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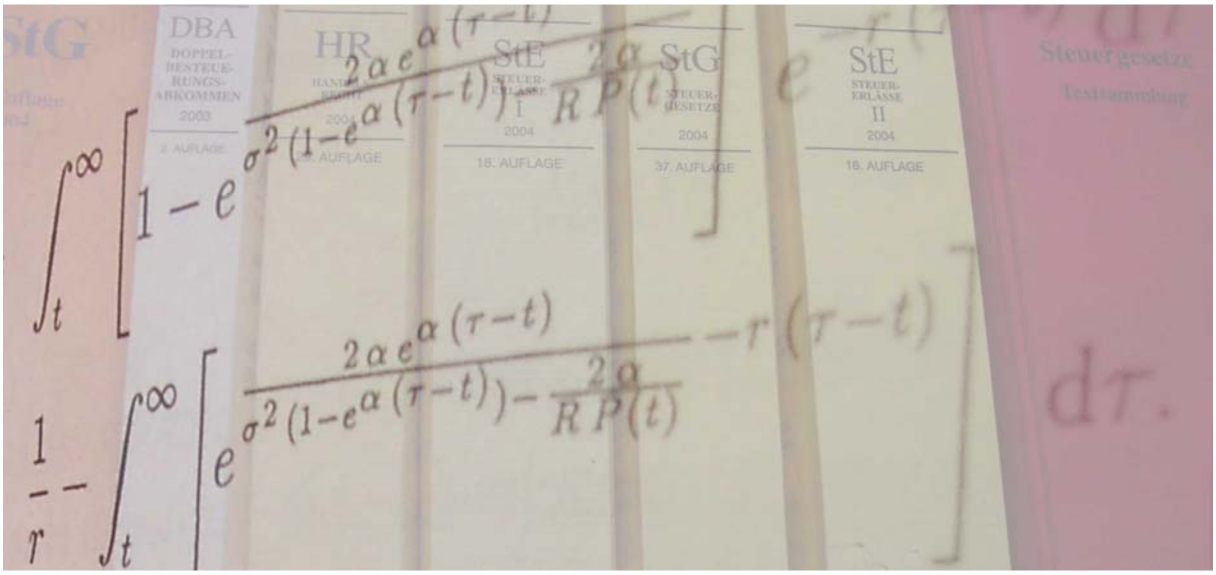

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How Do Germans React to the Commuting Allowance?

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How Do Germans React to the Commuting Allowance?

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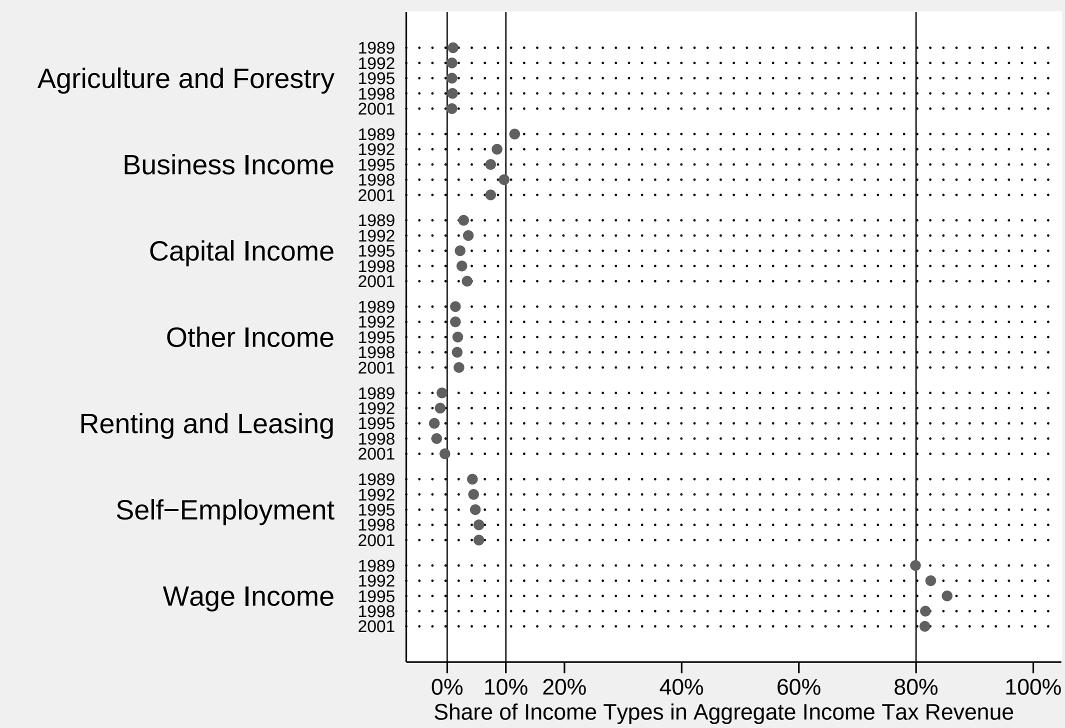
Abstract

I research the consequences of changes in the deductibility of commuting costs in Germany from 2001 to 2006. Official figures provided by the Federal Statistical Office highlight the fact that German taxpayers claimed deductions for commuting allowances to the tune of 23-29 billion € over the years 2001-2004. Granting or not granting these deductions thus has wide ranging fiscal implications, a point made more poignant by the fact that Anglo-Saxon countries have never allowed them. To determine whether Germans do react to the commuting allowance, I exploit the variation in the amount per kilometer granted between fiscal years 2003 and 2004 by looking at taxpayers featuring sufficient labor earnings and longish commuting distances whose deductions unambiguously exceed the basic allowance in the German Income Tax Code. I try to find evidence of changes along several behavioral margins in response to variations in the deduction granted. Labor supply behavior turns out to be unresponsive while the commuting distances do show a palpable reaction.

1 Introduction

"Human capital is the most important determinant of wealth and income for most individuals." This quote from Judd (1998) is borne out by both national income and income tax statistics for Germany. The former regularly shows a fraction of 65% of national income being distributed as wage income to private households (Federal Statistical Office, 2008b, p. 621), while the latter demonstrates that wage taxation contributes in excess[1] of 90% of the aggregate income tax base (Müller, 2004). **Figure 1** shows the historical development over the last two decades, reinforcing the view that taxation from wage income – combined with the value added tax – has been responsible for the lion's share of tax revenue – and its stability – in Germany.

Figure 1
Share of Income Types in German Income Tax Revenue



Source: Müller (2004)

This overwhelming importance of human capital – as an input factor in a knowledge based economy and as a major source of factor incomes for most individuals – is matched by the increasingly sophisticated research methods into human capital issues, as evidenced by, for instance, the recent contributions by Elschner and Schwager (2007), Jacobs (2007), Jacobs and van Wijnbergen (2007) and Pantzalis and Park (2009). From a tax perspective, the investment

[1] The exact share depends on the notion of labor income pursued. If one takes it to denote a return to investment to human capital, then large swaths of income from self-employment and business income represent labor income as well. For the very closely related discussion under the Dual Income Tax sytems, cf. Genser and Reutter (2007, p. 452).

process into and the treatment of returns from human capital have recently been described and empirically tested in Weiss (2007, 2009). While the fundamental chasm running through income tax codes pursued therein, between cash-flow taxation of labor income and taxation of accounting profits for capital income, continues to be a neglected area of tax research, the tax effects during the *exploitation of existing human capital* have received even less attention.

Among them, the deductibility of commuting costs plays a particularly important role and has consequently been a political hot potato in Germany for as long as memory serves. While Anglo-Saxon countries have never devoted much thought to the idea that such expenses should be deductible for income tax purposes, the German policy has seen a lot of variation in its approach to the problem, but so far no full abolishment of this item.

The extent of the amounts deducted by German taxpayers over the course of the years 2001-2004 is evident from **table 6** on page 27. Table 6 shows in its row (1) the number of taxpayers that filed a tax return in the respective years, in row (2) the overall sum of income emanating from these returns. Row (3) shows the basic allowance for deductions from income from employment according to § 9a of the German Income Tax Code. Row (4) reports the number of taxpayers that declared income / claimed deductions[2] in the category "income from employment". Around 85% of all tax returns do indeed contain this item. Row (5) shows the amount of gross income declared in this category, reinforcing the overwhelming importance of wage taxation for the volume of income tax receipts in Germany. Rows (6) and (7) deliver central parameters of the distribution of the sums across taxpayers. With the mean exceeding the median, a right skewed income – and "deductions" – distribution is observed. Rows (8) and (9) highlight the split across the mass of taxpayers (4) according to the question whether they itemize their deductions (§ 9 German Income Tax Code) or claim their basic allowance (3). The amount of deductibles claimed by the taxpayers (9) can be observed in row (10). Row (11) shows that the fraction of (10) that is claimed for commuting costs has been stable at 2/3 of (10) over the observation period. In monetary terms, the claims amount to between 23 and 29 billion €.

Bearing in mind the extent of the deductions claimed by German taxpayers over recent years, as evidenced by table 6, it is important to investigate the effect their continued existence has on several behavioral margins. This investigation should aim to establish whether the commuting allowance serves any purpose with regard to the allocation of resources in the German economy. A subsidy for commuting costs[3] could potentially impact an infinite number of microeconomic decisions, with the most obvious candidates being the *labor supply* decision and the *choice of private residence* and/or of the *choice of place of work*.

Any beneficial effects found in the areas mentioned in the last paragraph must be weighed against the costs involved. Not only does the deduction lessen tax revenue in an obvious manner, it also causes *tax compliance costs* whose extent can only be guessed at[4]. German Tax Courts regularly have to deal with claims of taxpayers who, for instance, caused an accident while deviating from their usual route to work[5] while the tax administration has to decree the deductibility for

[2] The number of taxpayers claiming deductions slightly exceeds the number declaring income in all years due to anticipated costs in preparation for a resumption of labor market participation.

[3] Note that I do remain agnostic towards the question whether commuting should be taxed instead of subsidized, a notion which some literature does indeed seriously pursue. Cf. Wrede (2001).

[4] For a stab at estimation of compliance costs for the category "work-related expenses", cf. Baldry (1998a, p. 58).

[5] Federal Tax Court, Judgement dating from 10/11/1984, File Number VI R 48/81; Tax Court of Rhineland-

participants of ride sharing agreements (Federal Finance Ministry, 2006) or in cases where the taxpayer drives to work but covers part of the journey by ferry (Federal Finance Ministry, 2001). To boot, the problem of self reporting on the number of days the taxpayer drove to the workplace – and as to the most efficient route to take – and the resolution of conflicts with respect to her claims must be added to this list.

Steenken (2002, p. 146) traces the historic development of the German commuting deduction from the first beginnings in Prussia to the latest developments around the year 2000, reinforcing the casual observation that the variance of views onto the problem has been high ever since automobiles hit the roads and taxpayers have been able to choose their residence away from their workplace: The German legislator initially granted a relatively high allowance per kilometer of approx. 25 eurocents in the later part of the 1950s, but required the taxpayer to prove that his costs were "necessary" (Bach, 2003, p. 603). The allowance was differentiated along the lines of the means of transport used, and a maximum for the distance traveled was fixed at 40 kilometers. The year 1967 witnessed a major reduction to approx. 18 eurocents which was motivated by the high volume of traffic hitting German roads. The maximum of 40 kilometers was eventually abolished in 1971. The 1990s then saw increases in the allowance to counteract the additional tax burden on fuel enacted at the same time[6].

The recent attempt by the German government to curtail the deductibility of the first 20 kilometers of the commuting distance ties in neatly with the notion that fiscal considerations, rather than semantic disputes or concerns with regard to the constitution, determine the approach to the issue at hand. **Table 1** on the following page shows the development of the German commuting allowance in the relevant time frame. Major policy changes are observed between 2003 and 2004 and 2006/2007. Overall, the tendency to reduce – but not fully abolish – the deductible amounts is obvious[7]. Furthermore, the notion that the deduction should not be constant but somehow increase with the distance traveled seems to be a feature of the tax law, culminating in the drastic 2007 attempt to no longer grant the deduction for the first 20 kilometers.

In an international comparison, heterogeneity of rules governing the deductibility of commuting costs is observed as well[8]: *Great Britain, Spain, Ireland, Canada* and the *United States* simply disallow the deductions. *Italy* grants a high basic allowance of 4,500 €, but disallows an itemized deduction of commuting costs. *Switzerland* and *Finland* allow a deduction of the corresponding amount that the taxpayer would have to expend to use public transportation to cover the same distance. *Norway* allows deduction of "necessary costs" if they exceed a certain threshold (approx. 1,100 €). *Denmark* requires a minimum distance traveled of 12 kilometers and then grants an allowance of 15 eurocents while in *the Netherlands* a minimum of 10 kilometers is mandatory. From that distance onwards, a graduated scheme of allowances operates. *Sweden* demands a lower bound of approx. 750 € and a minimum distance traveled of 5 kilometers. In addition, time savings for car use vs. public transportation of two hours must be proved. Subject to these requirements, an allowance of 16 eurocents is applied. *Belgium* allows a deduction of 75% of costs if the taxpayer credibly itemizes her travel. Otherwise, an allowance of 15 eurocents

Palatine, Judgement dating from 5/29/2008, File Number 3 K 1699/05.

[6] Also see the table in Bach (2003, p. 604).

[7] Factoring in rising fuel prices and inflation would tend to reinforce this view.

[8] Cf. Steenken (2002, pp. 183-187) and Bach (2003, p. 607).

Table 1
Historical Development of Commuting Allowance During the Observation Period

Year	Allowance per km			Max	Source	Basic Allowance
	0-10 km	11-20 km	>20 km			
2001	0.36	0.40	0.40	5,112	§ 9 (1) 4	1,044
2002	0.36	0.40	0.40	5,112	§ 9 (1) 4	1,044
2003	0.36	0.40	0.40	5,112	§ 9 (1) 4	1,044
2004	0.30	0.30	0.30	4,500	§ 9 (1) 4	920
2005	0.30	0.30	0.30	4,500	§ 9 (1) 4	920
2006	0.30	0.30	0.30	4,500	§ 9 (1) 4	920
2007	0.00	0.00	0.30	4,500	§ 9 (2)	920

Column "Source" refers to German Income Tax Code
Column "Basic Allowance" refers to § 9a of German Income Tax Code
Thin horizontal lines denote policy changes
All amounts in €

is permissible. *Luxembourg* allows a standard deduction of 396 € for distances of less than 4 kilometers which rises to a maximum of 2,970 € in step with the distance travelled. *Japan* applies income dependent allowances instead of itemized deductions so that there is no dependence on the actual distance to the workplace.

I contribute to the literature in the following ways: *Tax base* effects, i.e. yes/no (binary) decisions as to the deductibility of certain items from the income tax, have not been subjected to rigorous analyses yet. This fact seems all the more surprising given that *time effects* gain (lose) importance with a rise (fall) in real interest rates. The recent decline in these rates has not had a dampening effect on literature output yet, though. As shown in row (11) of table 6, the commuting allowance is the major component of itemized deductions from the biggest revenue source of the German Income Tax System, i.e. income from employment. As such, it is a prime candidate to begin a strand of research aimed at illuminating the allocational consequences of tax base effects. At the same time, I subject the major component of income tax revenues in Germany, the income from employment, to further analysis.

I also try to shed light on the question which microeconomic decisions should be subjected to further scrutiny when assessing the impact that changes in the commuting allowance will exert on the allocation of resources in the private sector. The fundamental notion of *neutrality* is not yet well established in the realm of tax base effects, making an investigation into the empirically affected decisions worthwhile.

My dataset[9] is derived from the German Socio-Economic Panel, GSOEP, provided by the DIW, Berlin[10]. I construct a panel covering the years 2001 to 2006, comprising workers who cover

[9] The data used in this paper were extracted using the Add-On package PanelWhiz v2.0 (Nov 2007) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz generated DO file to retrieve the SOEP data used here and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are my own. Haisken-DeNew and Hahn (2006) describe PanelWhiz in detail.

[10] The data used in this publication were made available to me by the German Socio-Economic Panel Study (SOEP) at the German Institute for Economic Research (DIW), Berlin. Cf. Haisken-DeNew and Frick (2005) for further information.

commuting distances ranging from 0 to 100 km. I run appropriate mixed-effects regressions to check for the sensitivity of several behavioral margins to *variations* in the deductible amounts. The policy change between fiscal years 2003 and 2004 – a reduction in the deductible amount to the tune of 20-25% – provides a natural experiment to assess these issues. An important caveat is that I do not look at the related problem of indirect taxation, i.e. the question of the taxation of car fuel and its relation to the commuting decisions.
The rest of the paper is organized as follows: I report on the smallish body of prior research on my subject in section 2. I introduce my preferred econometric specification, the panel dataset and the results in section 3. I conclude in section 4. Section A delivers supplementary graphs while section B provides additional tables.

2 Prior Research

2.1 Theoretical Research

The subjects of scientific interest to tax research in business administration can be divided along the lines of time-, tax rate- and tax base- effects. The former effect has been extensively investigated for the last decades (Hundsdoerfer, Kiesewetter, and Sureth, 2008), while the latter has rarely received any attention at all. A further distinction can be made between the factor incomes concerned: While capital income issues have spawned a voluminous literature, labor income issues have rarely been covered. The relationship *between* these two income types was looked into in Weiss (2007, 2009).
The intersection between labor income and tax base effects is thus sparsely populated. Theoretical insights into workers' commuting costs are contained in van Ommeren and van der Straaten (2008) and Ng (2008). Empirical research into commuting behavior and the costs involved is delivered in van Ommeren and Fosgerau (2009) for the Netherlands. Baldry (1998a,b) adds equity considerations to the discussion which will not be germane for this paper.
For the German case, Wrede (2000, 2001, 2006, 2009) and Borck and Wrede (2005, 2008, 2009) investigate the relationship between commuting costs and taxation theoretically, as do Richter and Theile (1998), Richter (2006) and Richter and Söhn (2008). Ismer, Kaul, and Rath (2008) provide a rare example of an attempt to empirically investigate the effects of the commuting allowance. Distributional aspects of the commuting allowance are covered in Bach (2003) and Kloas and Kuhfeld (2003).
The empirically observed concentration of research into these issues points to economies of scale in this area. First and foremost, this manifests itself in the number of contributions per author, and the overall number of authors that supply in this market. A certain amount of concentration is also apparent in terms of the journals that publish these contributions, as they differ from those that traditionally print articles concerning tax research. One of the reasons for the concentration can be surmised to be the sheer complexity of modeling efforts needed to get to the bottom of the microeconomic issues surrounding commuting choices. It can be exemplarily observed in DeSalvo and Huq (2005). DeSalvo and Huq build a *partial equilibrium model* that is designed to explain both mode choices, i.e. the decision to switch between alternative means for commuting, and labor / leisure choices. They also incorporate differing tastes for housing

and changes in commuting costs.
Theoretical support for the behavioral margins mentioned in section 1, i.e. *labor supply* decision, the *choice of private residence* and the *choice of place of work*, can be found in Parry and Bento (2001) who research the influence of road pricing on labor force participation decisions, and Cogan (1981) who factors fixed costs into customarily used labor supply specifications.

2.2 Empirical Data

Official comprehensive data for Germany pertaining to the year 2001[11] can be found in Federal Statistical Office (2005, pp. 14- 20). Striking features of the tables reported there are:

- The heterogeneity across the 16 German federal states, as in Federal Statistical Office (2005, table 8): The political economy of commuting subsidies[12] in Germany is frequently impacted by a tug of war between federal states whose citizens tend to commute long or short distances, respectively. **Figure 2** on the next page shows this uneven distribution of cases of commuting allowances claimed and the amounts involved. The federal states Baden-Wuerttemberg, Bavaria, Lower Saxony and North Rhine-Westphalia are responsible for 59.5% of cases and almost the same share of the amount claimed for commuting deductions.

- The fiscal impact of a full-blown abolishment – without any attempt at modelling the behavioral changes entailed by such a move – is estimated[13] at around 6 billion € for the year 2001. This ballpark figure can serve as an approximation of short-run gains from the abolition[14].

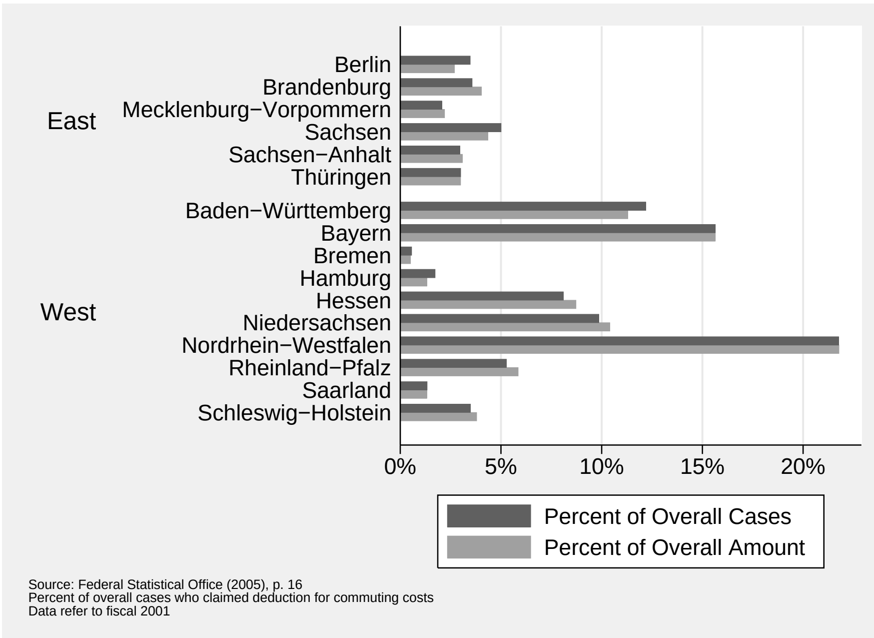
- With regard to the distances commuters cover, **figure 3** on page 8 shows a right-skewed distribution, with the mode occurring for the category "21-31" km.

- This discussion would not be complete without a check on the number of days that tax authorities use to calculate the allowance. **Figure 11** on page 24 displays this number of days, broken down by the commuting distances. The mean over all taxpayers depicted in figure 11, appropriately weighted by the number falling into each category, reaches 172 days.

Other literature reports on the means used to cover the way to the workplace[15]. **Figure 12** on page 25 shows that almost two thirds of Germans use their car, driving it themselves.

[11] The columns entitled "2001" in table 6 contain part of these data.
[12] Cf. Borck and Wrede (2005).
[13] Cf. Federal Statistical Office (2005, table 11).
[14] Cf. Bach (2003, p. 606) for a similar estimate.
[15] Cf. Kloas and Kuhfeld (2003, p. 624). The data used to draw figure 12 are representative for the entire German population while figure 2 and figure 3 merely cover those who claim a deduction exceeding the basic allowance, as seen in table 6, row (9).

Figure 2
Cases and Amounts Claimed for Commuting Allowance



3 Econometric Specification and Estimation

3.1 Modelling Heterogeneity

As figure 2, figure 3, figure 11 and figure 12 make patently clear, heterogeneity with regard to the effect of changes in the commuting allowance researched in this paper is likely to be an important property of the data generating process that throws up commuting distances[16]. Econometrics has a well-established body of models that allow the analyst to model different processes under a common heading.

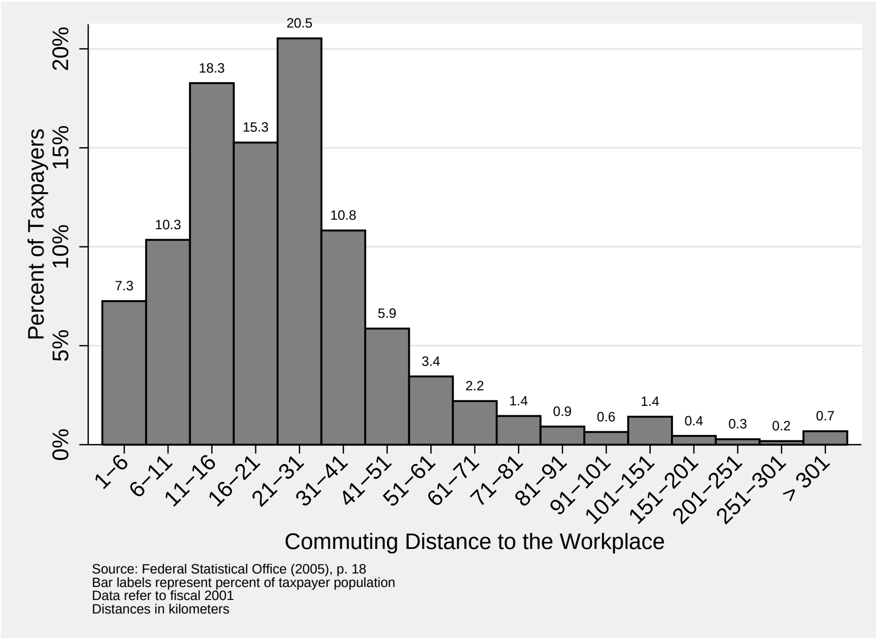
In a *cross-sectional* context, prominent ones include the zero-truncated and zero-inflated count data models[17], finite mixture models (Greene, 2008, sect. 16.9.7) and the famous Heckman selection model (Heckman, 1976). All of them share the common trait that the conditional distribution of the dependent variable is generated from at least two processes. In the case of the count data models, a process that pertains to the zeroes and another one that determines the non-zero observations, in the case of the finite mixture model, a finite number of densities mixed in unknown proportions.

In the *longitudinal* case, the additional availability of a time dimension allows the analyst to take into account the notion that the units observed could exhibit fixed effects, and that an estimation strategy that explicitly exploits this knowledge might perform better than one that simply lumps every observation together. Below, I explore the panel models in this area more widely.

[16] Also note that the German political process often sees smaller and larger federal states pitted against each other during negotiations regarding the extent of the commuting allowance.

[17] Cf. Greene (2008, p. 930).

Figure 3
Commuting Distances in 2001



3.2 Panel Data Models

The panel data models used in this contribution can be neatly summarized with a reference to[18]

$$y_{it} = x_{it}'\beta + z_{it}'u_i + \varepsilon_{it} \tag{1}$$

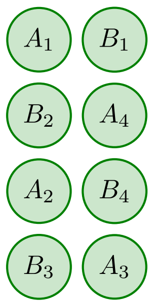
equation (1) which gives a very general representation of a linear panel data model for dependent variable y, observed for observational unit i in time period t, with a fixed effects portion – including an intercept – $x_{it}'\beta$ and a random effects portion $z_{it}'u_i$.

Several special cases can be derived from this general formulation: Setting z_{it}' equal to a zero matrix leads to a pooled OLS model, i.e. one that neglects any systematic difference between observations drawn from the same observational unit i and other units $\neq i$. **Figure 4** on the next page illustrates this model, depicting an urn. Draws from the urn neglect the panel structure of the data, i.e. the readily available information that an observation comes from a certain panel unit – either A or B – and was drawn in a particular time period – 1 to 4. Treating all draws as independent, this model clearly wastes useful information.

Letting $z_{it}' = \mathbf{1}$ in equation (1) gives a standard random effects model[19], which attaches a unit specific intercept to the units i. Its attractiveness to the researcher rests in its ability to provide valid inference for a larger population. The model does, however, impose unpalatable assumptions in terms of the exogeneity of the regressors. **Figure 5** on the following page highlights the improved utilization of information in this model: Given the available information on the panel units, the homogeneity within a single person can be readily expressed through the

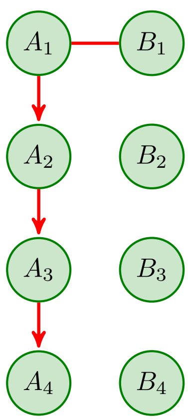
[18] Cf. Cameron and Trivedi (2005, sect. 22.8).
[19] Cf. Greene (2008, sect. 9.5).

Figure 4
Pooled Model



individual effects u_i.

Figure 5
Random Effects Model

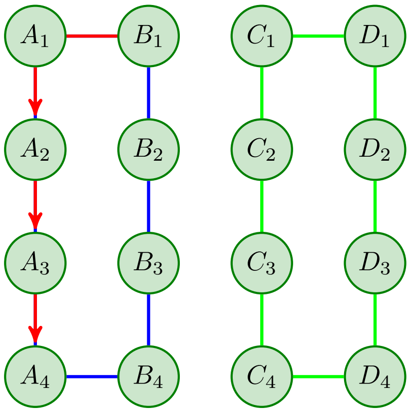


Populating z'_{it} with the same members as x'_{it} leads to a random coefficient model where the heterogeneity between units i is captured not only via differing intercepts but also by allowing *all* members of parameter vector β to vary across units.

3.3 Mixed Effects Regressions

The specification used in section 3.6 below uses a subset of x'_{it} to populate z'_{it} in equation (1). **Figure 6** on the next page depicts the setup: It is known that A/B and C/D share a common trait – denoted by the lines connecting them – which nests a lower level of effects that is only common to the individual over time – highlighted with arrows. A comparison shows that figure 5 is a special case of figure 6 with a single nesting level.
It is thus possible to *nest* several levels of random effects, so that the added variability due to an additional source of variation in either intercepts or slopes – or both – can be measured. As estimation of equation (1) proceeds via maximum likelihood, likelihood ratio tests can be employed to test nested alternatives for additional explanatory power.
Completing the specification for (1), the idiosyncratic errors ε_{it} are assumed to be distributed standard normal with variance σ^2_ε while the vector u_i is assumed to be standard normal with

Figure 6
Mixed Effects Model



variance-covariance-matrix Σ_u. The joint distribution between ε_{it} and u_i is assumed to exhibit zero covariance.
Translating (1) to a setting of binary dependent variables,

$$\Pr\left(y_{ij} = 1 \left| u_i \right.\right) = H\left(x'_{it}\beta + z'_{it}u_i\right) \tag{2}$$

equation (2) models the probability – $\Pr\left(\bullet\right)$ – of observing the outcome $y_{ij} = 1$ conditional on the random effects u_i. It closely resembles a standard specification of the well-known *logit model* which itself can be thought of as a Generalized Linear Model (GLM), with the logit

$$\log\left(\frac{p}{1-p}\right)$$

as the link function and variance function $\mu\left(1-\mu\right)$ for the special degenerate case of the Binomial distribution with only one draw, i.e the Bernoulli, with expectation μ. Completing the discussion of (2), $H(\bullet)$ denotes the cumulative distribution function of the logistic,

$$H\left(p\right) = \frac{\exp\left(p\right)}{1+\exp\left(p\right)} \tag{3}$$

3.4 An MC Study on Mixed Effects Regressions

To prove that the research strategy chosen in section 3.3 is fit for the purpose that it is intended to serve in this paper, I conduct a small Monte Carlo Study. To this end, two nesting levels, along the lines of figure 6, are simulated. On the upper level, 16 *federal states* feature fixed effects α_{fed} which I draw from

$$\alpha_{fed} \sim N\left(0, 3\right) \tag{4}$$

where $N(\mu, \sigma)$ denotes a normal distribution with expectation μ and standard deviation σ.
Within these federal states, 400 individuals each are nested whose fixed effects α_{ind} are obtained as

$$\alpha_{ind} \sim N(0, 2) \tag{5}$$

Realizations of the individuals' covariates are observed over 5 time periods where the idiosyncratic shocks ϵ_{it} impacting each period are generated as

$$\epsilon_{it} \sim N(0, 0.5) \tag{6}$$

and assumed i.i.d. over time. **Figure 13** on page 25 makes the nesting structure transparent. Covariates are taken to be

- Initial age, i.e. in the first time period of the simulation, which is drawn from a uniform distribution over $[25; 52]$, and subsequently increased in lockstep with the observation years (*age*).
- Schooling duration (*edu*), which is assumed to be mapped from the highest degree reached:
  - Lower school, "Hauptschule", which 40% of the population attended, credited with 9 years.
  - Intermediate school, "Realschule", which another 40% graduated from, credited with 10 years.
  - High school diploma, "Abitur", which the remainder of the population completed, credited with 13 years.
- A dummy for periods after t=2 (*time*).
- A gender dummy, with the share of men in the population 52% (*male*).

Subsequently, the data generating process for the participation decision is specified as

$$\text{logit}\,(participation = 1\,|\text{cov}\,) = 1 + 0.02 \text{ age} + 0.3 \text{ male} + \alpha_{\text{fed}} + \alpha_{\text{ind}} \tag{7}$$

so that participation increases with age, and men generally participate more often. Indeed, the marginal effect at the expectation for age emerging from the uniform distribution specified above, 38.5 years, is

$$H(1 + 0.02 \times 38.5) \times (1 - H(1 + 0.02 \times 38.5)) \times 0.02 = 0.00249$$

while for a discrete change from 0 to 1 on the gender dummy the marginal[20] effect is

$$H(1 + 0.02 \times 38.5 + 0.3) - H(1 + 0.02 \times 38.5) = 0.03350$$

where $H(.)$ is defined as in (3).

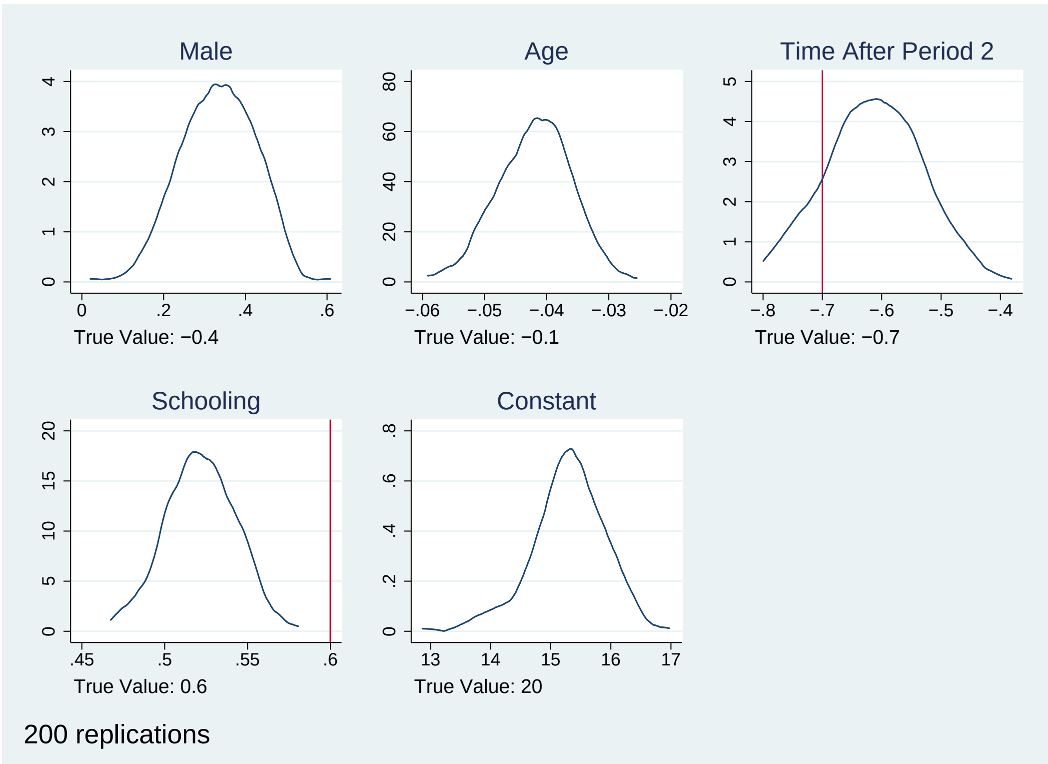
The process for the outcome (the commuting distance *cdist*), given participation (part), is generated as

[20] Rather, one estimates the discrete difference between the prediction at zero (for females) and one (for males).

$$\text{cdist}\,|\text{cov}, \text{part} = 20 \ \text{-}\ 0.4\text{fem}\ \text{-}\ 0.1\text{age}\ \text{-}\ 0.7\text{time} + 0.6\text{edu} + \alpha_{\text{fed}} + \alpha_{\text{ind}} + \varepsilon \tag{8}$$

Subject to these conditions, the mixed effects model (1) is applied to (8). In the first MC study, 200 simulations are run, not accounting for the participation decision resulting from (7).

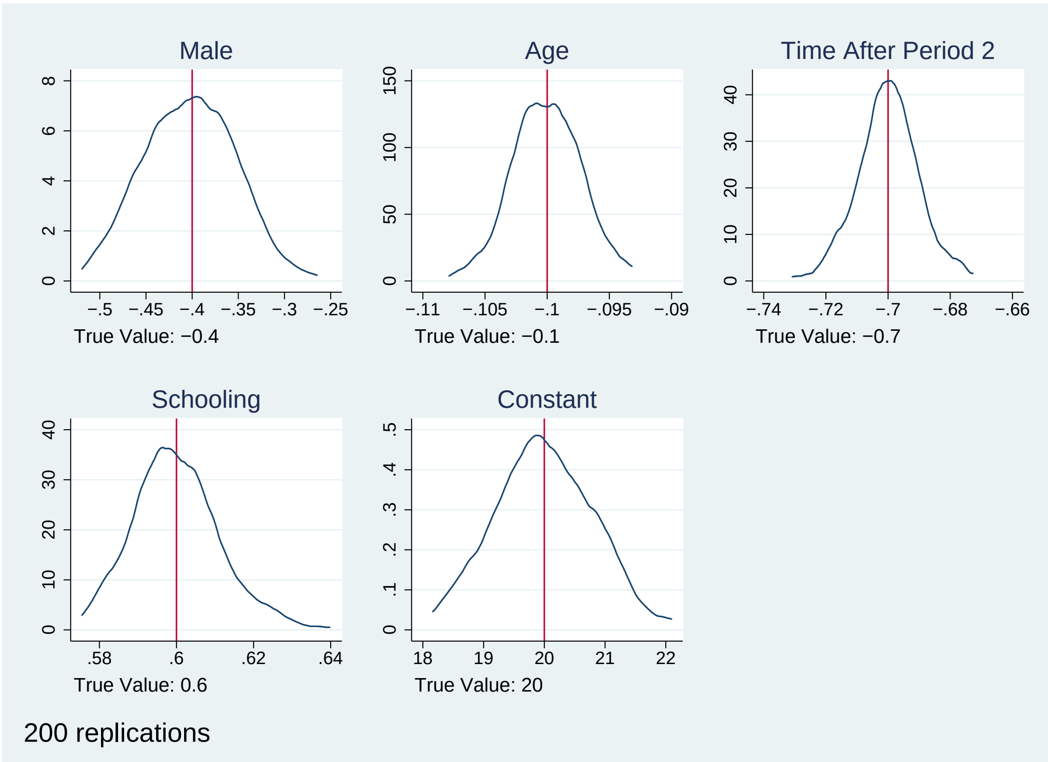
Figure 7
MC Results without Correction for Participation



As **figure 7** shows, the resulting point estimates are way off from their true value – denoted by thin vertical lines. Only the dummy for the time period is within range of the true value.
The second MC study, again featuring 200 simulations, conditions on participation in the first stage[21]. As is clear from **figure 8** on the following page, the estimator is now consistent, i.e. hits the true value on average. In terms of the performance of the random effects part of the model, predictions of the effects at the federal state level[22] are summarized as averages over the 200 replications run in **figure 9** on page 14.
As is apparent from the graph, the sign is correctly predicted for all 16 federal states, and the magnitude of the individual effect is measured quite precisely. Overall, the Monte Carlo simulation seems to support the estimation strategy chosen for this paper.

[21] The difference to a full-blown modelling strategy for both selection and outcome, as in Heckman (1976), is that the correlation between the errors from the participation and outcome stage is not taken into account.
[22] See equation (4) on page 10. Random effects at the personal level would result in a rather convoluted picture, so the assessment here is restricted to the federal state level.

Figure 8
MC Results, Conditioned on Participation



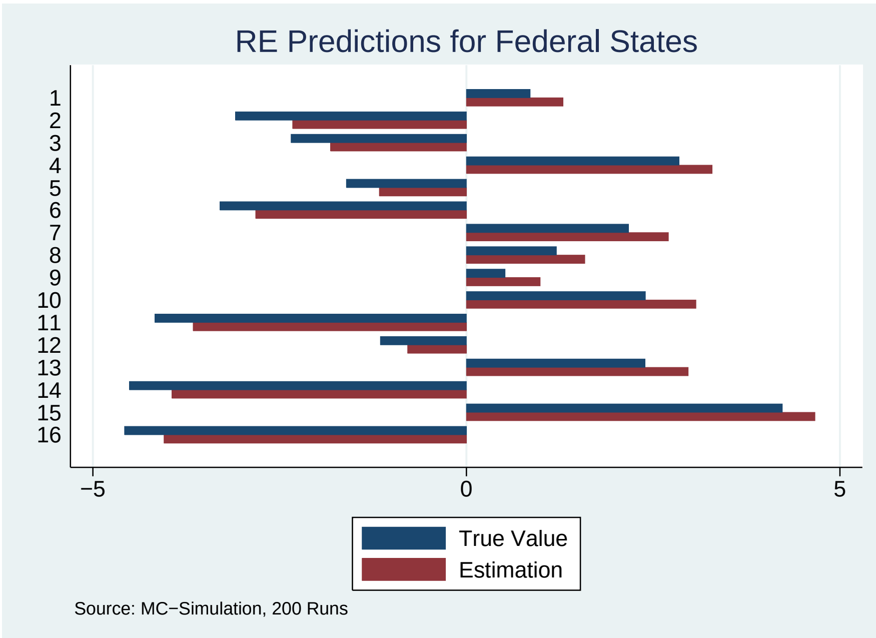
3.5 Dataset

The dataset for the analyses in section 3.6 is taken from the 2001 to 2006 waves of the German Socio-Economic Panel, GSOEP, conducted by the DIW, Berlin. The period covered is deliberately chosen to embrace a major policy change in the deductibility of commuting costs, i.e. the structural break observed in table 1 between the years 2003 and 2004[23].
To this end, I retrieve a panel dataset from the GSOEP where the participants are selected according to

- Age being greater than 25 and less than 52 in 2001. These restrictions are intended to exclude phases of education and leave the hazard of mandatory or voluntary early retirement out of the labor supply investigation in section 3.6.1.
- A fully specified employment history, i.e. no missings in any year on the employment status question in the GSOEP.
- Labor income information and responses to the questions regarding *commuting frequency* and *commuting distance* in the GSOEP in at least 2003 *and* 2004. This restriction is meant to allow at least a basic inference about the impact of the policy change observed

[23] I refrain from making inferences for the more comprehensive break between 2006 and 2007 as the data that would enable me to conduct the analysis are not yet available. At the very least, only short-run analyses would be possible. Also, the material presented in various figures in this paper and table 6 would be a little "remote" from these more recent events.

Figure 9
Random Effects Predictions (Averages)



between those years in table 1. Their commuting distances are trimmed such that the highest 1% is disregarded for the analysis[24].

- Information on marital status available so that the question of joint or single filing of tax returns can be assessed (§ 32a (5) German Income Tax Code).

Based on these restrictions to the data, I end up with 1,385 male and 928 female sample members. The central object of interest, their commuting distances, is displayed in **figure 10** on the next page. The median commuting distance in the first sample year, 2001, is 18 km, with the male and female commuting behavior visibly different across all percentiles, as evidenced by **table 2**.

Table 2
Distribution of Commuting Distances in the Sample according to Gender

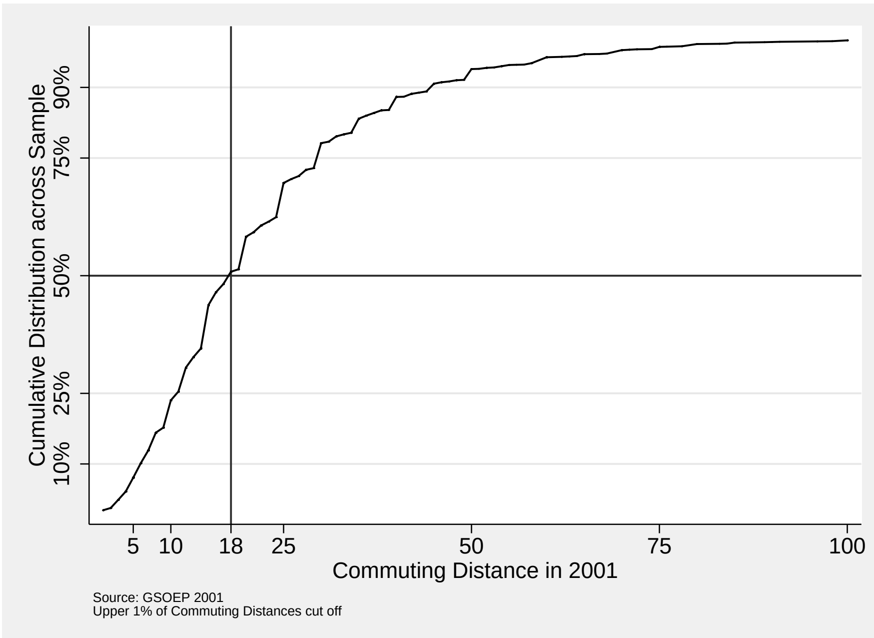
	Mean	Percentile					
		5	25	50	75	90	95
Male	25.0	5	12	20	32	50	60
Female	19.4	4	10	15	25	37	50
Total	22.8	5	11	18	30	45	58

Source: GSOEP 2001
Percentiles for Sample of 2001

A t-test on the equality of means between men and women yields a difference of 5.66 km, on

[24] The highest 1% of distances contained some implausibly high values. The restrictions causes the maximum of the distance to be 100 km. This approach also rids the data of any commutes via plane rides, which are governed by special rules.

Figure 10
Commuting Distances in the Sample



a standard error for the difference of 0.691, a 95 % CI of [4.306; 7.016] km and thus a clear rejection of equality. The Kolmogorov–Smirnov test on the equality of the distributions of commuting distance between *men and women* yielded a clear rejection at $p < 0.001$ as well. An ANOVA analysis on the equality of commuting distances between *federal states* confirms the picture emerging from figure 2 for the sample, resulting in a clear rejection, with an F statistic 18.34 on 15 degrees of freedom, and $p < 0.001$.

From the available spell data on labor market activity, I construct a dummy variable that is set to one if the person concerned discontinues his labor market activity in the respective year, and does not pick up a new job in the – entire – next year[25].

I also construct a variable containing the amounts deductible for commuting and the tax reduction obtained from them for the respective person-year. To this end, I employ the following variables:

- Marital status, to gauge whether the tax return is filed jointly
- The gross labor income received in the respective year
- The length of the daily commute
- Regarding the number of days for which the deduction can be claimed, there is very little information to go by in the dataset. I stick to the pattern emerging from figure 11, assigning the number of days on the basis of the category the taxpayer falls into in the respective year.

[25] This approach to the labor market participation is open to criticism: Arguably, the demand for the dummy could be for the participant to discontinue her labor market participation until at least the end of the study in the year 2006 for the dummy to be set to one.

On the basis of information on marital status and gross labor income, I calculate the marginal tax rate against which the deduction is taken. To this end, I factor in the tax schedules in force during the years 2001 to 2006, as stipulated by § 2 and § 32a of the German Income Tax Code. I also grant the basic allowance emerging from column 7 of table 1 and the special deductions on the basis of § 10c. I subsequently multiply the marginal rate and the commuting allowance to arrive at the tax reduction for the year. Note that this measure is rather crude, and cannot take into account the full complexity of the income determination process in § 2 of the German Income Tax Code. In particular, granting the basic allowance and subsequently using the itemized deduction introduces a slight circularity into the calculation.
The tax reduction thus obtained is subsequently compared to the basic allowance in the last column of table 1 to determine the maximum of the two which is subsequently taken as the deduction for the respective year. Furthermore, I generate a dummy variable indicating that the basic allowance has been exceeded by the commuting allowance alone.

3.6 Results

3.6.1 Labor Supply Decision

The labor supply decision determines whether the problem of the commuting allowance poses itself - or not. If labor supply is discontinued, the problem vanishes, so it is important to check whether variations in the commuting allowance have any real bearing on the labor supply decision[26].
To pick up on the discussion towards the end of section 3.3, the nesting level for the mixed effects model contains random effects for the

- Federal states of Germany
- Within federal states, the individual person

These variables, the federal state of residence and the person id, consequently form the subset z'_{it} for equation (1). The impact these variables have can thus be measured more delicately than would be possible in a pooled model or a pure random effects model, as shown in section 3.3.
As additional covariates, I introduce socioeconomic background variables and workplace characteristics such as[27]

- Age
- Number of children in the household
- Marital status
- A dummy for years after 2003

[26] Implicitly, the commuting distance goes to zero upon the cessation of labor market participation. This observation likens the partition between section 3.6.1 and section 3.6.2 to the "two-part" models popular in econometrics, such as the Heckman model (Heckman, 1976), the zero-inflated poisson (Greene, 2008, p. 930) or the zero-truncated poisson. All of these models implicitly let the zero/not-observed observations be governed by a data generating process different from the one that throws up the non-zero observations. Also see section 3.1.

[27] Covariates are introduced in the order in which they appear in table 3.

- The applicable marginal tax rate for the German Income Tax, determined based on the current gross labor income and marital status[28]
- An interaction between “years after 2003” and the marginal tax rate
- A dummy for individuals who exceed the basic allowance in the German Income Tax Code with their commuting allowance
- A continuous variable measuring the distance to the workplace covered
- The length of education in years – which proxies for German school degrees
- Gender (Random Effects only)

[28] All couples are assumed to file jointly – which is not a legal requirement of the German Income Tax Code.

Table 3
Logit models for labor supply

	Logit for Male Labor Supply		Logit for Female Labor Supply		Random Effects Logit	
Age	-0.0506***	(-6.78)	-0.0346***	(-4.70)	-0.0484***	(-7.88)
Number of Children in HH	-0.110***	(-3.45)	0.0495	(1.50)	-0.0441*	(-1.65)
Married	-0.164	(-1.57)	-0.289***	(-2.67)	-0.271***	(-3.14)
Year after 2003	0.132	(0.35)	-0.134	(-0.53)	-0.0906	(-0.40)
Marginal Tax Rate	-3.091***	(-4.29)	-2.179***	(-3.98)	-2.924***	(-6.12)
Year after 2003 × Marginal Tax Rate	-1.257	(-1.18)	-1.105	(-1.26)	-0.975	(-1.41)
Above Basic Allowance	0.193	(1.51)	0.157	(1.14)	0.176*	(1.68)
Distance Home to Work	0.00733**	(2.50)	0.00763*	(1.84)	0.00862***	(3.08)
Length of Education	0.0379**	(2.09)	0.0563***	(2.74)	0.0488***	(3.02)
Female					-0.0965	(-1.09)
Constant	0.0537	(0.13)	-1.305***	(-3.20)	-0.552	(-1.53)
σ_u					1.0168	(0.0874)
ρ					0.2391	(0.0313)
LR $\rho = 0$					56.51	
p-value					0.000	
Wald χ^2	176.133		111.833		231.620	
p-value	0.000		0.000		0.000	
Pseudo R^2	0.047		0.035			

Dependent Variable: Discountinue labor supply this year, no resumption until after next year

Panel Unit for Random Effect Specification: Individual Person

z statistics in parentheses

ρ denotes fraction of variance due to individual level effect σ_u

Wald χ^2 against naive (intercept only) model, 10 degrees of freedom

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source: GSOEP 2001-2006

Table 3 on the previous page shows in its first two columns the pooled logit model – where z'_{it} is set equal to a zero column vector and equation (2) collapses to the standard logit model – estimated separately for men and women. The results make the differences alluded to in the descriptive analysis[29] between men and women clear. Indeed, a seemingly unrelated estimation to combine columns (1) and (2) of table 3 allows one to run a test on the – joint – equality of the combined coefficients. In this particular case, it returns a test statistic $\chi^2 = 17.41$, with a critical value on 9 degrees of freedom of 16.92 and a p-value of 0.0427, thus leading to a rejection of equality.

The third column of table 3 reports the results for a random effects specification estimated on the joint sample of men and women. In this case, it yields coefficient estimates and significance levels that are quite similar to the pooled model.

Overall, table 3 shows that the coefficient which is the focus of this study, the dummy for the years after 2003, remains insignificant in all three specifications, even if one was willing to assume a significance level of 10%. The point estimate for the dummy for individuals above the basic allowance is positive, but only acquires significance on the 10% level. The interaction between the marginal tax rate and the dummy for years after 2003 remains insignificant as well. Also noteworthy is the low Pseudo-R^2 measure. Overall, there is very little evidence to tie the variance of the commuting allowance observed between fiscal 2003 and 2004 to any behavioral changes along the extensive margin.

As alluded to at the beginning of this subsection, I also provide results for a mixed effect logit as in equation (2), with random intercepts at the federal state and the person level. As **table 4** on the following page shows, there is little extra variation at the federal state level that could be exploited to explain labor supply decisions, over and above the one at the personal level that the random effects model in table 3 had already uncovered: The random intercept at the federal state level is insignificant.

3.6.2 Variation in the Commuting Distance

Once the labor market participation has been established, any changes in

- the place of private residence
- the place of work
- or both simultaneously

potentially impact the distance to the workplace and thus the deduction for commuting costs. I refrain from modelling these decisions as stand-alones – which would essentially require the application of the methods used in section 3.6.1. At the same time, they all – potentially – impact the commuting distance so that a *mixed effects regression* on the commuting distance suffices to uncover the main effect of interest here, i.e. the question whether behavioral change is detectable as a reaction to variations in the commuting allowance.

To this end, I restrict the estimation sample – over and above the restrictions enumerated in section 3.5 – to those who did not end their labor market participation, in the sense as used in

[29] Cf. section 3.5.

Table 4
Mixed Effects Model for Labor Supply

	Mixed Effects	
Age	-0.0488***	(-7.87)
Number of Children in HH	-0.0458*	(-1.69)
Married	-0.273***	(-3.14)
Female	-0.0935	(-1.05)
Year after 2003	-0.0936	(-0.41)
Marginal Tax Rate	-2.910***	(-6.05)
Year after 2003 × Marginal Tax Rate	-0.986	(-1.42)
Above Basic Allowance	0.177*	(1.68)
Distance Home to Work	0.00877***	(3.11)
Length of Education	0.0488***	(3.00)
Constant	-0.561	(-1.54)
Federal State Level		
sd(Intercept)	.0510042	(0.49)
Person Level		
sd(Intercept)	1.042267**	(2.49)
LR against pooled logistic (2 df)	59.87	

t statistics in parentheses
Source: GSOEP 2001-2006
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

the logistic regressions of table 3. As the dependent variable – the commuting distance – is now continuous, equation (1) is used to estimate the mixed effects model[30].

Table 5 on the next page is set up analogously to table 3 in combination with table 4. Its first two columns contain a pooled OLS model, separately estimated for men and women. A seemingly unrelated estimation on the two columns and a subsequent test on the parameter equality leads to a χ^2 test statistic of 97.60 on 8 degrees of freedom against a critical value of 15.50. Interestingly, the adjusted R^2s come in at around 50%. Against this benchmark, the random effects model in column (3) takes the panel structure of the data into account by treating the individual person as a unit that is assigned an individual intercept. The importance of this additional modelling strategy can be gauged from

$$\rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_e^2}$$

reported in the last row of table 5 which shows that almost two thirds of the variation in the errors is down to differences *between* individuals instead of idiosyncratic deviations *within* their data[31].

[30] Indeed, equation (1) can easily be set up as a special case of equation (2) by rejigging equation (3) as the identity link.
[31] The same story emerges from the split of the R^2 into within and between variation.

Table 5
Models for Commuting Distance

	OLS/Female		OLS/Male		Random Effects		Mixed Effects	
Age	-0.0674***	(-3.36)	-0.0845***	(-3.37)	-0.123***	(-5.82)	-0.0144	(-1.38)
Number of Children in HH	-0.0891	(-0.92)	0.0320	(0.33)	-0.124	(-1.22)	-0.00130	(-0.03)
Married	-0.269	(-0.87)	-0.684*	(-1.78)	-0.514*	(-1.85)	-0.165	(-1.05)
Above Basic Allowance	20.66***	(72.67)	24.32***	(72.89)	17.72***	(80.63)	22.12***	(36.52)
Year after 2003	2.673***	(3.25)	4.113**	(2.52)	3.838***	(7.14)	3.834***	(10.22)
Marginal Tax Rate	7.060***	(4.00)	11.74***	(3.82)	9.558***	(6.44)	6.346***	(7.59)
Year after 2003 × Marginal Tax Rate	5.258*	(1.95)	-1.368	(-0.31)	-1.953	(-1.27)	-4.574***	(-4.22)
Length of Education	0.318***	(5.45)	0.179***	(2.73)	0.365***	(5.85)	0.0855***	(2.79)
Gender					-2.554***	(-7.59)	-0.628***	(-3.91)
Constant	3.542***	(3.04)	4.708***	(3.11)	10.94***	(8.19)	5.902***	(9.00)
Federal State Level								
sd(Year after 2003 × Marginal Tax Rate)							1.7870***	(5.6736)
sd(Intercept)							0.0792***	(4.1378)
Person Level								
sd(Year after 2003 × Marginal Tax Rate)							15.475***	(181.72)
sd(Intercept)							3.687***	(11.38)
sd(Residual)							5.243***	(216.84)
LR against OLS (4 df)							1,405.39	
Adjusted R^2	0.538		0.446					
R^2 overall					0.486			
R^2 within					0.214			
R^2 between					0.578			
σ					11.314			
σ_u					9.240			
σ_e					6.530			
ρ					0.667			

t/z statistics in parentheses
Panel Unit for Random Effect Specification: Individual Person
ρ denotes fraction of variance due to individual level effect σ_u
sd denotes standard deviation of Random Effects
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Source: GSOEP 2001-2006

As can be seen from the R^2 measures broken down into components in the lower part of table 5, the model fit is very similar to the OLS models. The variable which is most important to the objective of the paper, the dummy for years after 2003, is highly significant throughout the models, yet its interaction with the marginal tax rate has so far been only marginally significant for the female population and not at all for the male population and the joint sample.

Column (4) then estimates a fixed-effects part identical to the other models. In addition, it breaks down the variation in intercepts and slopes of a subpart of the covariates on the level of the federal state and the level of individuals. Quite apart from the meaningful contribution made by random intercepts in the random effects model, as shown above, the mixed effects strategy shows a more fine-grained breakdown of *variation*[32] in commuting distances. As can be seen from the results, there is very substantial variation at the level of federal states with regard to the interaction between the marginal tax rate and the dummy for years after 2003. This observation also ties in nicely with the thrust of figure 2.

The same picture emerges on the individual level where the gyrations with regard to the reaction to the 2004 reform are much greater still. The remaining idiosyncratic variation in the commuting distance ("sd(Residual)") – left over after other sources of variation have been exhausted – is thus considerably lower at 5.243 than the one that the RE model in column (3) left unexplained (11.314). The LR test of the mixed effects strategy against the OLS estimator reported in table 5 drives home the point that the substantial heterogeneity between federal states and individuals is best modelled with the approach in column (4).

In comparison to columns (1)-(3), column (4) shows significance at the 1% level for the marginal tax rate interacted with the years after 2003, lending credence to the notion that there is an influence of a reduction in the deductible amount for the commuting allowance, and that it is tied to the marginal tax rate faced by the taxpayer: The higher the marginal rate, the more severely the taxpayer tends to react to the change. With regard to the magnitude of the coefficient, it must be borne in mind that the marginal tax rate can vary between 0% and 48.5%. A 10 percentage point increase in the marginal tax rate thus translated into 457 meters less of daily commute after the 2004 changes, controlling for the rest of the covariate vector.

4 Conclusion

Tax base effects abound in income tax law, and their heterogeneity certainly contributes to tax researchers' aversion to tackling them. It is peculiar and striking that theoretical research into the commuting allowance – as a weighty example of a tax base effect – is concentrated in a few researchers' output. One obvious conclusion is that competitive advantage in this strand of research comes at a substantial price in terms of specialization. Thus several issues have gone unanswered which cost the German tax authorities substantial amounts of money every year. The question whether extraordinary financial burdens (§ 33 German Income Tax Code) should be – partially – deductible from the income tax base has never been seriously discussed. This deduction, for instance, regularly reaches 10 billion € per year[33]. Neither has the question

[32] Note that the lower part of table 5 gives – estimated – standard deviations of the random slopes and associated standard errors – not point estimates of the slopes themselves.

[33] Cf. Federal Statistical Office (2005, 2006, 2007, 2008a).

whether lottery gains should be taxable income, whether hospitality costs should be deductible at 70% or 80% (§ 4 (5) Nr.2 German Income Tax Code), or whether investment bankers' suites should be recognized as a deductible expense.

This first shot at an illumination of these tax base effects is devoted to the biggest, most hotly discussed and distributionally challenging issue, the commuting allowance enshrined in § 9 (2) of the German Income Tax Code 2009. As the (cross-sectional) international comparison in section 1 and the (longitudinal) comparison of German tax rules over the last couple of years in table 1 show, there is no well-established treatment of these expenses that is constant across both dimensions. While certain countries have never allowed these deductions, no country has so far begun to tax the commuting behavior, at least not via direct taxation[34].

The preceding analysis has shown that the influence of the variation in the commuting allowance witnessed between the years 2003 and 2004 can be tied to a decrease in commuting distances, while labor supply seems to react inelastically to it. A more profound insight into this relationship was gained through the employment of mixed effects regression which are able to detect various nested sources of variation in outcomes. The interaction of the years after the policy change with the marginal tax rate showed an effect increasing with the marginal rate.

These results fuel the initial suspicion that the commuting allowance does influence behavior and thus should prompt further investigation. One avenue for future research is obviously to regard the policy change between 2003 and 2004 as a gigantic natural experiment, with those claiming no deduction unaffected by the new regime while those with long commutes impacted severely. This angle of attack opens up a whole range of new and innovative econometric methods, with *regression discontinuity* being one of the more obvious candidates.

[34] A sound reasoning for such a reversal in policy from the decades old subsidization of commuting could be seen in the revitalisation of inner cities or the prevention of urban sprawl.

A Supplementary Graphs

Figure 11

Commuting Distances vs. Average Relevant Days for Commuting Allowance

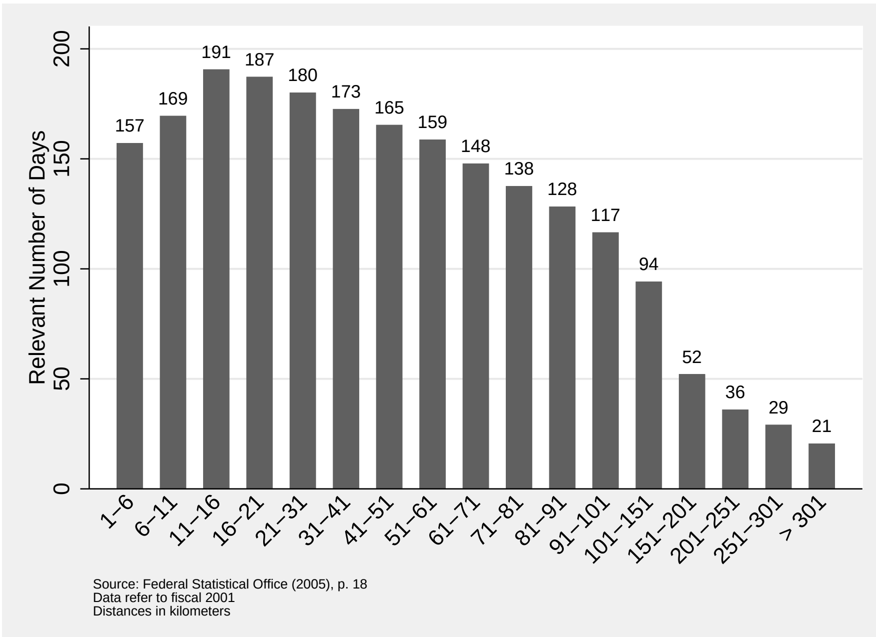


Figure 12
Means of Transport to Get to Work, by Federal States

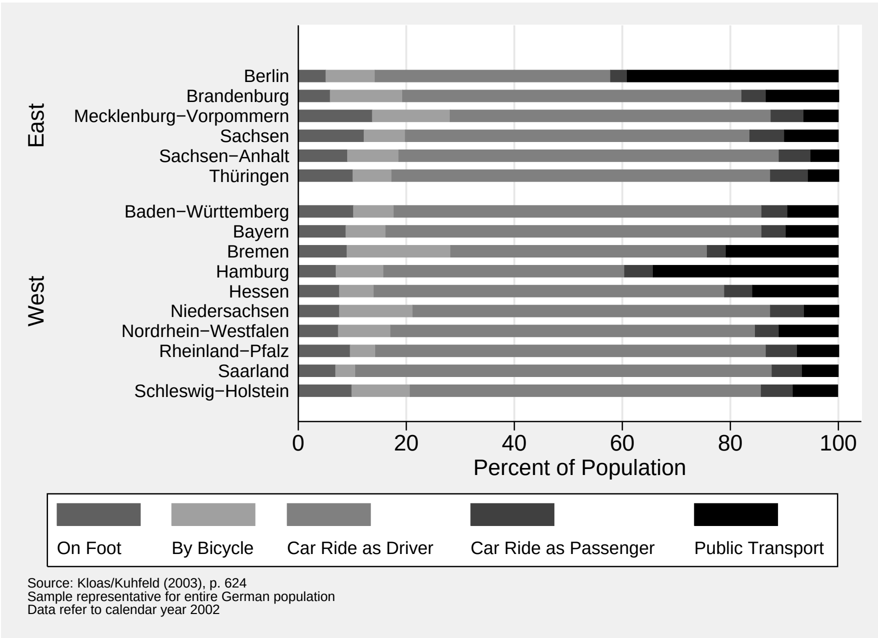
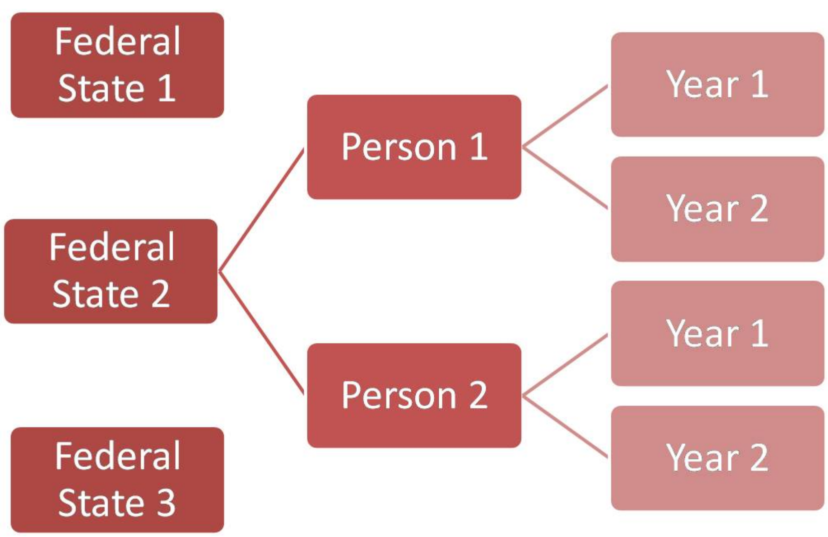


Figure 13
Nesting Structure for MC experiment



B Supplementary Tables

Table 6
Commuting Allowance in German Income Tax Returns for the Years 2001-2004

		2001		2002		2003		2004	
		Gross Wages	Deductions	Gross Wages	Deductions	Gross Wages	Deductions	Gross Wages	Deductions
(1)	# of taxpayers	27,709,160		27,627,685		27,008,320		26,571,491	
(2)	Overall Sum of Income in 1,000 €	961,713,473		957,530,069		938,140,682		951,369,052	
(3)	Basic Allowance in €		1,044		1,044		1,044		920
(4)	# of taxpayers reporting income from employment	24,141,431	24,188,195	23,968,222	24,024,648	23,271,841	23,336,429	22,627,187	22,675,645
		(87.12%)	(87.29%)	(86.75%)	(86.96%)	(86.17%)	(86.40%)	(85.16%)	(85.34%)
(5)	Income in 1,000 €	838,033,363	57,885,412	845,242,068	58,875,711	827,995,421	57,684,777	821,105,055	48,417,406
(6)	Mean Income in €	34,713	2,393	35,265	2,451	35,579	2,472	36,288	2,135
(7)	Median Income in €	29,365	1,665	29,805	1,708	30,151	1,725	30,570	1,466
(8)	# of taxpayers claiming basic allowance		10,571,895		10,424,648		11,236,429		10,975,645
			(43.71%)		(43.39%)		(48.15%)		(48.40%)
(9)	# of itemizing taxpayers		13,616,300		13,600,000		12,100,000		11,700,000
			(56.29%)		(56.61%)		(51.85%)		(51.60%)
(10)	Volume of itemization in 1,000 €		41,100,000		42,100,000		41,800,000		34,800,000
	Thereof:								
(11)	Fraction claimed for Commuting Allowance		63.9%		68.9%		69.8%		66.1%
(14)	in 1,000 €		26,262,900		29,006,900		29,176,400		23,002,800

Basic Allowance according to § 9a German Income Tax Code for the respective year
Row (4) percentages: Fraction of all taxpayers (Row (1))
Row (8)/(9) percentages: Fraction of taxpayers in Row (4)
Source: Federal Statistical Office (2005, 2006, 2007, 2008a)

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