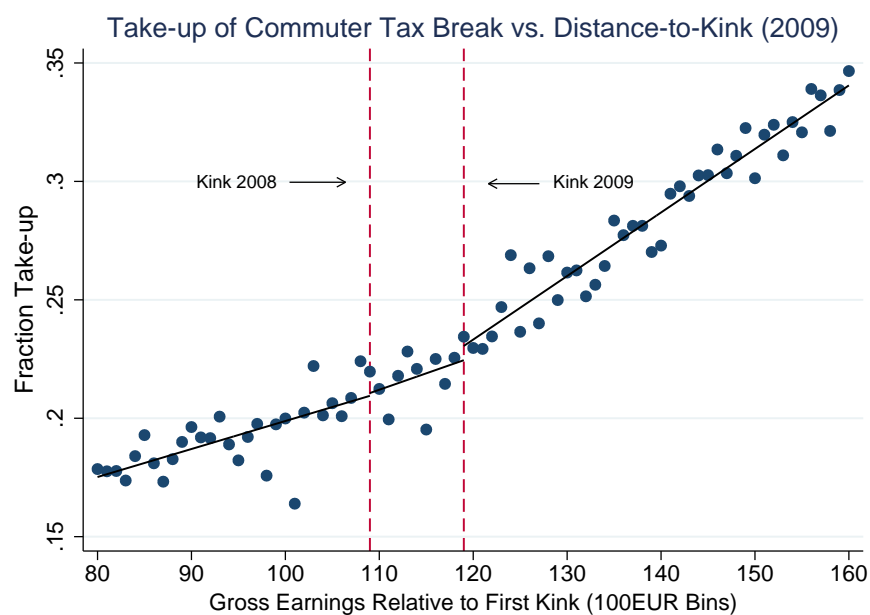
Dependent variable: Take-up of commuter tax break

	Model A	Model B
Gross earnings distance to kink	0.0014*** (0.0001)	0.0009*** (0.0001)
Dummy for gross earnings above kink	0.0049*** (0.0010)	0.0034*** (0.0010)
Gross earnings distance to kink \times dummy above kink	0.0012*** (0.0001)	0.0010*** (0.0001)
Covariates included	<i>No</i>	<i>Yes</i>
R^2	0.02	0.08
Observations	1,542,144	1,542,144

Notes: Model A is equivalent to the specification of Figure 7, with the interaction term testing for the change in slope at the kink. Model B adds the full set of covariates as controls. *, ** and *** indicate significance at 10-, 5- and 1-percent levels, respectively.



Panel A



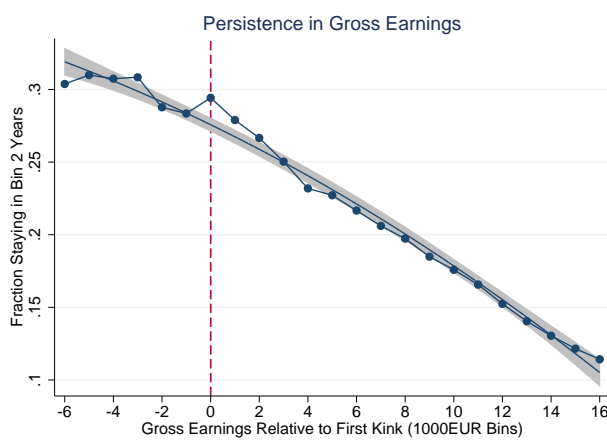
Panel B

Figure A. 6: RK-Design using shift in kink location, 2008 vs. 2009

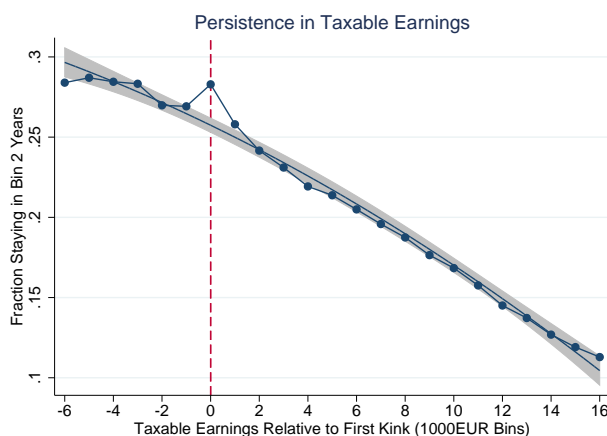
Notes: This figure shows the take-up rate of the commuter tax break in each bin of gross earnings in 2008 (Panel A) and 2009 (Panel B). In 2009, the cutoff point was increased by 1,000 EUR, as shown by the two dashed lines indicating the position of the kink for the two periods. The change in slope between the two periods in the interval between the two kinks is supportive of an effect of the cash value of the commuter tax break on the decision to claim it.

Bunching Persistence

In the following we examine whether the deduction behavior documented in the main text translates into bunching persistence over time. Therefore, Figure A.7 plots the persistence in gross earnings vs. persistence in taxable earnings. Panel A (B) puts taxpayers into 1,000EUR wide bins of gross earnings (taxable earnings) and plots the fraction of individuals who remain in the same bin after two years. Again, we add a quadratic polynomial of the bin averages to approximate the counterfactual probability to stay in a given bin. For both earnings measures, we find the probability of staying in the same bin to decline smoothly with earnings but observe a deviation from this trend exactly around the kink point. Mirroring our results of the main text, we find a sharper and bigger deviation for taxable earnings.³⁰



Panel A



Panel B

Figure A. 7: Persistence in gross earnings vs. taxable earnings

Notes: This figure shows persistence in gross earnings vs. taxable earnings over time. Panel A (B) plots the fraction of individuals who remain in the same gross earnings (taxable earnings) bin after two years. The solid blue curves are quadratic fits of the respective bin averages. The solid vertical line displays the cutoff point of the first kink.

³⁰It is important to note that the kink is not adjusted for inflation. Hence, staying at the kink over time means to either accept real earnings losses or to increase deductions. Furthermore, we again do not select on filing a tax return but use the entire population in our sample.

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