# The Distributional Effect of Commuting Subsidies - Evidence from Geo-Referenced Data and a Large-Scale Policy Reform

PRELIMINARY DRAFT

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**Abstract**

Tax legislation in virtually all OECD countries foresee tax breaks for commuters. One major rationale is that workers should not be financially disadvantaged by the length of their commute. Although the sum of foregone tax revenues is substantial, little is known about the distributional effects of commuting subsidies. In particular, it is unclear whether employers or employees bear the costs when the subsidy is abolished. In addition, we lack precise evidence on whether the subsidy is progressive or regressive in nature and how benefits are distributed between urban and rural workers. Drawing on a large set of geo-referenced employer-employee data we use the unexpected repeal of commuting subsidies in Germany in 2007 for distances below a certain threshold as exogenous source of variation to analyze the distributional effects of commuting subsidies. On a microeconomic level we use a difference-in-differences design to examine whether workers are compensated by their employer for a loss in commuting subsidies. We find no causal evidence for gross wage adjustments as a result of the reform. Looking at aggregate changes in the distribution of net wages, it turns out that higher income groups have benefited disproportionately from the original tax breaks and, in turn, carried the burden of the repeal of commuting subsidies. Hence, introducing a lower threshold for commuting subsidies, which is common on numerous countries, redistributes the tax burden in favor of lower income groups.

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## 1. Introduction

Tax laws in virtually all OECD countries foresee tax breaks for commuting. Underlying these regulations are usually both efficiency and equity considerations. Commuting subsidies are intended to increase efficiency in the labor market by encouraging workers to increase their radius of job search and to commute further for a better match (see e.g. Sinn (2003)).[1] The papers by Weiss (2009) and Boehm (2013) considering the German tax break system both provide empirical evidence for commuting subsidies being successful in this respect. It seems that workers commute longer distances if they can deduct commuting expenses from their wage tax. More specifically, Boehm (2013) shows that this result is to a large extent driven by workers moving into cities in order to reduce commuting distances in the face of decreasing commuting subsidies. With respect to equity concerns, it is usually argued that workers who are willing to accept longer commuting distances should not be disadvantaged financially. Compared to their effect on commuting distance, much less is known about the distributional consequences of commuting subsidies. While the (mainly theoretical) literature has usually focused on the question how commuting subsidies should be designed in order to be efficient, it has so far remained unclear to which extent workers benefit from existing regulations and how these benefits are distributed across workers groups. Specifically, we lack an understanding of whether workers would be compensated by their employers in the absence of commuting subsides. The size of such wage adjustments is ex ante indeterminate as compensation payments depend on the relative bargaining power of workers as well as on the extent to which wages are flexible enough to adjust to worker-specific circumstances (Baldry (1998)). This ignorance is rather unsatisfactory since the extent to which commuting subsidies effectively reduce the financial burden of commuters crucially depends on whether or not commuters would earn higher wages if tax breaks for commuting expenses were not granted. Closely related, if commuting subsidies were found to have an overall net wage effect on workers that would not arise in their absence, it is unclear how these benefits are distributed across worker groups. The obvious question is to which extent they are progressive or regressive in nature, i.e., whether they benefit

[1] Commuting subsidies are usually designed as deductions of commuting expenses from taxable income. As such, they offset negative effects from income tax on job search and commuting decisions (Richter et al., 2004). In a simple example, let $\Delta w$ be the wage premium for commuting and $c$ the commuting cost, then in the absence of taxation commuting will take place if $\Delta w - c > 0$. If income taxes are sufficiently high, commuting does not take place, since now $\Delta w(1-t) - c < 0$. If commuting is tax deductible every efficient job match will be achieved even under taxation since $(\Delta w - c)(1-t) > 0$ holds if $\Delta w - c > 0$.

mostly high-wage or low-wage workers. In the literature it is mostly assumed that high-wage workers benefit more than proportionally from the subsidy as they are subject to higher income tax rates and on average commute longer distances (Bach et al., 2007). While this argument is plausible, little is known about the specific distribution of benefits from commuting subsidies across income groups. [2] Furthermore, if benefits are distributed unequally across workers of different income levels, commuting subsides are likely to also have a spatial component inasmuch as they might redistribute income from cities into rural areas or vice versa. Ex ante, this effect is ambiguous since workers living in the countryside tend to commute longer distances, while urban workers on average earn higher wages. Hence, the distribution of benefits from commuting subsidies across wage groups as well as between region types to date are unanswered empirical questions.

This ignorance on the distributional effects of commuting subsidies not only stands in stark contrast to the equity concern by which they are inspired, but also to the substantial size that commuting subsidies make up in public budgets. In Germany, the sum of foregone tax revenues from tax breaks on commuting amounts to six billion Euro annually (Bach, 2003). This equals 0.6 percent of overall public expenditure and corresponds roughly to the total sum spent each year on active labor market policies. While these expenses are unlikely to be distributionally neutral, a proper identification of the distributional effects has so far been impeded by constraints on research design and data availability. Empirically, answering the counterfactual question of whether workers would be compensated for commuting costs in the absence of commuting subsidies is not an easy task since in a given legal setting comparable workers with and without entitlement to the subsidy usually do not exist. Ideally, one could find a natural experiment where the subsidy changed for some workers but not for others. In addition, conducting a proper distributional analysis not only poses substantial requirements on sample size, but also on the precision of information on commuting distances in order to be informative. The latter requirement disqualifies all data sets that contain locational information only on aggregate level, e.g., on county or community level, as these are not precise enough to correctly identify individual net wage effects of commuting subsidies.

In this paper we provide new and consistent evidence on the distributional ef-

[2] In 2010, the German Green Party expressed their concern about commuting subsidies favoring mainly higher income groups in an official inquiry to the Federal Government( "Kleine Anfrage an die Bundesregierung zur Verteilungswirkung der Entfernungspauschale") (Bundesministerium der Finanzen, 2010). The Government states in its response that information on the correlation between personal income and the size of granted tax breaks for commuting is not available.

fects of commuting subsidies. We therefore draw on a unique set of policy reforms in Germany, which in 2007 substantially reduced commuting subsidies for workers commuting more than 15 kilometers while commuting subsidies for distances below 15 kilometers were left unaltered. These abrupt changes in the tax regime were not only substantial in size (the German fiscal authority gained 2.5 billion Euro annually (Donges et al., 2008)), but have also shifted a major kink in the scheme of commuting allowances upwards. Exploiting the fact that some workers have incurred substantial reductions in net wages while others have been unaffected, in a first step we employ a difference-in-differences approach to identify gross wage adjustments as a response to changes in commuting subsidies. In a second step we shed light on the distribution of benefits from commuting subsidies between wage groups and between urban and rural workers. A precise and consistent estimation becomes possible through the availability of a large and novel data set which provides geo-referenced information on workers' exact place of work and place of residence. From these data and using GIS-software we construct a precise worker-specific measure of real commuting distances, which has not been available so far.

Comparing the distributional effects of the pre- and post-reform period is instructive beyond the German case as it allows to infer on the equity effects of different regimes of commuting subsidies. In several countries, commuting costs can be deducted for the full scale of commuting distances (e.g., in Finland) while other countries allow for tax deductions only above a certain minimum threshold (see Borck and Wrede (2009) for an overview). In Sweden, commuting costs are only deductible from 5km onwards while in Norway and Austria commuting costs can be deducted only for distances greater than 15km and 20km, respectively.[3] The German case is unique inasmuch as both types of regimes were consecutively implemented within one country. We exploit this rare opportunity to consistently estimate the distributional effect of a paradigm shift in granting commuting subsidies.

Our results show that the partial withdrawal of commuting subsidies in Germany in 2007 has not led to significant gross wage adjustments. Specifically, we find no evidence for compensations to be paid to workers who were affected by the policy change. This finding holds for the full sample as well as for subgroups that are more able to bargain for wage adjustments. With respect to the distribution of benefits between wage groups we find that deductibility of commuting expenses across the full range of commuting distances strongly favors

[3]The threshold in Sweden applies only to commuting by car; public transportation costs are deductible without limitations. The Austrian regime differs for usage of public transportation and private automobiles. While subsidies for public transportation are lower, workers have to proof unacceptability of public transportation to claim the higher automobile subsidy.

high-earning workers. Consistently, the tax burden of the reform was mainly borne by these workers. This result is instructive in that it shows that granting tax breaks only above a certain threshold of commuting distances, as it is practiced in a number of countries, has a progressive effect on the distribution of tax burden.

The paper is structured as follows. In section 2 we explain the design of commuting subsidies in Germany before and after the policy reform in greater detail. In section 3 we summarizes the data and provide descriptive statistics. In section 4 we outline the difference-in-differences design as our key identification approach to analyze wage adjustments as a result of the policy reform and provide the results obtained. In section 5 we examine the distribution of tax benefits across wage groups and across rural and urban workers, and discuss implications for different paradigms of commuting subsidies. Section 6 concludes.

## 2. The Policy Reform in Germany 2006/07

Since their first introduction in Prussia in 1891, commuting subsidies have been subject to continuous political debate. Depending on the prevailing political constellation, numerous adjustments were made once and again concerning the design and the level of the subsidy (Weiss (2009) and Boehm (2013) both provide more extensive historical overviews). The major reform we draw on in this paper was implemented between 2006 and 2007. In the baseline scenario prevailing before 2007, workers could either deduct 0.30 Euro per km of a one-way commute or make use of a lump-sum deduction of 920 Euro annually. Deduction are claimed from gross wages for every work day and as such reduce taxable income. With an average of 230 working days per year, under this regulation full-time workers commuting 15km are indifferent between claiming the lump-sum or deducting 0.30 Euro per kilometer per day; workers with lower commuting distances are better off claiming the lump-sum, while workers with commuting more than 15km per way opt for deducting 0.30 Euro per km.

Facing the urgent need to consolidate an increasing deficit in public budgets (Deutscher Bundestag, 2006), in June 2006 the German Parliament passed a reform of tax legislation which among other elements included a change of the commuting subsidy. This new law, which came into effect in January 2007, fell nothing short of a paradigm shift as it declared commuting to be privately caused. As a result, commuting costs exceeding the lump-sum amount of 920 Euro were not deductible any more. As completely abolishing the subsidy was, however, politically unfeasible, commuters traveling more than 20km per way were still granted a tax exemption of 0.30 Euro/km from the 21st km onwards, which was officially referred to as "hardship regulation" (Härtefallregelung).

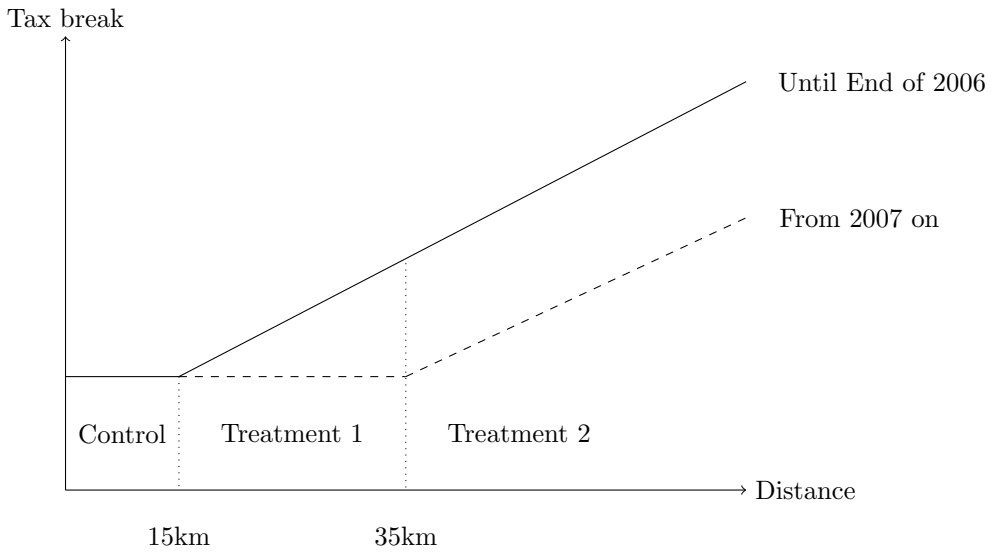


Figure 1: Setup of treatment and control groups

The lump-sum deduction of 920 Euro remained in effect unchanged. In effect, the reform shifted the indifference point substantially upwards to distribution of commuting distances, from 15km to 35km. Individuals living up to 35km to their workplace would now claim the standard deduction of 920 Euro per year, while only workers travelling more than 35km per one-way commute would now deduct 0.30 Euro per km for every working day.

Figure 1 shows how the reform has altered the distribution of tax breaks as a function of individual commuting distance. The two lines indicate the size of individual tax breaks before (solid line) and after (dashed line) the policy change in January 2007. Depending on commuting distance, three groups of workers can be identified, who differ with respect to the extent that they were affected by the reform. The size of tax breaks has remained unchanged for workers commuting less than 15km as they claim the lump-sum subsidy of 920 Euro before and after. Workers commuting between 15 and 35 km would have deducted 30 cents per kilometer before the reform and will claim the lump-sum after 2007. Workers commuting more than 35 km per way would in both scenarios claim the km-specific deduction. In the period after the reform they cannot, however, claim a tax deduction for the first 20km any more. In December 2008 the policy experiment ended abruptly when the Federal Constitutional Court declared the regulation as unconstitutional. The Court argued that it violates the constitutional principle of equal treatment (Allgemeiner Gleichbehandlungsgrundsatz), as short and long distance commuters were treated differently with respect to

the tax legislation.[4] As a result, the reform was scrapped in April 2009 and the scheme prevailing between 2004 and 2007 was reinstated and has not changed ever since.

## 3. Data and Descriptives

### *3.1. Data*

We employ registry data which are collected in the administrative processes of the German Federal Employment Agency and are contained in the Integrated Employment Biographies (IEB) of the Institute of Employment Research. The IEB cover all employed persons subject to statutory social security contributions as well as all recipients of unemployment insurance or unemployment assistance. Important for our purpose, for the years 2007 to 2009 the data contains precise geo-referenced information on workers' place of living and place of work for the years 2007 to 2009 (see Scholz et al. (2012)). These information can be used to calculate precise commuting distances. For the years between 1999 and 2006, the data are not geo-referenced but contain geographic information on the level of municipalities. In addition, information on wages, education, age, gender, full-time vs. part-time employment, nationality, firm size, and industry are provided.

From these data we draw a 25 percent random sample of workers on the basis of 2006, the year before the policy reform was implemented. For all workers in this sample we add all existing observations from 2004 to 2008. We truncate the sample in 2004 since the regime of commuting subsidies changed between 2003 and 2004. At the upper bound, we account for the fact that the reform was taken back in early 2009 by truncating the sample after 2008.

In order to properly identify the distributional effects of commuting subsidies, we further restrict the sample in a number of aspects. First, attrition bias is a relevant issue in the present context. During the period of observation, about twenty percent of workers leave the sample at an age of 60 years or more. These retiring workers differ from the rest of the sample in terms of higher wages and lower commuting distances. In addition, especially in the first half of the period of observation, which was characterized by rising unemployment, low-qualified workers left the population of employed workers by withdrawing their labor supply or by becoming unemployed. These workers were those with comparatively low wages and short commuting distances. Both types of selective sample attrition pose a threat to the identification of how commuting subsidies and their

[4] Technically, commuting costs were treated as work-related expenses only in cases where commuting distances exceeded 20km. This differential treatment was regarded by the Court as not satisfying the principle of equal treatment.

reform impacts on the distribution of wages. Addressing this issue we restrict the sample to individuals with a full set of employment observations, i.e., we exclude all individuals that become either unemployed or leave the sample during the period of observation.

Secondly, Weiss (2009) and Boehm (2013) both show that workers have reduced their commuting distance as a result of the reform. In our paper we are interested in the wage effect of the reform conditional on fixed commuting distances. In addition, in our difference-in-differences design we need to ensure that the assignment of treatment vs. control groups stays constant across time. We therefore restrict the sample to individuals with a constant place of residence[5], who are employed at the same firm during the period of observation.[6] This restriction also ensures that wages are not confounded by systematic job changes.[7]

Thirdly, since we are interested in the distributional consequences of commuting subsidies for regular commuters, we exclude commuting distances that cannot be covered on a day-to-day basis. We therefore keep only individuals with less than 100 km per one-way commute.[8]

Finally, we need to address the problem that wages in the data set are censored at the upper limit of social security contributions. In order to avoid bias from measurement errors, we delete all observations with wages above this ceiling (see Reichert (2014)).

These restrictions leave us with a balanced panel of about 1.7 million workers per year. Drawing on the geo-references in the data, we calculate two types of commuting distances for each worker. First, we determine crow-fly commuting distances. Secondly, using GIS software and data for all German roads provided by OpenStreetMap[9], we calculate the exact road distance for each worker between her place of residence and place of work. In all cases we take the shortest route, which is the distance relevant for calculating the individual tax break on commuting.[10] This is a much more accurate measure of commuting distance and also the measure used for tax declaration by fiscal authorities.

[5]Monte et al. (2015) show in a general equilibrium framework, that the elasticity of a local labor market is crucial to evaluate commuting and migration designs and policies. Not confounding these effects is another motivation for using only a balanced panel.

[6]We also exclude all individuals who work in establishments that changed their location.

[7]In addition, urban economic theory tells us to keep housing prices constant when examining gross wage adjustments as a reaction to a rise in commuting costs. As the individuals in our sample by definition do not move, housing prices should not change systematically since the policy applies to all workers independent of their region of residence. Therefore, even neighbors who work in different locations can be affected differently by the policy and hence there should not be systematic changes in house prices as a reaction to the policy.

[8]Note that the 95 percentile of commuting distances in the unrestricted sample ranges at 81 km; the 99th percentile lies at 370 km.

[9]The shapefile for German roads was provided by OpenStreetMap.

[10]If the fastest route does not coincide with the shortest route, the distance of the fastest route can be claimed only if the worker proves that time savings are substantial.

*3.2. Deriving Commuting Subsidies and Net Wages*

As one key ingredient for analyzing the distributional consequences of commuting subsidies we need to calculate each worker's individual net wage. We therefore derive the commuting subsidy as well as the individual tax rate for each worker using the procedure proposed by Gunselmann (2014) to which we add information on individual commuting distance, which allows for calculate the size of commuting subsidies. Figure .8 outlines how net wages are derived from gross wages and how commuting subsidy are embedded in the German tax system.

The point of departure is a worker's contractual gross wage, which is either negotiated collectively between employer organizations and unions or individually agreed upon between workers and firms. We observe daily gross wages in the data. The first step to obtain net wages is to deduct three types of expenses, which each reduces the taxable wage. These expenses encompass pension payments, extraordinary expenses like, e.g., high health costs, and income-related expenses.[11] The latter category contains all expenses that are necessary for a worker to keep up her employability. These entail commuting expenses, expenditures for work equipment and home office, double household allowances and membership in professional associations. In 2008, workers have claimed 45.4 billion Euro of income related expenses (Destatis, 2012). Commuting expenses provide with almost 60% and 20.8 billion Euro by far the biggest chunk of work-related expenses.[12] On average, each worker has deducted 1,603 Euro of commuting costs from her gross wage.

Unfortunately, we lack information on pension payments and extraordinary expenses. However, Reichert (2014) shows that net wages calculated from administrative data do not differ systematically from those reported in a survey. More precisely, he finds that on average calculated and reported annual net wages differ only by 6 Euro which means that measurement error is unsystematic and very small. We can therefore safely conclude that pension all other forms of deductibles do not influence our calculations systematically.

We subtract the standard deduction for income related expenses if commuting distance is below the threshold of 15 km between 2004 and 2006, or below 35km from 2007 onwards. For calculating commuting subsidies without standard deduction, we use exact information on distance between workplace and residence,

[11] For all employees, a standard minimum deduction is considered automatically; all further claims have to be filed individually by workers in their tax declarations.

[12] By means of comparison, expenditures for work equipment and home office, double household allowances, and membership in professional associations account for 8.3%, 5.4%, and 2.3% respectively.

which is multiplied by working days times 0.30 Euro. [13]
The expense-adjusted gross wage is taxed with a progressive rate, which depends on wage level and individual tax category. Due to a lack of further information we assume all individuals to fall under tax category I, which is the category for single workers. Tax category I is the most commonly used category which applies to 38% of all tax paying individuals[14]. Importantly, the specific tax category has no effect on concession and size of commuting subsidies.
Our calculations leave us with three new variables, namely individual commuting subsidy, tax savings, and net wage. Tax savings are defined as the individual commuting subsidy × individual tax rate.

### *3.3. Descriptives*

Table 1: Commuting Distances

| | **Commuting Distance (km)** | | |
|---|---|---|---|
| | Mean | Median | Std. Dev. |
| Overall | 22.65 | 7.18 | 61.03 |
| 15-24 yrs. | 21.05 | 7.44 | 55.83 |
| 25-34 yrs. | 25.19 | 7.99 | 65.38 |
| 35-54 yrs. | 22.93 | 7.40 | 61.42 |
| 55-65 yrs. | 19.76 | 5.68 | 56.84 |
| Low Qualification | 15.04 | 5.53 | 43.40 |
| Medium Qualification | 20.93 | 7.44 | 56.32 |
| High Qualification | 28.68 | 7.39 | 73.38 |

Table 1 shows that the average crow-fly commuting distance is about 23km. A comparison between mean and median commuting distance reveals that the distribution is highly right-skewed. Both mean and median differ substantially across worker groups. With respect to age, commuting distances follow an inverted U-shape with young professionals (25-34 years) commuting the longest distances. In addition, the mean commuting distance rises steeply with education. In fact, highly qualified workers commute on average nearly twice as far as low-qualified workers.
For the analysis of wage adjustments in section 4, we use both crow-fly and route distances. As figure 1 shows, the assignment to control versus treatment groups depends crucially on commuting distance. Figure .9 in the appendix shows with a small sample, how using crow-fly distances can be misleading. We

[13] We use the number of working days=calendar days - state specific number of holidays - 30 days. 30 days are subtracted as this is the number of vacation days for regular employment in Germany.

[14] In 2012 27.75 million of Germans were subject to payroll tax of which 10.7 millions belonged to tax category I. The second biggest group is category III, the category for married individuals, with 8.8 millions of observations. (Bundesministerium der Finanzen, 2014)

Table 2: Descriptives Groups

| | Overall | Control | Treatment |
|---|---|---|---|
| No. Obs. | 8.7 mio | 6.8 mio | 1.9 mio |
| 15-24 years | 2.2% | 2.3% | 2.0% |
| 25-34 years | 17.2% | 17.0% | 18.0% |
| 35-54 years | 68.0% | 67.8% | 69.0% |
| 55-64 years | 12.6% | 13.0% | 11.0% |
| low qualification | 12.2% | 13.2% | 8.6% |
| medium qualification | 72.1% | 72.0% | 72.6% |
| high qualification | 6.1% | 5.3% | 8.9% |
| mean firm size | 230 | 199 | 342 |
| median firm size | 26 | 24 | 35 |
| mean yearly gross wage (Euro) | 32,767 | 31,949 | 35,727 |
| median yearly gross wage (Euro) | 31,928 | 31,258 | 34,696 |
| mean yearly net wage (Euro) | 19,440 | 18,964 | 21,163 |
| median yearly net wage (Euro) | 19,228 | 18,885 | 20,809 |
| mean subsidy (Euro) | 1,120 | 920 | 2,306 |
| median subsidy (Euro) | 920 | 920 | 1,559 |
| mean tax savings (Euro) | 217 | 163 | 411 |
| median tax savings (Euro) | 179 | 171 | 271 |

therefore compute route distances using GIS software for all observations with a commuting distance between 10-35km[15]. For section 4 we assign treatment groups for all those individuals we have route distances for and assign those with a crow-fly commuting distance smaller than 10km to the control group and those with a crow-fly distance larger than 35km to treatment group 2.
Table 2 shows descriptive statistics both for the overall sample and classified into treatment vs. control group. The table reveals that treatment and control groups are comparable in age structure. While medium qualified is the biggest group, which seems independent of commuting distance, especially higher qualified tend to commute longer distances, as also shown in table 1, and hence contribute a larger share to the treatment group. Treatment and control group further differ in their income and in the possibility to deduct commuting subsidies from their working income. The size of the mean subsidy in 2006 was 1,490 Euro and 1,105 Euro in 2007. For both years, the 75th percentile observation is the standard deduction of 920 Euro, indicating that the majority of workers makes use of the standard deduction. In 2006, the 90th percentile corresponds to 2,652 Euro of annual subsidy, whereas it is 920 Euro in 2007. As table 2 shows, the median in the treatment group (i.e. those living further than

[15]As it is not yet possible to calculate the route distances at the FDZ facilities in Nuremberg, we had to restrict the sample for data privacy reasons. The goal is to compute exact distances for the whole sample in the course of this project.

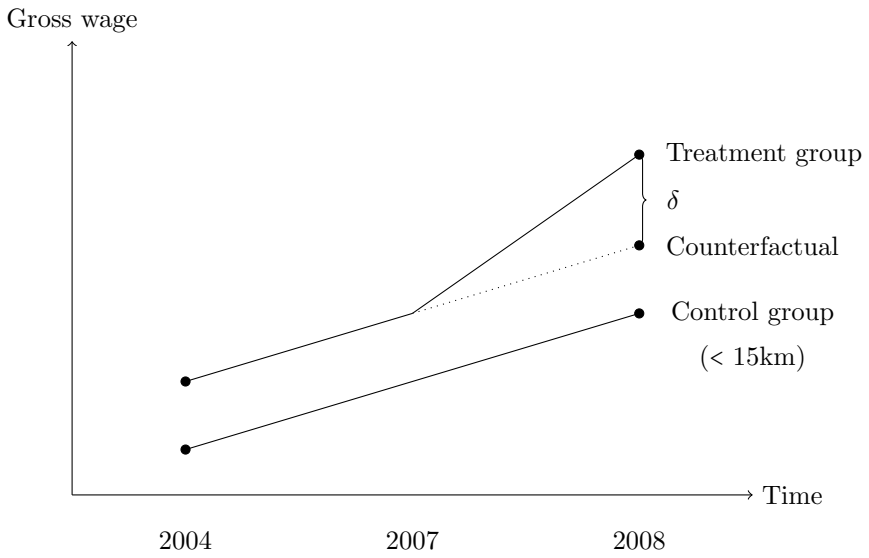


Figure 2: Difference-in-Differences

15km from their workplace) is with 1,559 Euro somewhat higher.

## 4. Gross Wage Adjustments as a Result of the Reform

*4.1. Empirical Design*

In this section we address the question whether individuals are compensated for commuting costs by their employers in the absence of commuting subsidies. In order to do so we examine whether gross wages of workers who effectively lose part of their net wage as a result of the reform rise relatively more compared to wages of unaffected workers. To test for differences in wage adjustments we apply a difference-in-differences approach. As illustrated in Figure 2, the key outcome variable is a worker's gross wages before and after the policy reform in 2007.

As mentioned above, the first treatment group (T1) consists of workers living between 15 kilometers and 35 kilometers away from their workplace. After 2007, these workers would make use of the opportunity to deduct a fixed amount of 920 Euros rather than deducting their expenses per kilometer. The second treatment group (T2) consists of workers who face a parallel shift in tax breaks. These workers would still use the per-distance option of tax deduction but could not deduct the first twenty kilometers any more. The control group (C) consists of workers living closer than 15 kilometers from their workplace. These workers claim the lump-sum deduction before and after the reform. If employers compensate workers who faced losses in net wages due to the policy change, gross

wages in the treatment group(s) should rise relatively more in 2007 than gross wages in the control group. The difference $\delta$ can then be interpreted as a causal effect of the reform. Based on these considerations we specify the following model to identify the causal effect of the policy change on gross wages.[16]

$$log(grosswage)_{it} = \alpha + \gamma Treatment_i + \lambda d_t + \delta(Treatment \times d)_{it} + \mathbf{X}_{it}\beta_1 + \mathbf{Z}_{it}\beta_2 + \mu_i + \varepsilon_{it} \quad (1)$$

We estimate equation 1 for all individuals $i$ for the years $t$ = 2004-2008. $Treatment$ is a dummy variable which is equal to 1, if commuting distance between home and work exceeds 15km. $d_t$ is a time effect which is equal to 1 for the years are 2007 or 2008 (i.e., the years the policy was in effect) and zero otherwise. $\mathbf{X}_{it}$ consists of individual time invariant controls like education, gender, nationality or industry group. $\mathbf{Z}_{it}$ consists of time-varying covariates ($age^2$, firm size). $\mu_i$ depicts individual fixed effects. The coefficient of interest is $\delta$, which indicates whether gross wages of treated workers rise as a result of the reform.
We modify our first specification and use gross wage growth as a dependent variable to capture differences in wage developments across groups.

$$\Delta log(grosswage)_{it} = \alpha + \gamma Treatment_i + \lambda d_t + \delta(Treatment \times d)_{it} + \mathbf{X}_{it}\beta_1 + \Delta\mathbf{Z}_{it}\beta_2 + \mu_f + \varepsilon_{it} \quad (2)$$

To additionally control for unobserved firm heterogeneity (wage agreements, teleworking policies etc.), we add firm fixed effects $\mu_f$.
In our estimations we differentiate between one and two treatment groups. In a first setting we differentiate solely between workers affected by the policy workers who were not. In a second setting we differentiate between the extent to which the withdrawal of commuting allowances affects individuals. In order to satisfy the common-trend assumption, we need to make sure that gross wage growth is equal across groups before the reform. Below we apply placebo tests to check whether this assumption is satisfied.

### *4.2. Results*

Table 3 shows the results from estimating equations 1 and 2 with a single treatment group (consisting of T1 and T2). The upper panel of the table displays gross wage effects as a reaction to the exemption of commuting subsidies. The lower panel shows the results from placebo tests we conduct for each specification. In the placebo test we restrict the sample to the years of 2004-2006

[16]The specifications are adapted forms of the estimation approach used in Mulalic et al. (2013).

Table 3: Wage Effects with one treatment group

| Sample | Full sample | | | Full sample | | | w/o cb | | HQ | males |
|---|---|---|---|---|---|---|---|---|---|---|
| Dependent Variable | $log(wage)$ | $\Delta log(wage)$ | | $log(wage)$ | $\Delta log(wage)$ | | $\Delta log(wage)$ | | $\Delta log(wage)$ | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| treat | -.0050** | .0013*** | .0001 | - | -.0001 | .0002 | -.0003 | .0001 | -.0007 | -.0000 |
| | (.0016) | (.0002) | (.0001) | | (.0002) | (.0002) | (.0002) | (.0002) | (.0007) | (.0002) |
| d07 | .0072*** | .0077*** | .0076*** | .0089*** | .0085*** | .0086*** | .0081*** | .0082*** | .0040** | .0100*** |
| | (.0005) | (.0005) | (.0005) | (.0009) | (.0006) | (.0006) | (.0003) | (.0005) | (.0011) | (.0007) |
| treat×d07 | .0041*** | -.0001 | -.0000 | -.0004 | -.0000 | -.0001 | .0006* | .0001 | .0000 | .0001 |
| | (.0003) | (.0003) | (.0003) | (.0007) | (.0003) | (.0003) | (.0003) | (.0004) | (.0011) | (.0004) |
| Placebo | | | | | | | | | | |
| d06 | .0018* | .0025** | -.0021** | .0021* | .0014 | -.0032*** | -.0024*** | -.0025*** | -.0067*** | -.0016 |
| | (.0007) | (.0007) | (.0007) | (.0009) | (.0010) | (.0007) | (.0002) | (.0004) | (.0012) | (.0010) |
| treat×d06 | .0022*** | -.0006 | -.0004 | .0000 | .0008 | .0006 | -.0010** | -.0015 | .0008 | .0002 |
| | (.0003) | (.0006) | (.0004) | (.0005) | (.0006) | (.0004) | (.0003) | (.0004) | (.0012) | (.0005) |
| Distance | Crowfly | Crowfly | Crowfly | Routes | Routes | Routes | Crowfly | Routes | Routes | Routes |
| Ind. FE | Yes | No | No | Yes | No | No | No | No | No | No |
| Firm FE | No | No | Yes | No | No | Yes | Yes | Yes | Yes | Yes |
| $N_{2007}$ | 8.67 mio | 6.93 mio | 6.93 mio | 8.67 mio | 6.93 mio | 6.93 mio | 4.21 mio | 4.21 mio | 423,770 | 4.57 mio |
| $N_{2006}$ | 5.20 mio | 3.47 mio | 3.47 mio | 5.20 mio | 3.47 mio | 3.47 mio | 2.10 mio | 2.10 mio | 315,880 | 2.28 mio |
| # groups | 1.73 mio | - | 443,510 | 1.73 mio | - | 443,510 | 352,188 | 352,188 | 48,287 | 297,106 |

and re-estimate the model using the 2006 as the year of treatment. We estimate the gross wage effects with crowfly and route distances.

In Column (1) and (4) we estimate equation 1 for the full sample of workers, with crowfly and route distances respectively. We observe a positive and significant treatment effect of 0.0041. This means that all else being equal, living further than 15km from the workplace led on average to a wage increase of 0.4% (which translates into 102.50 Euro per year for an annual income of 25,000€). The results from the placebo test in the lower panel do, however, cast doubt on this result: although the effect is only about half the size in magnitude, there is still a positive and significant gross wage effect in a year which is not affected by the treatment. Comparing the effects of column (1) with those in column (4) (routing distances), we see that there is no significant positive treatment effect by the exemption of commuting subsidies.

In Columns (2), (3) as well as (5) and (6) we therefore estimate equation 2 for the full sample with and without firm fixed effects. In both columns we find no evidence for a reaction in gross wage growth as a response to the policy. Our results with route distances further hint to an effect of exactly zero: all treatment effects ($treat \times d07$) are smaller and less significant.

It might be that wage adjustments are suppressed by collective wage agreements. In fact, although wage setting has become more flexible in recent years (Dustmann et al. (2014)), major parts of the German industry are still committed to wage agreements by unions (e.g. the construction sector). In column (7) and (8), we hence restrict the sample to workers who are potentially able to negotiate their wages. We therefore exclude all industries in which more than 50% of employees are subject to collective wage agreements[17] and re-estimate equation 2. We observe a very small increase in gross wage growth for those treated in 2007 when using crowfly distances. This effect again becomes insignificant when using route distances. We conclude that using route distances is more the more precise measure and superior to using crowfly distances.

If we interpret gross wage effects as expressions of differences in bargaining power, we would expect to find these effects to differ across qualification groups with highly qualified workers being most able to negotiate wage compensations for losses in net wages.[18] As column (9) shows, the treatment effect has an effect of exactly zero such that we can reject the hypothesis of highly educated being an exception. The same is true for a subsample of males, where none of the relevant effects is statistically different from zero.

[17] See Destatis (2013).

[18] Highly qualified workers are defined as those holding a degree from a university or from a university of applied science.

Table 4 shows the results when differentiating the treatment effect by two treatment groups (see figure 1). Again, we show results for both crowfly and route distances but refer to the latter as our preferred specification. There is a positive and significant effect for the first treatment group levels of log(gross wage) as a dependent variable for both types of distances. Regarding the placebo effects, however, we do not interpret this as a causal effect of the policy reform. There is a slightly positive and significant treatment effect when regarding the subsample without industries that are determined by collective wage agreements (column (7) and (8))[19]. Regarding a significance level of 5%, the result should be interpreted carefully, as the sample size is rather large. Bertrand et al. (2004) further argue that standard errors in difference-in-differences models tend to be underestimated, which is why we should regard this effect with even more caution.

All in all, we find no evidence for a systematic reaction in gross wages in response to a reduction of commuting subsidies. Although the loss in net wages is substantial at least for some individuals, there is no observable compensation in gross wages, neither for the whole sample nor for specific groups of workers with arguably higher bargaining power. One reason for this result could be the short time span of two years in which the exemption of commuting subsidies was in effect. However, using data on firm relocation Mulalic et al. (2013) provides evidence that the bulk of gross wage adjustments occurs within three years after an exogenous shock on net wages. Similarly, Boehm (2013) shows that adjustments to commuting distance, which is arguably an even more severe adjustment compared to wage negotiations, also happen within two years after the reform. Hence, it is unlikely that the absence of wage effects is rooted in the length of the treatment period. Alternatively, it could be that the absence of gross wage reactions is due to the fact that the years 2007 and 2008 coincide at least partly with the recession in Germany, where wages were held constant and short-time work was introduced as a labor market policy. In this case, however, we would expect at least wage adjustments for highly qualified workers, as for this group the unemployment rate never exceeded four per cent.

In the next section we turn to the question of how the benefits of commuting subsidies as well as the burdens of the reform are distributed across wage groups and between urban and rural workers.

[19]The placebo test further points to a negative effect in 2006, which would be in line with an interpretation of a causal reaction to the policy change.

Table 4: Wage Effects with two treatment groups

| Sample | Full sample | | | Full sample | | | w/o cb | | HQ | males |
|---|---|---|---|---|---|---|---|---|---|---|
| Dependent Variable | $log(wage)$ | $\Delta log(wage)$ | | $log(wage)$ | $\Delta log(wage)$ | | $\Delta log(wage)$ | | $\Delta log(wage)$ | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| treat1 | - | .0012*** | -.0001 | - | .0006 | .0002 | -.0004* | -.0003 | -.0015 | -.0001 |
| | | (.0002) | (.0002) | | (.0003) | (.0002) | (.0002) | (.0003) | (.0008) | (.0003) |
| treat2 | - | .0012*** | -.0003 | - | -.0003 | .0003 | -.0000 | .0002 | -.0005 | -.0001 |
| | | (.0003) | (.0003) | | (.0003) | (.0002) | (.0003) | (.0002) | (.0008) | (.0002) |
| d07 | .0076*** | .0084*** | .0084*** | .0089*** | .0085*** | .0086*** | .0082*** | .0082*** | .0040** | .0100*** |
| | (.0005) | (.0004) | (.0004) | (.0009) | (.0006) | (.0006) | (.0003) | (.0005) | (.0011) | (.0007) |
| treat1×d07 | .0040*** | .0003 | .0005 | .0022*** | .0002 | .0003 | .0009** | .0009* | .0011 | .0004 |
| | (.0003) | (.0003) | (.0003) | (.0005) | (.0004) | (.0004) | (.0004) | (.0004) | (.0011) | (.0005) |
| treat2×d07 | .0053*** | .0004 | .0002 | -.0012 | -.0001 | -.0002 | .0002* | -.0001 | -.0003 | .0000 |
| | (.0006) | (.0005) | (.0006) | (.0007) | (.0003) | (.0004) | (.0006) | (.0004) | (.0011) | .0004) |
| Placebo | | | | | | | | | | |
| d06 | .0016* | .0023** | -.0025*** | .0016* | .0021** | -.0025*** | -.0024*** | -.0024*** | -.0059*** | -.0012 |
| | (.0007) | (.0007) | (.0005) | (.0007) | (.0007) | (.0005) | (.0002) | (.0002) | (.0007) | (.0007) |
| treat1×d06 | .0019*** | -.0004 | -.0006 | .0019*** | .0002 | -.0005 | -.0011*** | -.0010*** | -.0007 | -.0006 |
| | (.0003) | (.0008) | (.0005) | (.0003) | (.0006) | (.0004) | (.0003) | (.0003) | (.0007) | (.0005) |
| treat2×d06 | .0021*** | -.0016 | -.0012 | .0021*** | .0002 | -.0011 | -.0007 | -.0006 | .0009 | .0016 |
| | (.0006) | (.0013) | (.0011) | (.0006) | (.0007) | (.0009) | (.0006) | (.0005) | (.0009) | (.0011) |
| Distance | Crowfly | Crowfly | Crowfly | Routes | Routes | Routes | Crowfly | Routes | Routes | Routes |
| Ind. FE | Yes | No | No | Yes | No | No | No | No | No | No |
| Firm FE | No | No | Yes | No | No | Yes | Yes | Yes | Yes | Yes |
| $N_{2007}$ | 8.67 mio | 6.93 mio | 6.93 mio | 8.67 mio | 6.93 mio | 6.93 mio | 4.21 mio | 4.21 mio | 423,770 | 4.57 mio |
| $N_{2006}$ | 5.20 mio | 3.47 mio | 3.47 mio | 5.20 mio | 3.47 mio | 3.47 mio | 2.10 mio | 2.10 mio | 315,880 | 2.28 mio |
| # groups | 1.73 mio | - | 443,510 | 1.73 mio | - | 443,510 | 352,188 | 352,188 | 48,287 | 297,106 |

## 5. The Distribution of Benefits Across Worker Groups

### *5.1. Empirical Design*

We begin by examining the distribution of tax breaks and tax savings across wage groups. To do so, we use the same sample as in section 4.1, which consists of individuals with stable full time employment and stable residence. As before, we truncate commuting distances at an upper threshold of 200km. To analyze distributional effects, we compute bins of gross wages from 5000 Euro to > 57,000 Euro in steps of 2,000 Euro. For each of these bins we compute the mean of subsidies and tax savings.[20] For each bin with $n$ individuals, the mean is calculated as $\frac{1}{n}\sum_i^n subsidy_i$. A complete list of numbers of observations per year can be found in table .9 in the Appendix. Figure .10 illustrates the number of observations per bin. We plot these means against the gross wage bins in order to investigate the distribution of subsidies and tax savings before and after the policy reform.

To deepen the insight from the graphical descriptions, we apply inequality measures to quantify the distributional effects across all workers. In addition to the effects on overall income inequality we are interested if a change in commuting policy affects the distribution of tax savings differently for groups with different geographic characteristics. In the context of commuting characteristics in Germany we expect some differences for East and West Germany as well as for rural and non-rural (i.e. urban) areas. Therefore we subdivide the sample in East/West and ruaral/urban and calculate separate inequality measures for each subgroup. In principle several inequality measures exist and discrimination between them is not easy. However, when mutually exclusive and exhaustive subgroups are considers as is the case in our analysis the Theil index has some useful properties which allow us to further decompose the overall inequality measure into a "within-" and a "between"-component. This gives us an idea of how much of the overall inequality is due to inequality within the groups (within component) and how much is due to inequality between the groups (between component). It can be shown that for this type of analysis the Theil index is superior to other inequality measures as for example the Gini coefficient, see e.g. Morduch and Sicular (2002). The Theil-T index, which belongs to the

[20] We display averages by bin rather than a scatterplot of individual data both for data privacy reasons, which does not allow us to compute graphics that make it possible to identify individuals, and for a better readability of the graphs.

generalized entropy family of inequality measures, is defined as follows:

$$T = \underbrace{\frac{1}{n}\sum_{i}^{n}\frac{y_i}{\bar{y}}\ln\left(\frac{y_i}{\bar{y}}\right)}_{\text{overall}} = \underbrace{\sum_{k}^{K}\left(\frac{y_k}{y}\right)T_k}_{\text{within}} + \underbrace{\sum_{k}^{K}\left(\frac{y_k}{y}\right)\ln\left(\frac{\bar{y}_k}{\bar{y}}\right)}_{\text{between}} \tag{3}$$

where $y_i$ is the outcome variable of interest (i.e. net income, tax savings etc.) for individual $i$, $y$ denotes the value of the outcome variable for all $n$ individuals and $\bar{y}$ is the respective mean value. The Theil index varies between 0 and $\infty$ where a value of 0 describes a totally equal distribution and a higher value indicates a larger inequality. The index can be further decomposed when subgroups are considered, see Shorrocks (1980). This can be inspected on the righthand side of equation (3). The within part is a weighted sum of the subgroup Theil indices $T_k$, where $k$ is a specific subgroup of the $K$ groups considered. The relative income of subgroup $k$ is used as a weight, respectively. The between component is again a weighted sum, whereas now the log of the relation of subgroup mean level to the overall mean is considered. The properties of the log function assure that whenever the subgroup mean is equal to the overall mean the respective term vanishes from the between inequality expression.

The typical outcome variable in the inequality literature is income. We therefore use net wages to measure the differences in inequality before and after the policy reform. As net wage distributions are mainly driven by cyclical patterns, we apply a counterfactual exercise to isolate the reform's effect from trends. To do so, we compute counterfactual net wages: first, we compute net wages for 2007 and 2008 with the regime pre-reform. Second, we compute the net wages before the reform (2004-2006) with the scheme after the reform[21]. We then calculate Theil and Gini indices and plot both the real and the counterfactual indices to compare the effect of a trend with that of the reform.[22]

### *5.2. Results*

Figure 3 shows the mean of absolute commuting tax breaks and gross wages. We observe that in both years the subsidy increases in absolute terms with gross wages. Additionally, the absolute amount of subsidies increases at a faster rate with higher income, as the slope becomes steeper. This pattern can be explained by overall increasing commuting distances with increasing gross wages. We interpret the pattern of the distribution as higher incomes profiting more from commuting subsidies, at least in absolute terms.

The graphs show that the reform led to an overall reduction in subsidies. While

[21] I.e. people can deduct per km commuting only from distances greater than 35km onwards.

[22] Results for this part are still to come.

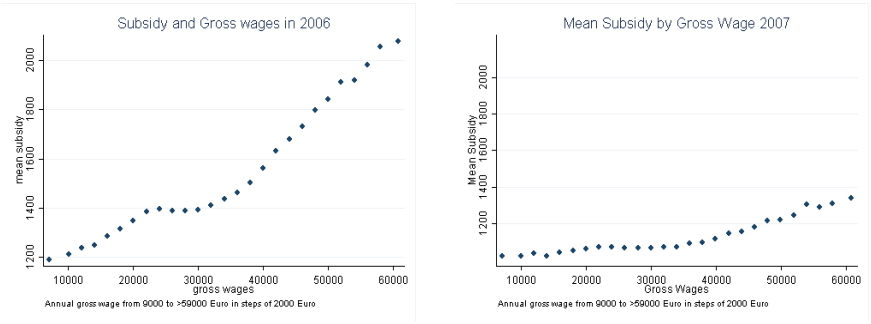


Figure 3: Commuting Subsidy and Gross Wages, 2006 and 2007 (absolute)

this absolute decrease is negligible for small incomes, it rises for higher income groups. For example, workers with a yearly gross wage of 31,000-33,000 Euro (this group includes the median income in both years) could deduct on average 1412 Euro from their taxable income in 2006, whereas the same income category could on average deduct only 1,067 Euro in the year after the reform.

In figure 4, we plot mean tax savings per bin and gross wage bins before and

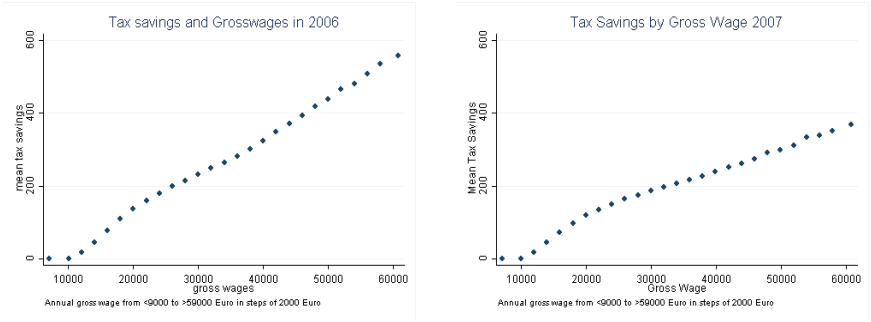


Figure 4: Tax Savings from Commuting Subsidy and Gross Wages, 2006 and 2007 (absolute)

after the reform. Again we see that higher earnings categories profit more from commuting subsidies, as they are characterized by longer commuting distances as well as higher tax rates as a result of progressive taxation. For incomes below 20,000 Euro annually, tax savings remain virtually unchanged. In contrast, the decrease for higher income groups is more obvious, such that highest income groups save less than 400 Euro annually whereas their savings from commuting subsidies measured almost 600 Euro before the reform.

To put these numbers and patterns into perspective, we now turn to the size of subsidies and tax savings relative to gross wages. Relative numbers are calculated as $subsidy/grosswage$ and $taxsavings/grosswage$, respectively. Figure 5 shows that the subsidy is highest relative to annual gross wages for low income groups. The relative subsidy decreases with growing income and amounts

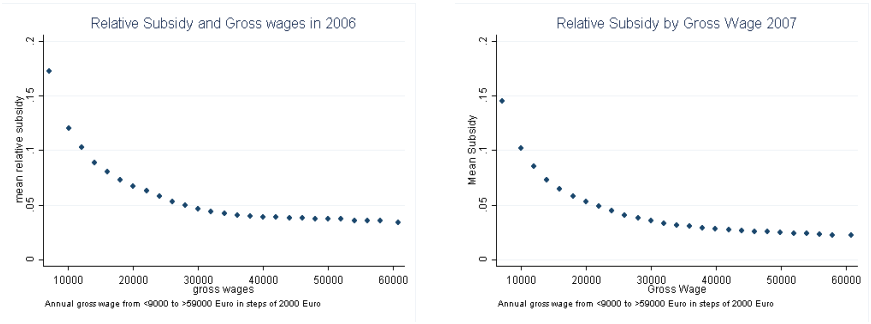


Figure 5: Relative Commuting Subsidy and Gross Wages, 2006 and 2007

to 3.4% of annual income in the highest income category in 2006 and 2.2% in 2007. For lower incomes, the change is even more substantial. Within the lowest threshold category between 9,000 and 11,000 Euro, i.e. the lowest earnings category where commuting subsidies can actually be claimed the size of the subsd fell from 12% to 10%.

More interestingly, figure 7 shows tax savings relative to gross wages in 2006

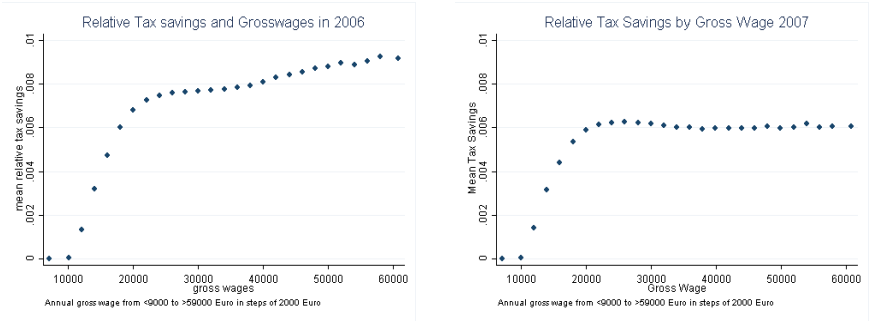


Figure 6: Relative Tax Savings from Commuting Subsidy and Gross Wages, 2006 and 2007

and 2007. It is obvious that relative to their income, lower income groups profit least from commuting subsidies and can save only less than 0.2% of their annual gross wages through the policy in both years. At the same time, relative tax savings increase monotonically (albeit slowly) for higher income groups in 2006. In 2007, in contrast, they start to become flat from medium income groups onwards. In addition, the scale decreased for all medium and high income groups by about 0.4 percentage points. It has to be noted that for all groups, the average relative savings that are induced by commuting subsidies are rather small. The graphs in figure 7 suggest that the policy reform in 2007 actually led to a more equal income redistribution as effects of the progression are reduced by the policy reform. The left panel in figure 7 illustrates how the relative loss in subsidies increases with income. The relative change in subsidy is calculated as

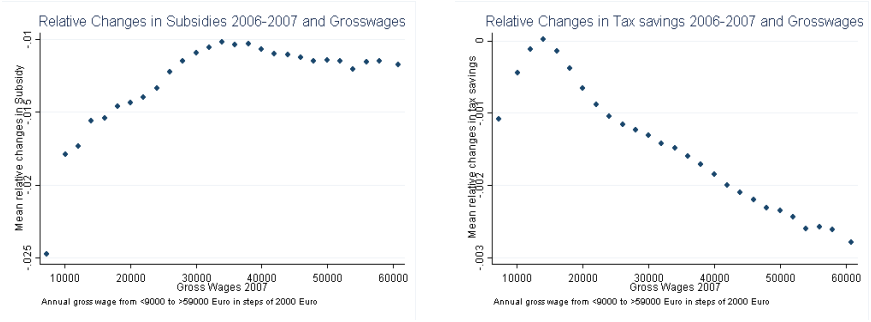


Figure 7: Relative Tax Savings from Commuting Subsidy and Gross Wages, 2006 and 2007

$\frac{1}{n}\sum_i^n \frac{\Delta subsidy_i}{grosswage_i}$ for $n$ individuals in an income category. The figure shows that this relative change flattens out for higher medium incomes at losses of about 1%. Relative changes are highest for low incomes (4.7%), which reinforces the interpretation of commuting subsidies being most important for lower incomes. On the right hand side we see relative changes in tax savings and gross wages. Although changes are small for all income groups (between -0.3% and 0), the graph shows that higher incomes lose relatively more than lower incomes, as the distribution is downward sloping. This pattern suggests that the reform actually served as a redistribution from higher to lower incomes, as higher incomes lost relatively more while lower incomes were mostly unaffected. As we can measure only reductions from taxable income due to commuting but have no data on other income related expenses, especially tax savings for higher income classes are only a lower bound. As mentioned in section 2, apart from commuting costs workers can also deduct expenses for home offices or costs for double housekeeping etc. These expenses are more likely to arise for workers of higher income classes. As Destatis (2012) show, commuting costs as "income related expenses" are most important for higher middle incomes (30,000-40,000 Euro annually), while especially top earner make little use of this sort of tax break. Therefore it is likely that the distributional effects are even larger than measured in this analysis.

Overall, we observe that in 2006 lower incomes are disadvantaged by commuting subsidies compared to higher income groups. As after the Federal Constitutional Court's verdict in December 2008, the law was reinforced to the state as in 2006 and has not changed ever since, the legislative is equivalent to today's commuting subsidy law. As our analysis shows, the regime prevailing in in 2007/2008 led to distributional effects which disadvantaged higher incomes while leaving lower incomes relatively unaffected. As such, from an equity perspective, the policy from 2007 and 2008 seems to be preferable to the regime before and after. Together with about 2.5 billions Euro of additional tax revenues per year

(Donges et al., 2008), it seems that the reform was maybe a superior regime after all.

Having analyzed the distributional effects of different commuting policies in general, we next look at the distributional consequences for different geographical groups using Theils' inequality measure. Table 5 shows the Theil index values for the whole sample $T$ as well as for the relevant groups $T_k$. The values are compared before and after the implementation of the partial abolishment of commuting subsidies in January 2007. First it can be stated that the new policy has led to a more equal distribution of tax savings in all subgroups as well as in the overall sample, which is indicated by a decrease in the Theil index. Second, tax savings are more unequal distributed in East Germany compared to West as well as in rural compared to urban areas for both years. This can be motivated because in the eastern part there is a larger share of long-way commuters compared to west (see e.g. Redding and Sturm (2008)) and in urban areas the share of long-way commuters is in general negligible, see Winkelmann (2010). Third, the effect of the reform on equity is relative stronger in West and in urban areas.

Table 5: Evolution of Theil-T index of tax savings for different geographic groups

| | 2006 | 2007 | $\Delta$ |
|---|---|---|---|
| $T$ | 0.3365 | 0.2143 | -0.122 |
| $T_{East}$ | 0.3917 | 0.2955 | -0.0962 |
| $T_{West}$ | 0.3237 | 0.1973 | -0.1264 |
| $T_{Rural}$ | 0.3470 | 0.2267 | -0.1203 |
| $T_{Urban}$ | 0.2937 | 0.1789 | -0.1148 |

In table 6 we decompose the overall Theil index into a within and between component. It can be seen that the major part of the inequality is captured by the within component. The between part contributes with less than one per cent to overall inequality in both categories considered, indicating that although there are differences considering inequality in each subgroup, as is visible in table 5, the mean tax savings are quite similar in the subgroups. Furthermore, in the rural/urban comparison the between component, which was considerable low before the reform nearly vanished after the reform was imposed.

Table 6: Decomposition of Theil-T Index of Tax Savings

| | 2006 | Rel. Contribution | 2007 | Rel. Contribution |
|---|---|---|---|---|
| Overall | 0.3365 | | 0.2143 | |
| Within (East/West) | 0.3338 | 0.99 | 0.2125 | 0.99 |
| Between (East/West) | 0.0027 | 0.01 | 0.0018 | 0.01 |
| Within (rural/urban) | 0.3340 | 0.99 | 0.2141 | 0.99 |
| Between (rural/urban) | 0.0025 | 0.01 | 0.0002 | 0.01 |

## 6. Discussion

In this paper we discuss two dimensions of distributional effects of commuting subsidies. Drawing on a large-scale policy reform in Germany, we estimate gross wage compensations in a difference-in-differences approach. We find no evidence for gross wage adjustments as a result of the reform, which supports the notion that commuting costs are mainly paid for by workers. In the second part of the paper we have therefore turned to the question how the benefits of commuting subsidies are distributed across workers of different wage groups and who in the workforce carried the burden of the reform. Our analysis shows that the repeal of commuting subsidies negatively affects mainly workers with a higher income whereas lower incomes remain relatively unaffected.

As there has not been a reform of commuting subsidies ever since, politicians should reconsider the legal distinction of short and long distance commuting for subsidies again, as it is used e.g. in Sweden, Norway, and Austria. Furthermore, giving incentives to use public transportation instead of using automobiles could additionally have a positive effect on environmental protection. Although the latter aspect is not discussed in this paper, future research should make use of the new geocoded data sets to gain insight on environmental effects of commuting subsidy policies.

## References


Bach, Stefan (2003) "Entfernungspauschale: Kürzung gerechtfertigt."

Bach, Stefan, Jutta Kloas, and Hartmut Kuhfeld (2007) "Wem nützt die Entfernungspauschale?," *Informationen zur Raumentwicklung*, Vol. 2, No. 3, pp. 201–209.

Baldry, Jonathan C. (1998) "Income tax deductions for work-related expenses: The rationale examined," *Australian Economic Papers*, Vol. 37, No. 1, pp. 45–57.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan (2004) "How much should we trust Difference-in-Differences estimates?," *Quarterly Journal of Economics*, Vol. 1, No. February, pp. 249–275.

Boehm, Michael J. (2013) "Concentration Versus Re-Matching? Evidence About the Locational Effects of Commuting Costs."

Borck, Rainald and Matthias Wrede (2009) "Subsidies for intracity and intercity commuting," *Journal of Urban Economics*, Vol. 66, No. 1, pp. 25–32.

Bundesministerium der Finanzen (2010) "Antwort des deutschen Bundestags auf die kleine Anfrage (17/2546) der Bundestagsfraktion Bündnis 90/ Die Grünen."

——— (2014) "Datensammlung zur Steuerpolitik."

Destatis, Statistisches Bundesamt (2012) "Finanzen und Steuern - Jährliche Einkommenssteuerstatistik."

——— (2013) "Verdienste und Arbeitskosten Tarifbindung in Deutschland."

Deutscher Bundestag (2006) "Entwurf eines Steueränderungsgesetzes 2007."

Donges, Juergen, Johann Eekhoff, Wolfgang Franz, and Clemens Fuest (2008) "Gegen die Neubelebung der Entfernungspauschale."

Dustmann, Christian, Bernd Fitzenberger, Uta Schönberg, and Alexandra Spitz-Oener (2014) "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy," *Journal of Economic Perspectives*, Vol. 28, No. 1, pp. 167–188.

Gunselmann, Isabelle (2014) "Programmierbeispiele zur Umrechnung des Brutto- in ein Netto-Tagesentgelt für administrative Daten des FDZ," *FDZ Methodenreport*, No. 1, pp. 1–31.

Monte, Ferdinando, Stephen J. Redding, and Esteban Rossi-Hansberg (2015) "Commuting , Migration and Local Employment Elasticities."

Morduch, Jonathan and Terry Sicular (2002) "Rethinking inequality decomposition, with evidence from rural China," *Economic Journal*, Vol. 112, No. 476, pp. 93–106.

Mulalic, Ismir, Jos N. Van Ommeren, and Ninette Pilegaard (2013) "Wages and Commuting: Quasi-natural Experiments' Evidence from Firms that Relocate," *The Economic Journal*, Vol. 124, pp. 1086–1105.

Redding, Stephen J. and Daniel M. Sturm (2008) "The Costs of Remoteness : Evidence from German Division and Reuni fi cation," *American Economic Review*, Vol. 98, No. 5, pp. 1766–1797.

Reichert, Adrian (2014) "Nettoeinkommen in Deutschland," *FDZ Methodenreport*, Vol. 13.

Richter, Wolfram F., Peter Bareis, Matthias Wrede, and Martin Gasche (2004) "Ist die Abschaffung der Entfernungspauschale ökonomisch sinnvoll?," *ifo Schnelldienst*, Vol. 57, No. 5, pp. 5–19.

Scholz, Theresa, Jörg Reiher, Cerstin Rauscher, and Tobias Bachteler (2012) "Geocoding of German Administrative Data Geocoding of German Administrative Data The Case of the Institute for Employment Research,"Technical report, Research Data Centre of the German Federal Employment Agency at the Institute for Employment Research, Nuremberg.

Shorrocks, A. F. (1980) "The Class of Additively Decomposable Inequality Measures," *Econometrica*, Vol. 48, No. 3, pp. 613–625.

Sinn, Hans-Werner (2003) "Hände weg von der Entfernungs- Pauschale!," *ifo Standpunkt*, No. 48.

Weiss, Martin (2009) "How do Germans React to the Commuting Allowance?,"Technical report, Arbeitskreis Quantitative Steuerlehre.

Winkelmann, Ulrike (2010) ",,Manche pendeln weit" – Berufspendler im Bundesländervergleich," *Statistisches Monatsheft Baden-Württemberg*, Vol. 4, pp. 121–124.

## Appendix

Table .7: Overview on Changes in Tax Breaks for Commuting

| | |
|---|---|
| 2004 - 2006 | Deduction of 0.30 Euro per km for one-way commute; Commuting distances up to 15km fall within a lump-sum tax deduction |
| 2007 - 2008 | Deduction of 0.30 Euro per km for one-way commute only for distances further than 20km; de facto all commuting distances <35km fall within the lump-sum deduction |
| from 2009 on | Regime as from 2004-2006 |

Figure .8: Procedure of Deriving Net Wages from Gross Wages

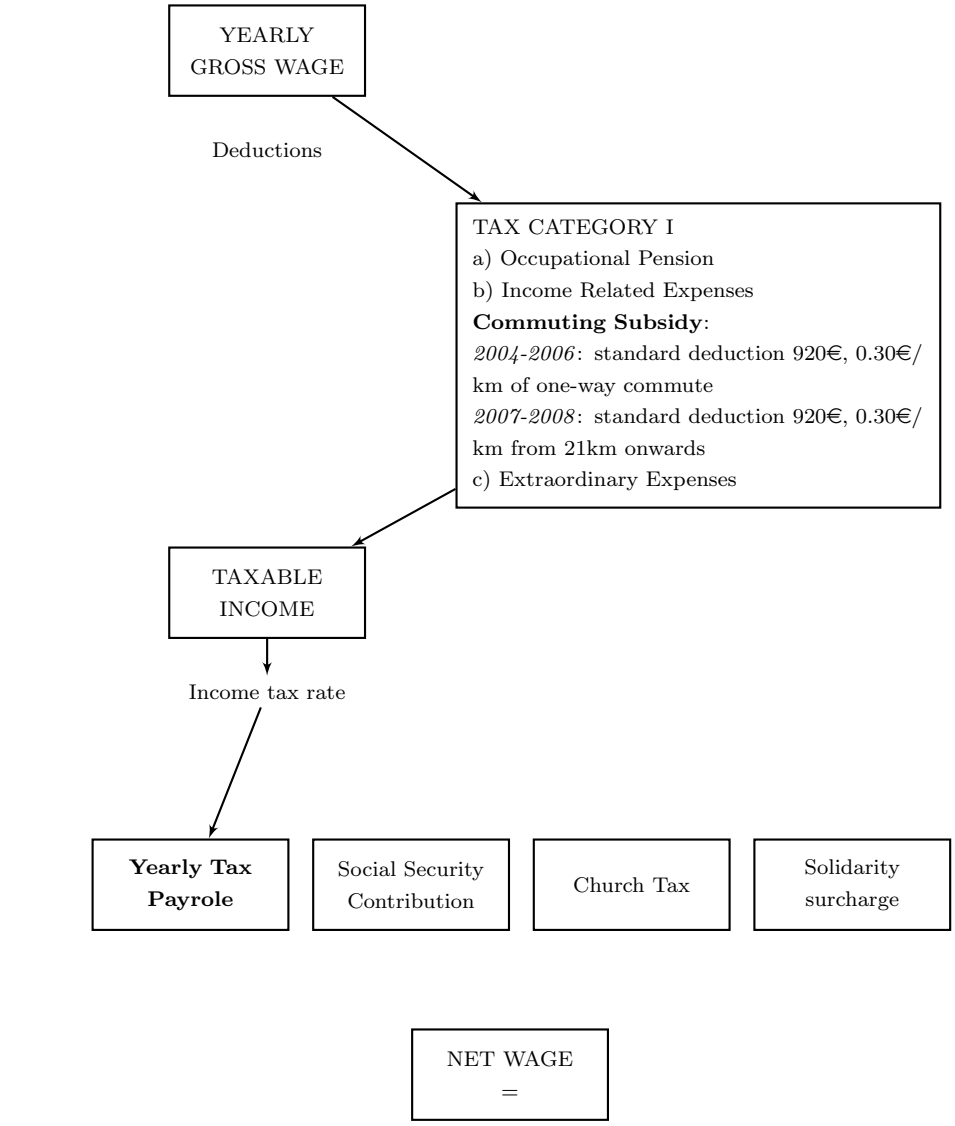
YEARLY
GROSS WAGE
Deductions
TAX CATEGORY I
a) Occupational Pension
b) Income Related Expenses
**Commuting Subsidy**:
*2004-2006*: standard deduction 920€, 0.30€/ km of one-way commute
*2007-2008*: standard deduction 920€, 0.30€/ km from 21km onwards
c) Extraordinary Expenses
TAXABLE
INCOME
Income tax rate
**Yearly Tax Payrole**
Social Security Contribution
Church Tax
Solidarity surcharge
NET WAGE
=
Taxable Income - Tax Payrole - Social Security Contribution - Church Tax - Solidarity Surcharge

Table .8: Sample Attrition

| Sample | Deleted | Observations |
|---|---|---|
| Full sample | | 71,201,183 |
| Employed only | 9,462,808 | 61,738,375 |
| Commuting distance <200km | 13,796,352 | 47,942,023 |
| Only 2004-2009 | 19,832,259 | 28,109,764 |
| Stable residence (community) | 600,646 | 27,509,118 |
| Stable workplace (establishment) | 2,658,280 | 24,850,838 |
| Stable workplace (community) | 608,892 | 24,850,838 |
| Balanced Panel | 11,006,526 | 13,235,420 |
| Fulltime employment | 3,973,384 | 9,262,036 |
| < assessment ceiling | 480,150 | 8,781,886 |
| > marginal employment | 112,906 | 8,668,980 |
| Final sample | | 8,668,980 |

Table .9: Annual Gross Wage Categories, in Euro

| Gross Wage Category | 2006 | share 2006 | 2007 | share 2007 |
|---|---|---|---|---|
| ≤ 9,000 | 18,208 | 1.05% | 16,981 | 0.98% |
| 9,000-11,000 | 17,380 | 1.00% | 16,719 | 0.96% |
| 11,000-13,000 | 25,485 | 1.47% | 23,876 | 1.38% |
| 13,000-15,000 | 33,558 | 1.95% | 31,486 | 1.82% |
| 15,000-17,000 | 45,895 | 2.65% | 42,661 | 2.46% |
| 17,000-19,000 | 55,804 | 3.22% | 52,320 | 3.02% |
| 19,000-21,000 | 64,301 | 3.71% | 60,439 | 3.49% |
| 21,000-23,000 | 76,343 | 4.40% | 71,016 | 4.10% |
| 23,000-25,000 | 91,798 | 5.29% | 84,918 | 4.90% |
| 25,000-27,000 | 114,631 | 6.61% | 105,921 | 6.11% |
| 27,000-29,000 | 128,875 | 7.43% | 121,991 | 7.04% |
| 29,000-31,000 | 138,216 | 7.97% | 131,931 | 7.61% |
| 31,000-33,000 | 134,601 | 7.76% | 130,908 | 7.55% |
| 33,000-35,000 | 124,900 | 7.20% | 123,854 | 7.14% |
| 35,000-37,000 | 110,185 | 6.36% | 112,070 | 6.49% |
| 37,000-39,000 | 92,069 | 5.31% | 96,361 | 5.56% |
| 39,000-41,000 | 77,860 | 4.49% | 81,681 | 4.71% |
| 41,000-43,000 | 69,718 | 4.02% | 72,458 | 4.18% |
| 43,000-45,000 | 58,454 | 3.37% | 62,129 | 3.58% |
| 45,000-47,000 | 50,762 | 2.93% | 52,646 | 3.04% |
| 47,000-49,000 | 43,671 | 2.52% | 46,405 | 2.68% |
| 49,000-51,000 | 36,377 | 2.10% | 39,034 | 2.25% |
| 51,000-53,000 | 31,954 | 1.84% | 34,753 | 2.00% |
| 53,000-55,000 | 24,865 | 1.43% | 29,809 | 1.72% |
| 55,000-57,000 | 21,711 | 1.25% | 25,239 | 1.46% |
| 57,000-59,000 | 18,165 | 1.05% | 22,444 | 1.29% |
| >59,000 | 28,010 | 1.62% | 43,746 | 2.52% |
| Total | 1.73 Mio | 100% | 1.73 Mio | 100% |

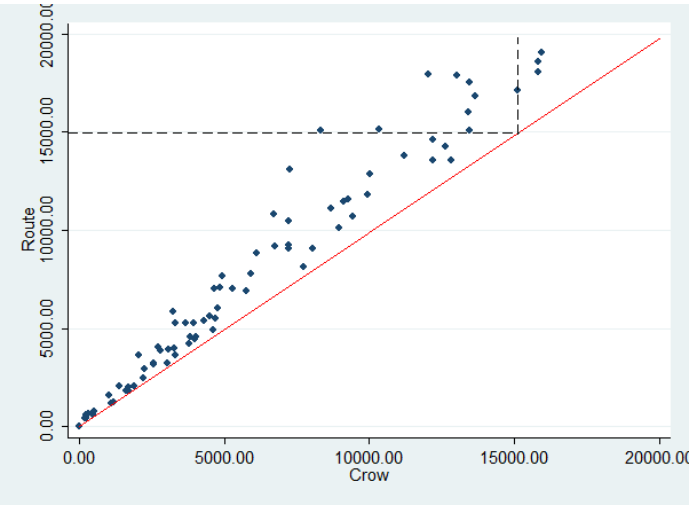


Figure .9: Crow-fly vs. Route Distances

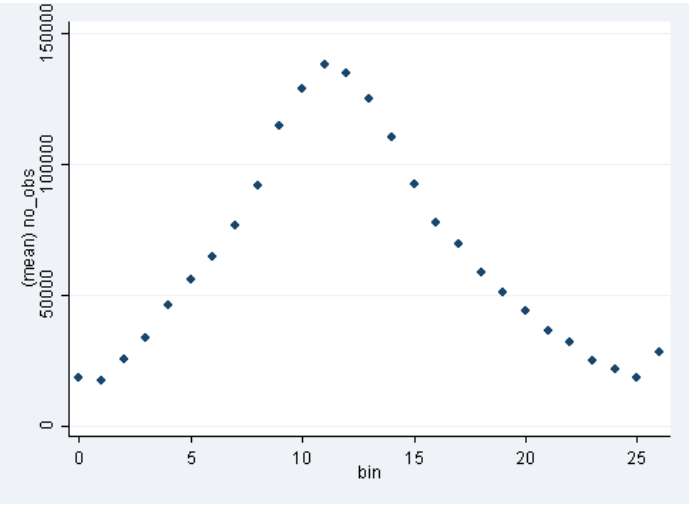


Figure .10: Gross Wage Categories, 2006