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STUDY PAPER No. 62

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*Address:*

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Soelvgade 10, 2.tv.

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Telephone +45 33 34 48 00

Fax +45 33 34 48 99

E-mail [forskningsenheden@rff.dk](mailto:forskningsenheden@rff.dk)

Home page [www.rff.dk](http://www.rff.dk)

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# Tax Reforms and Intertemporal Shifting of Wage Income: Evidence from Danish Monthly Payroll Records\*

CLAUS THUSTRUP KREINER  
UNIVERSITY OF COPENHAGEN AND CEPR

SØREN LETH-PETERSEN  
UNIVERSITY OF COPENHAGEN

PEER EBBESEN SKOV  
THE ROCKWOOL FOUNDATION RESEARCH UNIT AND UNIVERSITY OF  
COPENHAGEN

## *Abstract*

*Intertemporal shifting of wage income takes place when income earned in one tax year is paid out in another tax year in order to save taxes. Shifting has implications for the evaluation of the distortionary and distributional effects of taxes and may cause serious bias in empirical estimates of the elasticity of taxable income (ETI) for use in policy analysis. Based on new monthly payroll records for the universe of Danish employees we provide evidence of widespread intertemporal shifting of wage income in response to a tax reform that significantly reduced the marginal tax rates for 1/4 of all employees. Ignoring shifting, we estimate the overall ETI to be 0.1 and find that the ETI is increasing in the earnings level. After controlling for shifting, we obtain negligible ETI estimates at all earnings levels. We show that shifting is concentrated on few individuals spread out evenly across industry sectors, and we provide evidence suggesting that tax salience, liquidity constraints and firm willingness to cooperate in shifting are important factors in explaining shifting behavior.*

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## I. Introduction

This paper provides clear empirical evidence of large, widespread intertemporal shifting responses in wage income. Intertemporal shifting of wage income takes place when income earned in one tax year is paid out in another tax year so as to reduce the tax payment of the individual. The incentive to do so is present whenever marginal tax rates vary over time, for example because of changes in individual circumstances (retirement, marriage, promotion etc.), because of sunset provisions that automatically change marginal tax rates at some specified future date, or because of reforms that change the tax system from one year to the next year.<sup>1</sup> Knowledge of intertemporal shifting behavior is therefore relevant for evaluating the revenue implications of tax reforms and the efficiency loss and distributional impact of the tax system.<sup>2</sup> It is also relevant for the burgeoning literature, pioneered by Feldstein (1995) and recently surveyed by Saez, Slemrod and Giertz (2012), exploiting tax reforms to identify the elasticity of taxable income (ETI) that is used to quantify the distortionary effects from taxation. It is well-known that the estimates of the underlying structural elasticity may be upward biased because of short-run income shifting responses around the implementation of the tax reforms (Slemrod, 1998; Goolsbee, 2000; Saez, Slemrod and Giertz, 2012).

Our empirical analysis is based on new Danish administrative records with monthly information about wages and salaries that allow us to identify high frequency movements in wage income in a way not possible with data measured at the annual frequency. The monthly records cover all employees and have been third-party reported by employers to the tax authorities since

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<sup>1</sup> A recent example of a sunset provision is the American Economic Growth and Tax Relief Reconciliation Act of 2001 that lowered the top marginal tax rate from 39.6 percent to 35 percent but introduced a clause stating that the tax cut would expire by 2011. After a two year extension of the tax cut in 2010, the American Taxpayer Relief Act of 2012 returned the top marginal tax rate to its 2001 level of 39.6 percent. The Congressional Budget Office (2013) projects that 2013 tax revenue decreases because of shifting of income from calendar year 2013 into late 2012 in anticipation of the higher 2013 tax rate.

<sup>2</sup> For example, standard optimal tax theories call for age-dependency in tax rates (Banks and Diamond, 2011), while the possibility of shifting, *ceteris paribus*, calls for constant marginal tax rates over the life cycle. Evaluation of tax reforms normally focuses entirely on the long run, structural effects. However, often a tax reform is replaced by a new reform a few years later, implying that income shifting effects may be non-trivial in the long run. For example, the Danish 2010 tax reform studied in this paper was the sixth tax reform within a period of 25 years and seven reforms were implemented in the United States in the 25 year period from 1980 to 2005.

the creation of the register in January 2008. The identifying variation is provided by a large tax reform in Denmark, which reduced the highest marginal tax rate on earnings from 63 percent to 56 percent, thereby significantly changing economic incentives for the 1/4 of full-time employees with the highest incomes. The reform was announced in March 2009 and changed the tax scheme for income earned from 2010 and onwards, thereby creating an incentive for high-wage earners to shift earnings from the end of 2009 to the beginning of 2010. Shifting of income, however, required the cooperation of the employer, who is reporting earnings to the tax authorities. It was possible to shift up to five months of earnings from 2009 to 2010 without coming into conflict with the tax law, and the income shifting studied here is therefore a classic example of tax avoidance (for a discussion of the distinction between avoidance and evasion see Slemrod and Yitzhaki, 2002).

We start our analysis by providing simple graphical evidence revealing income shifting taking place around the implementation of the tax reform. By computing the differences between post-announcement and pre-announcement monthly reported earnings, we observe a clear negative spike in the last months of 2009, followed by a positive spike in the beginning of 2010, when comparing the group of high-income individuals (treatment group) to a group of middle-income individuals with only negligible changes in incentives (control group). We detect no systematic effects in other months, including December 2010/January 2011, confirming that the observed pattern is driven by income shifting. We obtain the same overall picture across all industry sectors also after controlling for a large number of covariates, which shows that shifting behavior is a widespread phenomenon.

The spike around New Year 2010 is difficult to reconcile with models of real behavior, suggesting that the observed movement in income is due to tax avoidance rather than real responses (Slemrod, 1995). Considering all the individuals with an incentive to shift income, we find that the average level of reported wage income is nearly 10 percent higher in January 2010 and correspondingly lower in November and December of 2009, revealing rather large shifting effects even at the macro level. The share of income shifted is steadily increasing with the income level. On average, individuals in percentiles 95-99 shifted 15 percent of the average monthly wage income around New Year 2010 and for the top 1 percent of wage earners close to 30 percent was shifted.

When we run a simple difference-in-difference estimation on annual earnings before and after the reform, we find an overall ETI of around 0.1. The estimated ETI is increasing as a function of income from 0 for individuals with the lowest income levels within the treatment group to 0.25 for the taxpayers in the top one percent of the income distribution. We show in different ways, for example by excluding December and January observations, that these ETI estimates are almost entirely due to income shifting responses and that the 'structural' elasticity---after removing the shifting component---is close to zero throughout the treatment group. The aggregate shifting response masks substantial heterogeneity. Among the employees with an incentive to shift income, we find that less than 5 percent engage in shifting activity but that these individuals shift large amounts. Given that it was not illegal to shift income, it would be natural to expect that more people would exploit the opportunity to shift income and save taxes. This indicates that some types of optimizing frictions are crucial for our observed shifting behavior, in line with the conclusions in Chetty, Friedman, Olsen and Pistaferri (2011) and in Chetty (2012) that frictions are important for understanding income and labor supply responses to taxation.

Because our data covers the universe of employees and may be linked to socio-economic variables of the employees as well as background information of the firm, we are able to shed further light on the anatomy of shifting behavior and the underlying frictions. First, we find that shifting is negligible among government employees, is more common in small private firms than in large firms, and that shifting is much more common among the top-five earners within a firm. We speculate that this is because some employers are less willing to participate in tax avoidance due to the risk of bad publicity, which limits income shifting to small/medium sized private firms and top management. Second, some taxpayers may not have sufficient savings, or access to credit, to maintain living expenses during the period where income is shifted forward. Consistent with this explanation, we find that shifting is more pronounced for individuals with large amounts of liquid assets in proportion to income before the reform. Third, taxpayers may not be fully aware of the option and gains from income shifting. Indeed, recent empirical evidence shows that taxpayer information and salience of the tax code are important for the understanding of behavioral responses to taxation (Chetty, Loony and Kroft, 2009; Chetty, Friedman and Saez, 2013). In order to study the degree of information/inattention among workers, we conducted a telephone survey of a randomly selected group of individuals in the working-age population and

linked it to our register data. The survey responses reveal that few taxpayers are aware of the tax incentive and know that it is legal to shift their wage payments. Individuals in the treatment group are more informed, showing that those who have an incentive to shift income are also more aware of the possibility, but even for this group only 1 out of 5 is fully informed. Our results further indicate that the shifting activity is concentrated among those who are informed in the treatment group, but on the other hand, that less than 10 percent of these informed individuals actually engage in shifting.

To summarize this part of our analysis, the results do not point to a single type of friction that prevents taxpayers from exploiting the incentive to shift income but rather to several types of frictions that complement each other in explaining why some employees engage in shifting activities while others do not.

Danish tax return records have recently been used to provide some of the most compelling evidence of behavioral effects of taxation with respect to income responses, labor supply behavior and tax evasion (Chetty, Friedman, Olsen and Pistaferri, 2011; Kleven, Knudsen, Kreiner, Pedersen and Saez, 2011; Kleven and Schultz, 2013; Kleven, Landais, Saez and Schultz, 2013). Our empirical results complement these findings by providing novel evidence of tax avoidance in the form of intertemporal shifting of wage income where existing knowledge is limited. Previous empirical analyses have detected strong intertemporal shifting effects in capital income due to retiming of capital gains (Auerbach, 1988), in self-employment income due to retained earnings schemes (le Marie and Schjerning, 2013) and in taxable income of executives due to timing in the realization of stock options (Goolsbee, 2000).

The study by Goolsbee looked at the five highest-paid employees in US public companies, giving a dataset of the annual income of 6,133 top executives, and their responses to the marginal tax rate increase implemented in 1993 by President Clinton. Goolsbee found little responsiveness of salary and bonuses to the tax hike. This is in contrast to Sammartino and Weiner (1997) who found evidence in aggregate data of time-adjustments in bonuses due to the 1993 US tax reform. A reason for this discrepancy may be that it is easier and more valuable for top executives to change the timing of the realization of stock options rather than bonuses, while other high-income individuals, who do not have stock options, instead focus their effort on shifting bonuses and regular wage and salary payments. Our results provide some support to this conjecture as our income measure only includes wage income, implying that

the shifting behavior documented in our study is not related to the realization of stock options. We also show that income shifting behavior is not only a phenomenon confined to top earners in the biggest companies. Although the shifting effects are large for these individuals, they are few in number. If we exclude the top-five earners in companies with more than 100 employees from the analysis, then the results are practically unaffected, showing that income shifting is more widespread.

Section 2 describes the Danish 2010 tax reform and Section 3 describes the data sources. Section 4 describes our approach to identifying shifting behavior, Section 5 describes the degree of shifting across the income distribution, while Section 6 decomposes the short-run elasticity of taxable income into a temporary shifting component and a permanent, structural component. Section 7 provides a more detailed analysis of shifting behavior and the underlying explanatory factors. Finally, Section 8 concludes.

## **II. The Danish 2010 tax reform and the scope for intertemporal income shifting**

The 2010 tax reform was proposed on March 1st 2009, passed in the Danish parliament on May 28th the same year, and signed into law taking effect from January 1st 2010.<sup>3</sup> The time between the announcement date and the actual implementation of the tax reform gave taxpayers at least half a year to plan and carry out the movement of reported income from 2009 to 2010. The declared goal of the reform was to reduce taxation of labor income in order to stimulate labor supply. The tax cut on labor income was financed primarily by decreasing the value of deductions (including interest payments), reducing business subsidies and increasing energy and environmental taxes, thereby keeping the government revenue constant (before behavioral responses).

The reform mainly reduced marginal tax rates on labor income for high-wage earners. In the tax year 2009, high-wage earners with labor income (LI) above the top/middle tax income threshold of 377,000 Danish kroner (DKK) faced a marginal tax rate of around 63 percent comprising labor contributions (LC = 8% of LI), a regional tax (32.8% of LI-LC in the average municipality), a

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<sup>3</sup> It is the sixth tax reform in Denmark within the last 25 years, and it broadly follows the direction of the previous reforms, which have reduced tax rates and broadened tax bases; see e.g. Kleven and Schultz (2013) for more details about the Danish tax system and the previous reforms.

bottom tax (5.04% LI-LC), a middle tax (6% of LI-LC), a top tax (15% of LI-LC) and a church tax (0.7% of LI-LC on average).<sup>4</sup>

The tax reform removed the middle tax and reduced the bottom tax to 3.67 percent implying that the marginal tax rate for high-wage earners ( $\tau_H$ ) was reduced to 56 percent, equivalent to a reduction in the after-tax rate,  $1-\tau_H$ , of close to 20 percent. Individuals with income just below the top/middle tax cutoff did not pay the middle tax and the top tax, and therefore faced a marginal tax rate of 43.4 percent before the reform and 42.1 percent after the reform, corresponding to a reduction in the after-tax rate,  $1-\tau_L$ , of only 2 percent.<sup>5</sup>

The incentive to shift income was also influenced by a change in the top/middle tax income cutoff, which was increased from DKK 377,000 to DKK 424,000. Figure 1 shows how the economic incentive to shift one month's salary from 2009 to 2010 varies with the (average) monthly level of gross taxable earnings and salaries in 2009. The left panel shows the gain measured in DKK and the right panel shows the gain measured in proportion to the monthly after-tax income. For individuals with monthly income below DKK 32,000, the gain from shifting is very small (less than 1,000 DKK). It then increases with earnings due to the change in the top/middle tax cutoff, and for people with monthly earnings above DKK 35,000, the economic incentive is constant at 7 percent of the amount shifted (the slope in Panel A), giving a sizable economic gain corresponding to nearly 20 percent of the monthly after-tax income (see Panel B).

The aim of the Danish tax law on the payment of earnings and salaries is primarily to protect employees from being exploited by employers. According to the rules, companies have to remit taxes on labor income at the time income is paid out to the employees, and wages and salaries have to be paid out no later than 6 months after the income is earned. This implies that income earned after July 1st can be paid out to the employee in the following income year

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<sup>4</sup> With an exchange rate of 6 DKK per USD, the top/middle tax cutoff of DKK 377,000 corresponds to around USD 63,000.

<sup>5</sup> These computations of the marginal tax rates would apply to the majority of taxpayers. The top/middle tax cutoff depends also on the size of net capital income (excluding stock income) provided it is positive. However, the large majority of taxpayers have negative net capital income. Computations of marginal tax rates often involve complicated interactions between spouses (Immervoll et al., 2011). Denmark has an individual-based tax system with a few elements of jointness. For example, when computing the middle tax, it is possible to transfer unutilized allowances between spouses, implying that some married persons with income in a certain range pay the top tax but not the middle tax.

without workers or firms coming into conflict with the law. This gave workers an opportunity to save taxes legally by shifting income from 2009 to 2010, provided that employers would cooperate. Obviously, this type of behavior is not intended by the tax reform and the tax laws and is therefore an example of tax avoidance.

### **III. Data**

In the empirical analysis we use a new data resource that records wages and salaries at a monthly frequency for the universe of Danish taxpayers. It is based on an administrative register, known as the eIncome register, that contains the information reported by firms to the tax agency (SKAT) about the monthly wages and salaries of each employee. In the remainder of the paper we simply refer to wages and salaries as income, and we will not consider shifting of other types of income. The law behind the eIncome register was passed on May 2006, with the actual reporting obligation being gradually phased in from January 2007 to be fully effective from January 1st 2008, the date at which our data window starts. The increased reporting requirement was introduced to provide the Danish tax authorities with more detailed information about the incomes liable to taxes and to provide a unifying report that could be shared by all governmental bodies so as to reduce the overall administrative burdens of firms.

The eIncome register contains the personal registration number of the employee and a firm identifier, which enable us to link the data to various background information of the individual and of the firm from other administrative registers at Statistics Denmark. We also link the register data to a small survey sample containing information about taxpayer awareness of the shifting opportunity. These additional data sources are used in Section 7 where we explore the anatomy of shifting behavior in greater detail.

The high frequency of the income reporting offers a unique possibility for measuring the importance of intertemporal income shifting, which is expected to take place mainly around New Year. For example, employees and employers may decide to postpone payouts of earnings or bonuses from the end of the year to January. The monthly frequency of our data makes it possible to convincingly detect this shifting behavior.

The data set covers the entire Danish population from January 2008 to January 2011 and contains monthly information about some 3.7 million individuals over this period. Many of these are children and other people with irregular

earnings and temporary employment contracts. In Figure 2, we focus on individuals who are employed throughout 2008, corresponding to having a wage record for every month, and who have positive income in all the years 2008-2010. Panel A displays the development over time in the average monthly nominal income. The graph reveals systematic seasonal variation with high average wage income in April and December and low average wage income in the Winter and in the Fall. As a first indication of income shifting, note that income drops around the New Year in all years but that it drops less than usual in January 2010.

Panel B shows the distribution of the average monthly income in 2008. The median income level is approximately DKK 30,000, and around 1/4 of the full time employees have monthly earnings above DKK 35,000 and are therefore subject to a non-negligible incentive to shift income.

#### **IV. Empirical identification of shifting behavior**

In order to identify intertemporal shifting behavior, we focus our sample and employ standard difference-in-difference identification strategies where we compare the income path of workers with an incentive to shift income (treatment group) to those without an incentive (control group). Our strategy is based on allocating people to a tax bracket based on income in 2008, i.e. before the tax reform could have impacted their income. In order to be able to allocate the employees to a tax bracket that they are likely to naturally belong to throughout the period 2008-2010, we focus on individuals who are recorded as employed throughout 2008, as is also done in Figure 2. We define the treatment group (T-group) as the employees in the private sector with monthly earnings above DKK 35,000 in 2008, which is percentile 75 in Panel B of Figure 2, and define the control group (C-group) as the employees in the private sector with monthly income in the range DKK 30,000-35,000. We pick a relatively narrow income interval for people below the top-tax threshold in order to make the control group as comparable to the treatment group as possible.<sup>6</sup> This leaves us with 329,270 individuals out of which 219,598 belong to the treatment group.

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<sup>6</sup> The cut-off defining who is included in the control group is somewhat arbitrary. We have experimented with a range of cut-offs including a wider set of incomes, but that did not impact the estimates in any important way (results not reported). Of course including all individuals with income below the top-tax threshold would influence the results as the control group would then include people with low salaries and irregular wage payments.

Panel A of Figure 3 shows the average monthly wage income of the T-group and the C-group, respectively. For both groups seasonal variation resembling the pattern in Figure 2 is evident. More importantly, the graph uncovers important differences around New Year 2010 across the two groups. The income in December 2009 for the T-group is below the annual average of the group for 2009, and income increases from December 2009 to January 2010. This is in contrast to both the year before and the year after where the December income of the T-group is above the annual average, and where income decreases from December to January. The December 2009--January 2010 income pattern of the T-group is also in stark contrast to the pattern of the C-group where the December wage income level is clearly above the annual average and where the monthly income decreases from December to January. Moreover, this opposite pattern of the control group is observed across all three years. Overall, these observed income patterns are consistent with the T-group shifting income from 2009 to 2010 because of the 2010 tax reform.

To further identify the income shifting effect, we compute the percentage change in the monthly wage for each individual relative to year 2008 and compare T-group and C-group according to

$$(1) \quad x_{y,m} = \frac{1}{n^T} \sum_{i \in T} \frac{z_{y,m,i} - z_{2008,m,i}}{\bar{z}_{2008,m,i}} - \frac{1}{n^C} \sum_{i \in C} \frac{z_{y,m,i} - z_{2008,m,i}}{\bar{z}_{2008,m,i}},$$

where  $i$  denotes the individual,  $T$  denotes the treatment group,  $C$  denotes the control group,  $n$  denotes the number of individuals in each of the groups,  $y$  denotes the year,  $m$  denotes the month, and  $z_{2008,i}$  denotes the average monthly wage of individual  $i$  in 2008. We compute percentage changes instead of using a log-transformation because earnings may be zero or close to zero in some months, for example due to income shifting. Panel B of Figure 3 shows the estimates of  $x_{y,m}$  over the time period. By definition, it is zero in each month of 2008. In 2009 it fluctuates a little around zero but then drops down in November and December of 2009 before the implementation of the tax reform. It then increases sharply just after implementation of the reform, and finally drops down to a lower level in the remaining months. The wage income of the T-group is 3 percent and 5 percent below the control group level in the two months before the reform, and 9 percent above in January 2010. Note also that no effects are observed around New Year 2011, consistent with the interpretation that the response observed around New Year 2010 is indeed related to tax-motivated shifting behavior. The shifting effects are highly

significant with a 95 percent confidence interval of [-5.0%,-4.2%] for December 2009 and [8.7%,9.6%] for January 2010.

Figure 3 indicates that income shifting takes place but it is also evident that the data exhibit a lot of noise. There are, for example, significant positive spikes in April, August and October of 2010, although these spikes are not systematically preceded by negative spikes in the previous months. These variations can arise for many reasons, for example because of differences in the level and timing of bonus payments across the treatment and control groups.

In order to obtain estimates that are less susceptible to such movements, we also pursue another strategy based on the observation that intertemporal shifting at the individual level is expected to generate a decrease in the observed income before the reform and an increase in income after the reform. Thus, we construct a shifting dummy variable that takes the value one in any given month if income in that month is at least 50 percent above the average monthly income level of the individual in 2008 and income in the preceding month is at least 50 percent below the 2008 average income level.

Figure 4, Panel A plots the average value of this dummy variable for the T-group and C-group across the observation period. There is a clear spike in January 2010 for the T-group, and movements are otherwise relatively small for both the T-group and the C-group. Panel B plots the difference between the two groups, and it clearly shows how income shifting takes place around New Year 2010 when compared to any other month, including January 2011. The size of the spike in Panel B is 2.7 percent with a 95 percent confidence interval of [2.6%,2.8%]. Thus, according to this estimate about 3 percent of the top taxpayers engage in shifting behavior.<sup>7</sup>

## V. Shifting behavior across the income distribution

A conclusion from the elasticity of taxable income literature is that income responses to tax changes are larger at higher income levels. In Figure 5 and Figure 6, we look at shifting across levels of income in the top-tax bracket. Figure 5 looks at the number of individuals shifting according to the 50%-50%

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<sup>7</sup> The 50%-50% cut-off criteria defining shifting behavior is somewhat arbitrarily chosen, and we have therefore also experimented with a 25%-25% criteria and a 75%-75% criteria. This gives similar results, although the number of shifters varies a little across the different criteria. With a 25%-25% criteria, the share of shifters becomes 3.0 percent, while it becomes 1.9% with a 75%-75% criteria.

criterion described above, while Figure 6 looks at the amounts shifted estimated using formula (1). We consider four income groups according to the position of taxpayers in the income distribution: (i) [80;90), (ii) [90; 95), (ii) [95; 99) and (iv) [99; 100], where numbers refer to percentiles in the overall income distribution illustrated in Figure 2, Panel B. The graphs in Figures 5 and 6 show that shifting is taking place across the entire distribution, but that the extent of shifting is increasing in the level of income. The share of shifters is 1-2 percent in the group with the lowest income, 3 percent in the second group, 5 percent in the third group, and close to 8 percent for the top-one percent highest paid employees. The share of income shifted is steadily increasing in the income level with around 5 percent of the average monthly wage income being shifted around New Year 2010 for the first group, 10 percent in the second group, 15 percent in the third group, and close to 30 percent for the top earners. These estimates are striking as they only concern wage and salary income. People at the highest end of the income distribution most likely also receive payments in the form of stock options or other forms of compensation, cf. Goolsbee (2000), that we do not observe in our data.

## **VI. Shifting behavior and the elasticity of taxable income**

The elasticity of taxable income (ETI) is a key parameter in determining optimal tax policies. The excess burden of the tax system and the limits to redistribution (the Laffer rate) are governed by the income responses to taxation summarized by the ETI. For the design of optimal policies, the main interest is in the structural ETI that may be used to compute the permanent tax distortions of a given tax structure.

The transitory income movements due to income shifting have implications for the empirical literature, pioneered by Feldstein (1995) and recently surveyed by Saez, Slemrod and Giertz (2012), that exploits variation in tax rates generated by tax reforms to estimate the ETI. If taxpayers temporarily shift income from a period with a high tax rate to a period with a low tax rate then this effect enters into the empirical estimate, implying that the estimated short run ETI is an upward biased estimate of the underlying structural elasticity. This problem is well-known in the literature (see Saez, Slemrod and Giertz, 2012) but only a single study by Goolsbee (2000) has been able to gauge the potential size of the upward bias. Goolsbee considered annual income responses of the five highest-paid employees in US public companies, consisting of 6,133 top executives, following the 1993 US tax reform, which raised marginal tax rates of high-income individuals. He concluded that most

of the income variation of these very highly paid individuals seemed to be generated by retiming in the realization of stock options, implying that most of the elasticity of taxable income was due to intertemporal income shifting rather than a high underlying structural elasticity.

We now explore to what extent the short run ETI may be attributed to income shifting responses. We start by computing a simple difference-in-difference estimate of the ETI:

$$(2) \quad ETI = \frac{\frac{1}{n^T} \sum_{i \in T} \frac{z_{y,m,i} - z_{2008,m,i}}{\bar{z}_{2008,m,i}} - \frac{1}{n^C} \sum_{i \in C} \frac{z_{y,m,i} - z_{2008,m,i}}{\bar{z}_{2008,m,i}}}{\frac{\Delta \tau_T}{1 - \tau_T} - \frac{\Delta \tau_C}{1 - \tau_C}}.$$

The numerator is the percentage change in yearly income of the T-group from the year before the implementation of the reform to the year after implementation, and measured relative to the C-group.<sup>8</sup> This overall ETI estimate, reported in the top-left corner of Table 1, is equal to 0.1 and is very precisely estimated. The size of the elasticity is in line with recent empirical evidence for Denmark by Kleven and Schultz (2013) using yearly income data, spanning a period of 25 years with identifying variation provided by a series of tax reforms. In the rows 2-6 of column 1, we present the ETI estimate for different points in the income distribution, following the income grouping applied in Figure 5. It shows that the ETI is increasing in income, as is also found in other studies (Saez, Slemrod and Giertz, 2012), and is equal to around 0.25 for the top 1% of the earners.

In order to analyze how much of the ETI may be attributed to shifting, we first recalculate the ETI using a subset of the data where we leave out individuals from the T-group and the C-group who are classified as shifters according to the 50%-50% criterion. This procedure removes only 9 thousand out of 330,000 individuals from the sample but implies that the overall ETI estimate drops from 0.10 to 0.05. This result is reported in column 2 of Table 1. Looking at the effect through the income distribution in column 2, we see that the impact on the ETI estimate is largest at the top of the income distribution.

Another way to analyze the effect of shifting is to decompose the overall ETI estimate into the variation coming from December 2009-January 2010, where

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<sup>8</sup> We measure the income differences relative to 2008 rather than 2009 income levels because the latter is influenced by the shifting behavior and in order to keep consistency with the remaining part of the analysis. The sensitivity analysis in Table A1 shows that the ETI results are similar if we instead use 2009 as the baseline year for the analysis.

income shifting is most prevalent, and the variation in the data coming from the remaining 22 months. When doing so, we use 2008 observations to control for seasonal variation. For example, the estimation of the ETI for the shifting period December 2009-January 2010 is based on

$$(3) \quad ETI = \frac{\frac{1}{n^T} \sum_{i \in T} \frac{[z_{2010,i}^{Jan}] - [z_{2008,i}^{Jan}]}{\bar{z}_{2008,m,i}} - \frac{1}{n^C} \sum_{i \in C} \frac{[z_{2010,i}^{Jan}] - [z_{2008,i}^{Jan}]}{\bar{z}_{2008,m,i}}}{\frac{\Delta\tau_T}{1-\tau_T} - \frac{\Delta\tau_C}{1-\tau_C}}.$$

The regression results are displayed in column 3 of Table 1 and show that the overall ETI estimate explodes to about 0.9, i.e., nine times as high as the basic estimate, and the effect is even more dramatic when going to the top of the income distribution where the elasticity estimate is above 3.

If we assume that shifting only takes place in December and January, we can estimate the structural ETI by focusing only on the remaining 22 months. This gives an estimate of the overall structural elasticity equal to 0.03 (column 4). However, Figure 3 indicates that some of the shifting is already taking place in November 2009, so it may give a better measure of the structural elasticity if we also exclude November 2009 from the calculation, as done in column 5. In that case, the point estimate becomes 0.01 and it is statistically insignificant. These results suggest that intertemporal income shifting, taking place very locally around the point of the implementation of the tax reform, are responsible for almost all the variation that is used for estimating the ETI. Results align when we move through the income distribution. Many of the elasticity estimates in columns 4 and 5 are insignificant and the point estimates indicate that income shifting explains at least half of the standard ETI estimate and in some cases all of it. In particular, the high ETI estimates in the top of the income distribution can be explained entirely by intertemporal income shifting.<sup>9</sup>

The sensitivity analysis in Table A1 in the appendix shows that the results are robust to changing the size of the control group, to changing the baseline year and to the removal of observations around the top tax threshold.

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<sup>9</sup> A way to avoid the inclusion of temporary shifting effects when using a simple difference-in-difference estimator would be to exclude the year before the reform and the year after the reform from the analysis and look at years more distant from the reform. A drawback of this strategy is that the common trend assumption underlying the comparison of treatment and control groups is more likely to be violated and that estimates become more imprecise because of the strong serial correlation normally observed in shocks to income.

## VII. The anatomy of shifting behavior

Our results indicate that shifting activity is concentrated among a few individuals in the treatment group, i.e., around 3 percent according to the 50%-50% criteria. Given that it was not illegal to shift income, it would be natural, from the point of view of standard economic theory, to expect that more people would exploit the opportunity to engage in shifting activity and save taxes. This indicates that some types of frictions are preventing taxpayers from fully engaging in shifting activities, in line with conclusions in Chetty, Friedman, Olsen and Pistaferri (2011) and Chetty (2012) that frictions are important for understanding income and labor supply responses to taxation. For example, many employees may not be aware of the opportunity to shift income or they may have insufficient savings, or access to credit, to maintain living expenses during the period where income is shifted forward. Another potential explanation is that the employer is unwilling to cooperate in organizing income shifting because avoiding taxes may impact public opinion about the firm negatively. In this section we describe the anatomy of shifting behavior in more detail and explore some of the characteristics of shifters that are likely correlated with one or more of these explanations for why some taxpayers exploit the opportunity to shift income while others do not.

### *VII.A. Type of industry*

We start by looking across different industries at the frequency of individuals shifting income. The results are reported in Table 2. We have constructed the table by decomposing all firms into 10 industry groups and have repeated the analysis in Figure 4 for each industry group. The row labelled 'all industries' shows that 2.7 percent of all taxpayers in the treatment group are shifters according to the 50%-50% criteria, corresponding to the spike at January 2010 in Panel B of Figure 4. For each industry group, we obtain a graph similar to Figure 4 with a clear spike at January 2010, and the size of the spike is reported in Table 2.

The results in Table 2 reveal that the shifters are surprisingly equally spread across the various industry groups, suggesting that shifting conditions, for example the willingness of employers to cooperate in shifting, are similar across areas of the economy. Shifting appears to be more common within Real Estate and, somewhat surprisingly, less concentrated on people in Finance and Insurance, where one might expect people to understand the incentives and possibly also be better informed about tax matters than the average person.

The industry groups in Table 2 are relatively broad with many different kinds of firms within each group, so it is natural to expect some variation within each group. For example, we may look at Accountants, a small subgroup within Other Business Services, and a group likely to be well informed and capable of organizing income shifting. For this group, the fraction of shifters reaches 8 percent, more than twice the industry average of 3 percent.

#### *VII.B. Firm size and position of employees within the firm*

It may be easier to organize shifting in a small firm than in a large firm, for example because a large firm may be more in the public eye and care more about its public reputation, or because the workers are closer to the decision-making process in a small firm. In Figure 7, we split the sample according to firm size. The graphs display the extent of shifting for individuals working in firms with less than 25 employees, with 25-99 employees, with 100-499 employees, and with 500 or more employees. Shifting appears to be much more widespread among small firms where 5-6 percent are shifters according to the 50%-50% criterion. The share of shifters declines steadily as firm size increases, and for the largest firms, shifting only takes place for about 1 percent of employees.

In Figure 8, we repeat the firm size stratification but confine our sample to include only the top-five best paid employees from each firm. That changes the picture. We still observe about 6 percent shifters among the small firms, but the share of shifters is now at the same level for larger firms. Thus, income shifting is a more prevalent phenomenon among the top management within each firm. This aligns with the findings of Goolsbee (2000) showing that income shifting is prevalent among the highest paid top executives in large US public companies. More importantly, our results show that shifting by top management in large companies only accounts for a limited part of overall income shifting. If we remove the top-five best paid employees in large companies (defined as more than 100 employees, the top decile measured by number of employees) from the sample then the share of shifters changes from 2.7 percent to 2.6 percent. Thus, shifting is not confined to the small elite of top managers in large firms. Moreover, if we remove the top-five best paid people within each firm throughout all the firms in the sample, then the share is still 1.8 percent. For both of these subsamples, our conclusion concerning the ETI is the same. The overall ETI is estimated to be 0.08-0.09 (instead of 0.10) and the estimate of the structural elasticity becomes small and insignificant when we remove shifting in the same way as done in Table 1.

### *VII.C. Liquidity constraints*

The decision to engage in income shifting is likely to also depend on the financial position of the employees. Shifting a full month of income from December 2009 to January 2010 requires financial resources to maintain living expenses in that month, or perhaps access to credit at a level of cost that does not exceed the gains from shifting. As a proxy for financial capacity of an employee, we compute the amount of financial assets, i.e., money in bank accounts and the value of shares and bonds, at the end of 2008 and measure it in proportion to annual disposable income in 2008. This is similar to the approach commonly applied in the consumption literature following Zeldes (1989).<sup>10</sup> Figure 9 presents a local polynomial regression of the 50%-50% shifting dummy on the financial capacity indicator. The graph shows a remarkably linear and significant relationship between the amount of financial asset held in 2008 and the propensity to engage in shifting one year later. This indicates that liquidity constraints have a role to play when employees decide whether or not to engage in shifting behavior.

### *VII.D. Multivariate analysis*

So far we have provided evidence based on bivariate correlations of the 50%-50% shifting indicator with industry type workplace, firm size, best-paid persons within the firm, and financial capacity of the employees. In Table 3 we collect all these factors in a linear probability model by estimating

$$(4) \quad y_i = \beta_0 + d_i\beta_1 + x_i\beta_2 + d_i(x_i - \bar{x})\beta_3 + \varepsilon_i,$$

where  $y_i$  is the 50%-50% shifting indicator,  $d_i$  is a dummy variable that is equal to one if the employee belongs to the T-group,  $x_i$  is a vector of explanatory factors,  $\bar{x}$  is the sample mean of the explanatory variables, and  $\varepsilon_i$  is an error term. In this specification,  $\beta_1$  measures the overall share of individuals who are shifting income after controlling for observable differences between the treatment group and the control group, and  $\beta_3$  captures variation in the share of shifters across observables around the mean effect (Wooldridge, 2002). Column 1 of Table 3 displays the estimate of  $\beta_1$  before including any explanatory variables. It corresponds to the result in Figure 4 and shows that 2.7 percent of employees shift income. In column 2,

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<sup>10</sup> A recent study by Johnson, Parker and Souledes (2006) shows that people with little liquid wealth had larger spending responses to the 2001 US federal income tax rebates. Our construction of the financial capacity indicator on Danish data follows Leth-Petersen (2010) who studies the effects of a large mortgage credit reform in Denmark.

we have added explanatory variables,  $x$ , corresponding to the factors studied in the partial analyses presented in the previous subsections. The first conclusion from this exercise is that the  $\beta_1$ -estimate of the average number of shifters is almost unchanged (2.4 percent instead of 2.7 percent). The second conclusion is that all the results from the partial analysis also hold in the multivariate analysis. None of the  $\beta_3$  coefficients for industry types are significant, showing that shifting is widespread in the economy rather than concentrated on a few sectors. The other estimates show that the share of shifters is higher in smaller firms, is higher among the five best paid employees within firms, and is higher among employees with greater liquidity.<sup>11</sup>

#### *VII.E. Private sector versus public sector*

While the shifting of income is not illegal, as described in Section 2, it is an unintended effect of the tax reform and the tax laws. A natural presumption is that public sector employers would be less willing to cooperate in organizing tax avoidance, implying that one would expect shifting to be less frequent in the public sector. In Figure 10, we show the frequency of 50%-50% shifters among people working in the local government sector. The difference between the treatment group and the control group in January 2010 is half a percentage point but differences of this magnitude are also observed for some of the other months. Thus, the evidence does not suggest that shifting takes place in the local government sector, and in any case, the extent of shifting is small compared to the private sector, cf. Figure 4.

#### *VII.F. Information and awareness*

A reason why only a few individuals in the treatment group exploit the opportunity to shift income and save taxes could be that taxpayers are unaware of the possibility and of the potential benefits associated with shifting. The opportunity to engage in tax shifting was, of course, not advertised by the tax authorities. There was, however, a fairly intense debate in the popular press, including countrywide newspapers and on the webpage of the news programs of the two major nationwide TV channels (DR and TV2), about the possibility for shifting earnings. Some of these reports even included a statement from the tax authorities that income shifting was legal. In order to get a better

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<sup>11</sup> We have also estimated a regression with firm fixed effects in order to control for unobserved factors. When we only exploit the within-firm variation in the data, we find that 2.4 percent of the employees are shifters, which is identical to the result in Table 3.

understanding about the level of information and awareness, we included two questions in a telephone survey of a random sample of individuals from the adult population in Denmark in February 2010, just after the reform was implemented. The survey data was afterwards merged at the person level to the eIncome register giving us a sample of 878 taxpayers with 588 persons belonging to the treatment group and 290 individuals belonging to the control group.

First, we asked each respondent whether it would be most beneficial for them, from a tax point of view, to obtain a little extra wage income 'just before New Year 2010', 'just after New Year 2010' or 'equally beneficial'. For almost all taxpayers, it would be beneficial to receive the income after New Year because of the tax reform, although the incentive is modest for individuals with monthly income below DKK 32,000 as described above. Second, we asked the respondent whether she perceived it to be 'legal' or 'illegal' for an employee to make an agreement with the employer about postponing the payout of some of the income earned in 2009 to 2010.

Table 4 shows the distribution of answers across the treatment and control groups. Only about 1/3 of the taxpayers state that it is most beneficial to obtain extra wage income after New Year, and most people state that it is equally beneficial to get it before or after New Year. The share of individuals answering 'after New Year' is nearly twice as big in the treatment group as in the control group. Nevertheless, only two out of five respondents in the treatment group were able to point out that it would be most beneficial to receive the extra pay after New Year. Around 40 percent of the respondents stated that they perceived it to be legal to postpone the payout of earned income from 2009 to 2010, and without any significant differences in the responses across the treatment group and the control group. Finally, if we define individuals to be aware of the shifting opportunity if they answer both 'after New Year' and 'legal' then only 17 percent of the individuals in the treatment group are informed, in spite of the fact that it was publically debated.

In Figure 11, we explore shifting behavior in the survey sample. Panel A repeats the analysis in Figure 4 by plotting the evolution of the average value of the 50%-50% cut-off dummy variable for the T-group and the C-group, respectively. With only 588 and 290 individuals in the two groups the series become rather noisy but January 2010 still has the largest spike and the difference between the T-group and the C-group is around 2.5 percent, which

corresponds to our estimates for the full population. We would expect the shifting effect to be driven by the informed part of the T-group and the evidence also indicates that this is the case. To see this, we redo the graphical analysis considering only those in the T-group who are informed about the opportunity to shift income (Panel B). In this case, the spike at January 2010 is clear and the difference between the T-group and the C-group shows that 5.5 percent of the informed individuals shift income according to the 50%-50% criteria.

Overall, the evidence suggests that awareness of the legal possibility and the financial gain has been an important factor in explaining why some employees are shifting income while others are not. This aligns with the point emphasized by Chetty, Loony and Kroft (2009) that tax incentives need to be salient to actually affect consumer behavior. On the other hand, the extent of shifting among those who seem to be aware of the opportunity is not large, indicating that salience alone cannot explain why some taxpayers engage in shifting activity while others do not.

### **VIII. Concluding Remarks**

Our results contribute in several ways to the empirical literature on the behavioral effects of taxation. First, using full population tax data we show that intertemporal income shifting is a significant issue for regular wage income and not only for more exotic types of compensation available exclusively for very high income individuals. Second, shifting may well account for all the income variation that is used to estimate the short run ETI and it may be the reason why observed ETI estimates are often increasing with the level of income. Third, shifting is widespread – it takes place at practically all levels of income and the extent of shifting is similar across industry sectors. Fourth, shifting is concentrated on relatively few individuals who shift large amounts. Fifth, the fact that only a few of the taxpayers with an incentive to shift income exploit the opportunity is probably related to unawareness of the potential benefits and legality of income shifting together with some of the taxpayers being liquidity constrained as well as limited willingness of employers to cooperate with the employees in organizing this type of tax avoidance.

Different ways of decomposing the simple difference-in-difference estimate of the ETI into a temporary shifting component and a long run, structural elasticity show that most or all of the ETI estimate may be attributed to the shifting component. This could potentially reconcile why Chetty, Friedman,

Olsen and Pistaferri (2011) find elasticities of taxable income close to zero when applying the bunching identification strategy of Saez (2010), compared to the larger elasticities often found when using income variation generated by tax reforms for identification. The bunching method identifies the ETI by using the distribution of income around a kink in the tax schedule and, therefore, does not rely on variation over time in tax rates, which generates temporary income shifting effects.

For clarification, note that these results do not necessarily imply that the structural ETI relevant for tax policy analyses is negligible. As shown in Chetty (2012), small frictions may imply that the structural elasticity is of a considerable size although the estimated short run ETI is small or even zero. Other types of evidence also point to a non-trivial structural elasticity, for example the compelling graphical evidence of long run effects in Kleven and Schultz (2013) and the structural analysis of labor mobility in Kreiner, Munch and Whitta-Jacobsen (2012).

Our results indicate that information and salience is important for income shifting behavior but our analysis cannot establish that this is a causal relationship, as can Chetty, Loony and Kroft (2009). Nevertheless, it is striking that we obtain reasonably large effects in a setting where only one out of five seem to be informed about the possibility of income shifting. It is also striking that so few among those who seem to be informed engage in shifting. Our evidence points to the importance of liquidity constraints and firm cooperation but we cannot rule out other explanations, for example tax morals and social norms.

Significant intertemporal income shifting effects in wage income may call for policy considerations. One may argue that the temporary shifting effects are small compared to the long run effects of a tax reform. However, often a tax reform is replaced by a new reform a few years later, implying that income shifting effects are non-trivial in the long run. For example, Denmark has had six tax reforms within the last 25 years. The individual benefits from shifting are very unequally distributed with large benefits in the top of the income distribution and without any corresponding gain in economic efficiency.<sup>12</sup> Thus, from a standard equality-efficiency trade-off perspective, social welfare

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<sup>12</sup> The effect on economic efficiency is negative in a standard neoclassical setting. The change in economic efficiency from a (small) tax reform is approximately equal to the behavioral effects on government revenue, which is negative because shifting behavior reduces tax revenue.

would increase if income shifting was prevented or reduced. One way to reduce shifting could be to require that taxes have to be paid on wages and salaries earned within a year instead of on wages and salaries paid out during a year. This would make income shifting illegal, classifying it as tax evasion instead of tax avoidance, which might reduce the willingness of both employees and employers to engage in shifting activity. As a part of an enforcement device, the tax agency could use the 50%-50% criteria applied here to select potential income shifters for audits. Of course, such a proposal should be balanced against other considerations, for example it may require more detailed third-party reporting by firms to the tax authorities.

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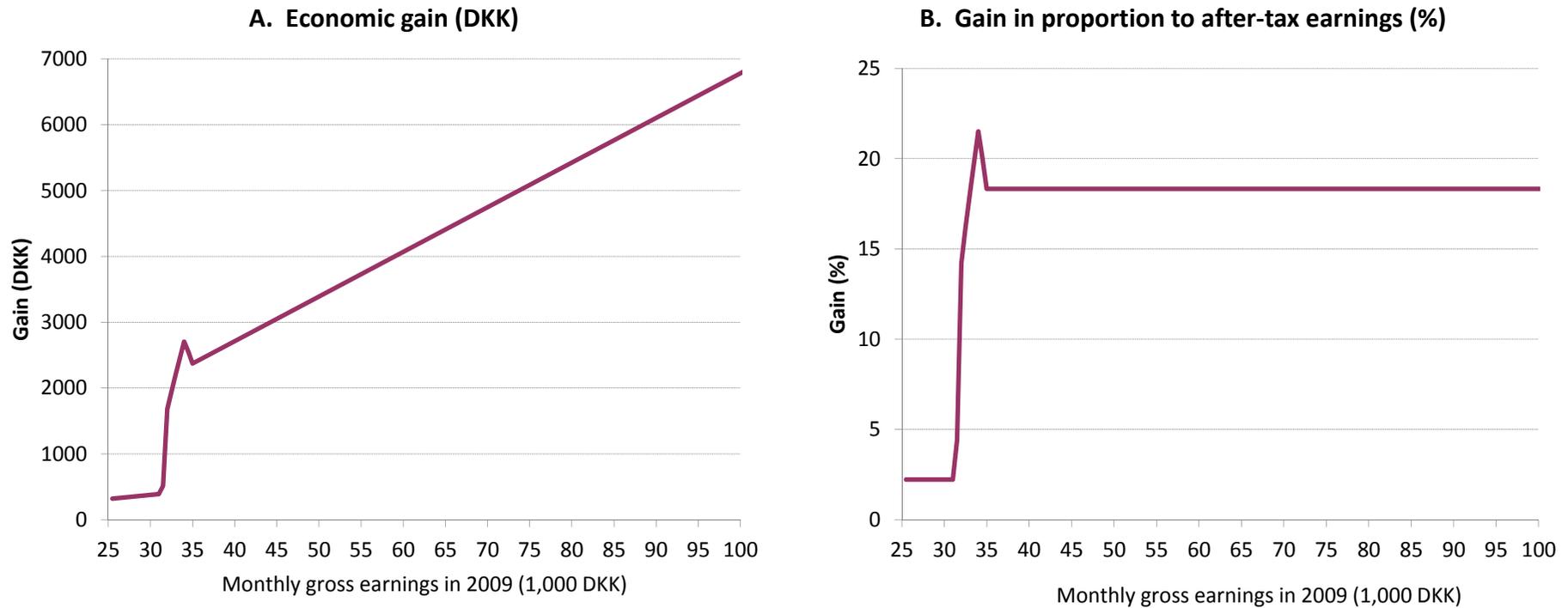
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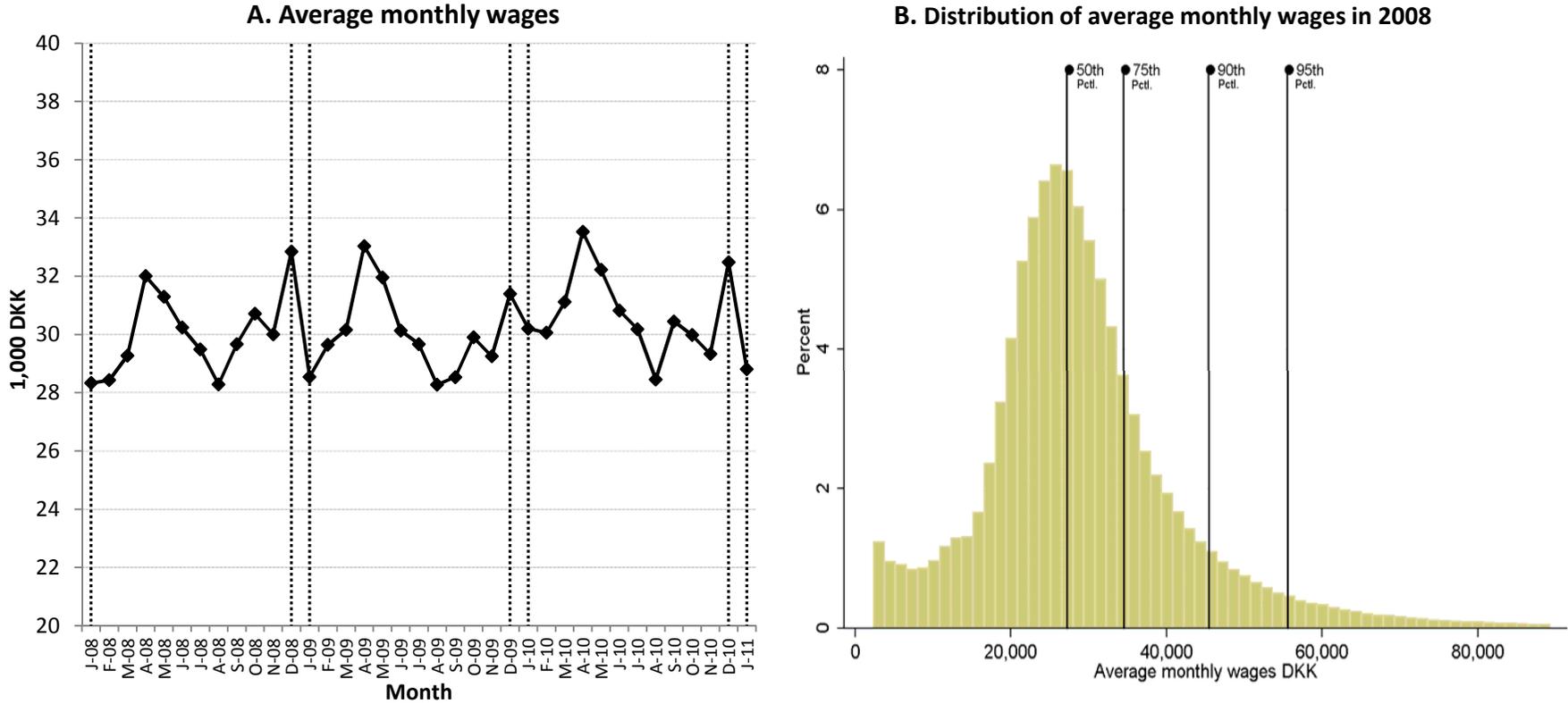
**Figure 1: Incentive to shift one month's salary from 2009 to 2010**



Note: The graphs show the increase in disposable income of a taxpayer who shifts wages and salaries earned in one month of 2009 to 2010 as a function of the monthly gross earnings in 2009 of the tax payer. It is assumed that the tax payer has the same monthly earnings level in all months. The computations are based on a two percent growth rate in nominal wages from 2009 to 2010.

Source: Authors' own calculations.

**Figure 2: Monthly wages over time and across employees**



Note: The left panel shows average monthly nominal wage income from January 2008 to January 2011 for all individuals (1,600,147) with 12 monthly wage payments in 2008 and an average monthly earnings level above DKK1,000 in each of the years 2008, 2009 and 2010. The right panel shows the distribution of average monthly 2008 wage income.

Source: The monthly payroll (elIncome) register from the Danish tax authority (SKAT).

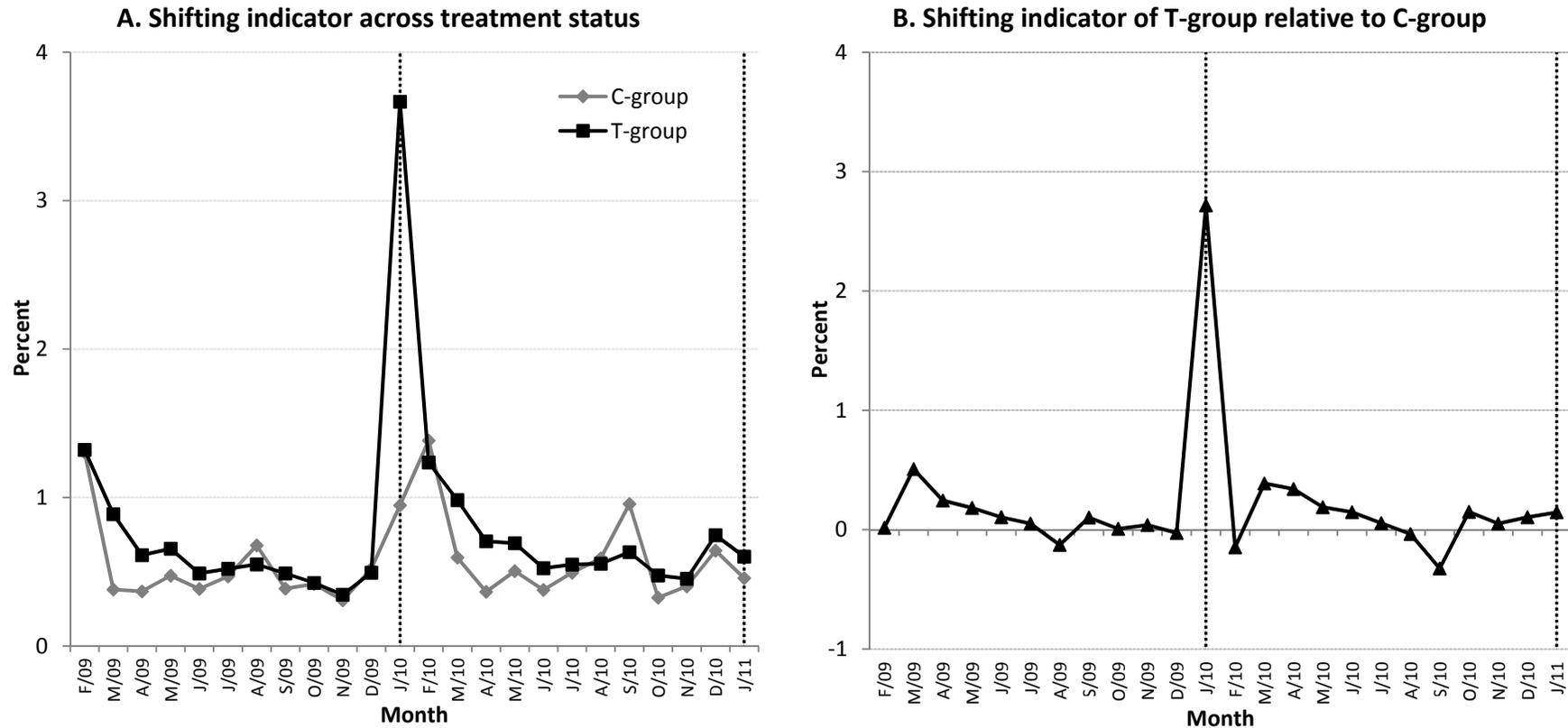
**Figure 3: Share of income shifted**



Note: The left panel shows the monthly wage income of the T-group and the C-group. The T-group consists of all private sector employees with average monthly wage income above DKK 35,000 in 2008 and positive wage income in 2009 and 2010. The C-group consists of all private sector employees with average monthly wage income in the range DKK 30,000-35,000 in 2008 and positive wage income in 2009 and 2010. This gives 219,598 employees in the T-group and 109,672 employees in the C-group. The right panel shows the difference between the wages in a given month and the same month in 2008 (as a percentage of the average monthly wage in 2008) for the T-group and measured relative to the C-group (in percentage points).

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT).

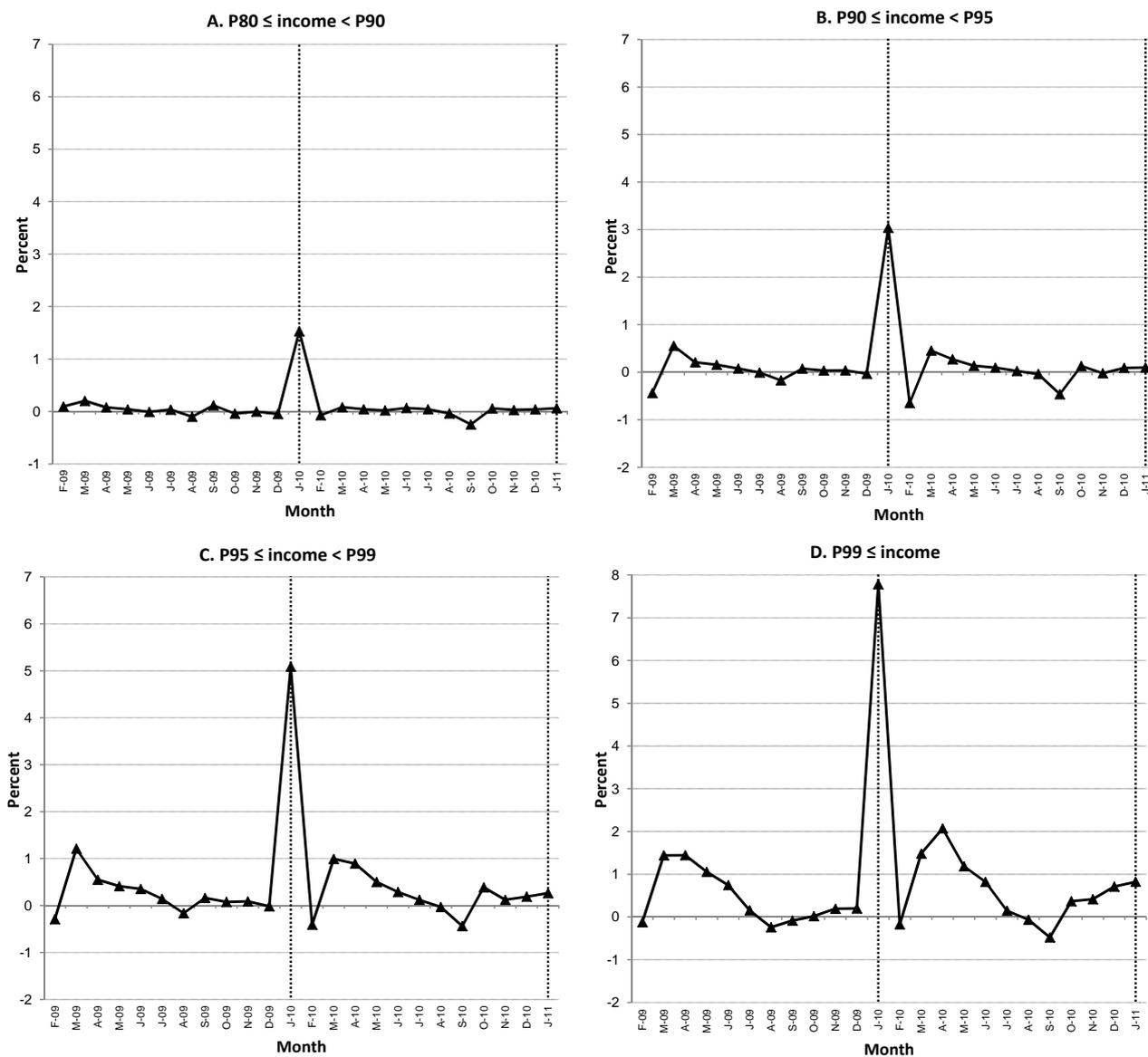
**Figure 4: Share of employees shifting income**



Note: The shifting indicator is constructed separately for all months and is equal to one if the income of the employee in that month is at least 50 percent above the average monthly income level in 2008 and income in the preceding month is at least 50 percent below the 2008 average income level. The left panel shows, for each month, the share of employees fulfilling the 50%-50% criteria across treatment status. The right panel shows the difference in the share of employees fulfilling the 50%-50% criteria between the T-group and the C-group, where the size of this difference in January 2010 is taken as an approximation of the share of income shifters. The construction of the T-group and the C-group is described in the note to Figure 3.

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT).

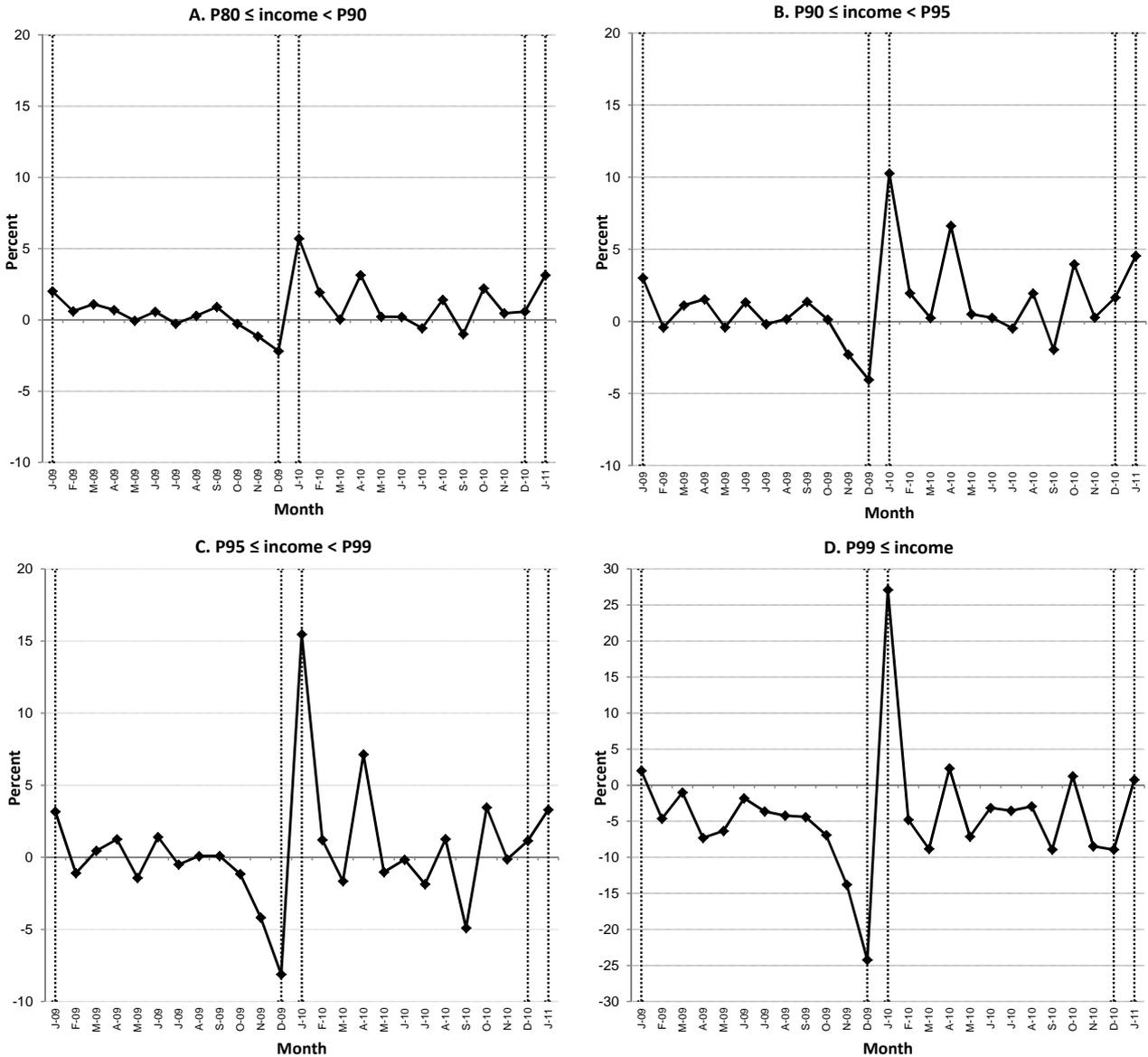
**Figure 5: Share of employees shifting income across income groups**



Note: The figure shows the difference in the share of income shifters, according to the 50%-50% shifting indicator, between the T-group and the C-group for each month. In Panel A, the T-group includes private employees with average monthly earnings within the 80th and 90th percentile of the wage distribution, cf. Figure 2. The T-group selection moves upwards in the wage distribution as we move from Panel A to Panel B and forward. The 50%-50% shifting indicator is constructed separately for all months and is equal to one if the income of the employee in that month is at least 50 percent above the average monthly income level in 2008 and income in the preceding month is at least 50 percent below the 2008 average income level. The construction of the T-group and the C-group is described in the note to Figure 3.

Source: The monthly payroll (elIncome) register from the Danish tax authority (SKAT).

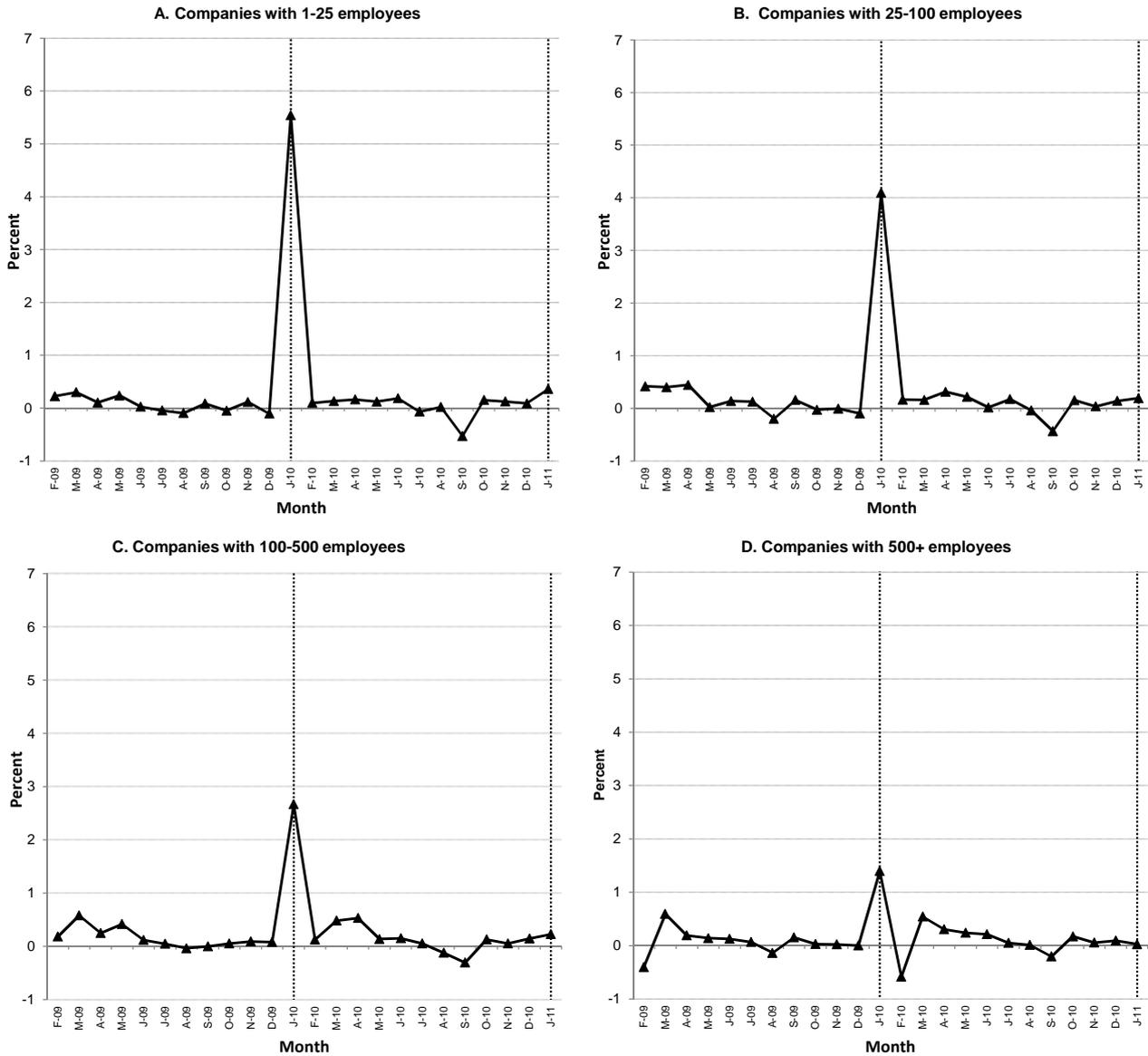
**Figure 6: Share of income shifted across income groups**



Note: The figure shows the difference between wages in a given month compared to the same month in 2008 (as a percentage of the average monthly wage in 2008) for the T-group and measured relative to the C-group. In Panel A, the T-group includes private employees with average monthly earnings within the 80th and 90th percentile of the wage distribution, cf. Figure 2. The T-group selection moves upwards in the wage distribution as we move from Panel A to Panel B and forward. The construction of the T-group and the C-group is described in the note to Figure 3.

Source: The monthly payroll (elncome) register from the Danish tax authority (SKAT).

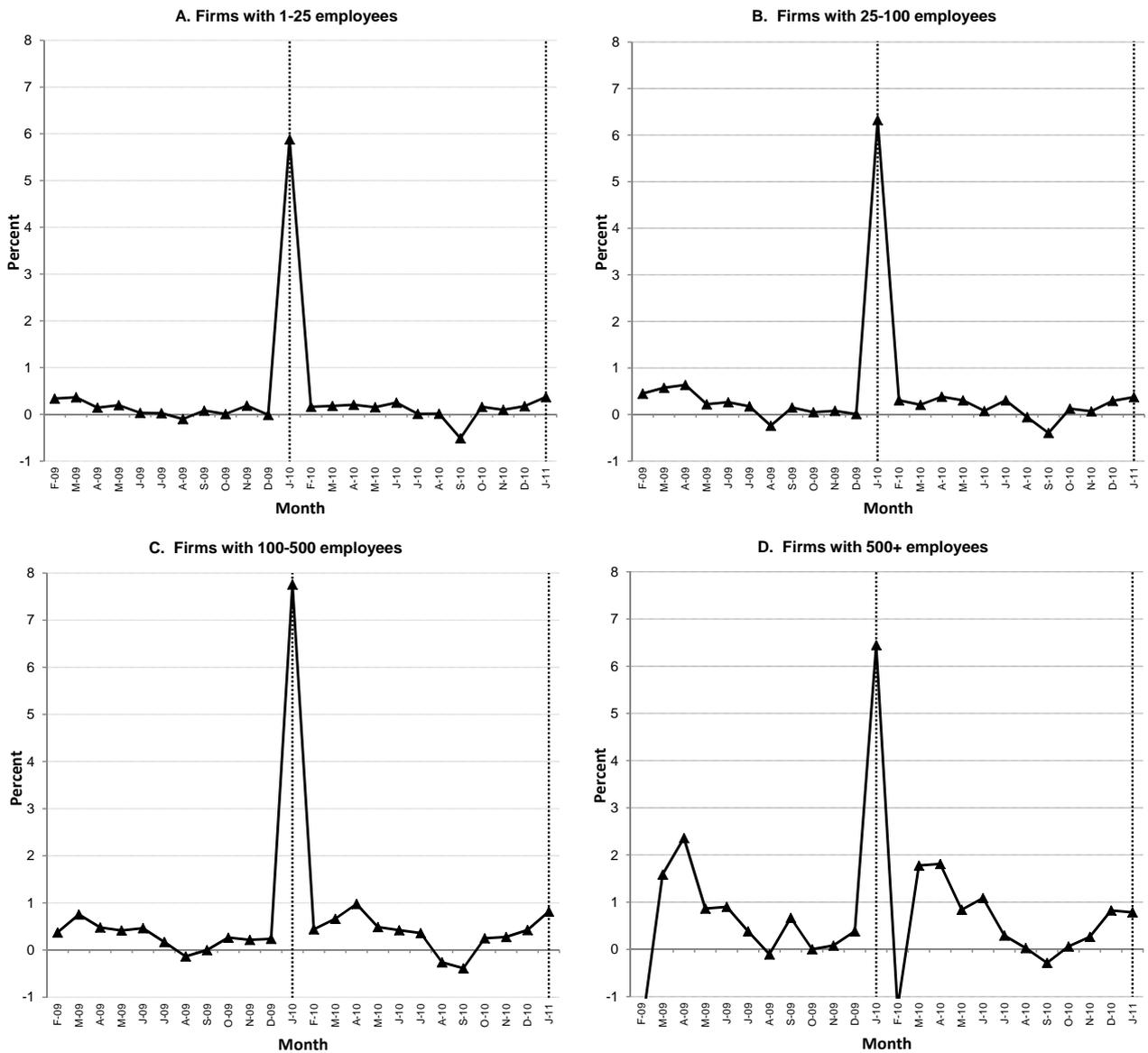
**Figure 7: Share of employees shifting income across firm size**



Note: The graphs show the share of shifters, according to the 50%-50% shifting indicator, across firm size. The graphs correspond to panel B of Figure 4 and are constructed by splitting the full sample used in Figure 4 into four subsamples. The graph in Panel A is based only on persons working in companies with 1-25 employees, Panel B is based on persons working in companies with 25-100 employees, and so on. The 50%-50% shifting indicator is constructed separately for all months and is equal to one if the income of the employee in that month is at least 50 percent above the average monthly income level in 2008 and income in the preceding month is at least 50 percent below the 2008 average income level. The construction of the T-group and the C-group is described in the note to Figure 3.

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT).

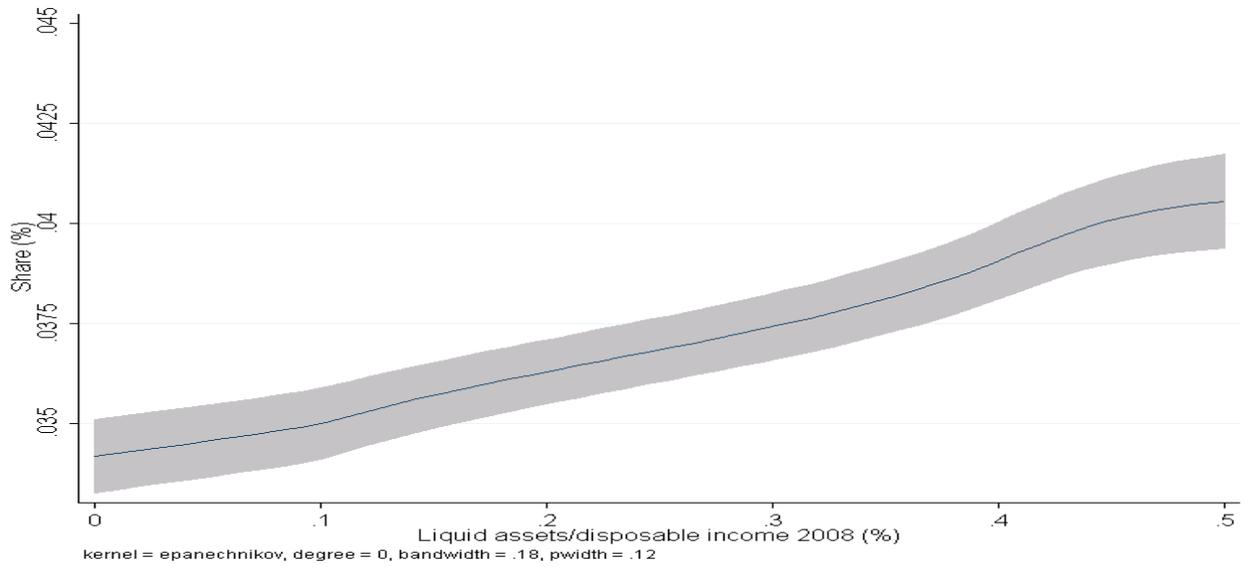
**Figure 8: Share of top-five employees shifting income across firm size**



Note: The graph in each panel corresponds to the same panel in Figure 8 with the exception that only top-five wage earners within each firm are included in the analysis. The graphs show the share of shifters, according to the 50%-50% shifting indicator, among the top five highest paid employees across firm size. The graph in Panel A is based only on persons working in companies with 1-25 employees, Panel B is based on persons working in companies with 25-100 employees, and so on. The 50%-50% shifting indicator is constructed separately for all months and is equal to one if the income of the employee in that month is at least 50 percent above the average monthly income level in 2008 and income in the preceding month is at least 50 percent below the 2008 average income level.

Source: The monthly payroll (income) register from the Danish tax authority (SKAT).

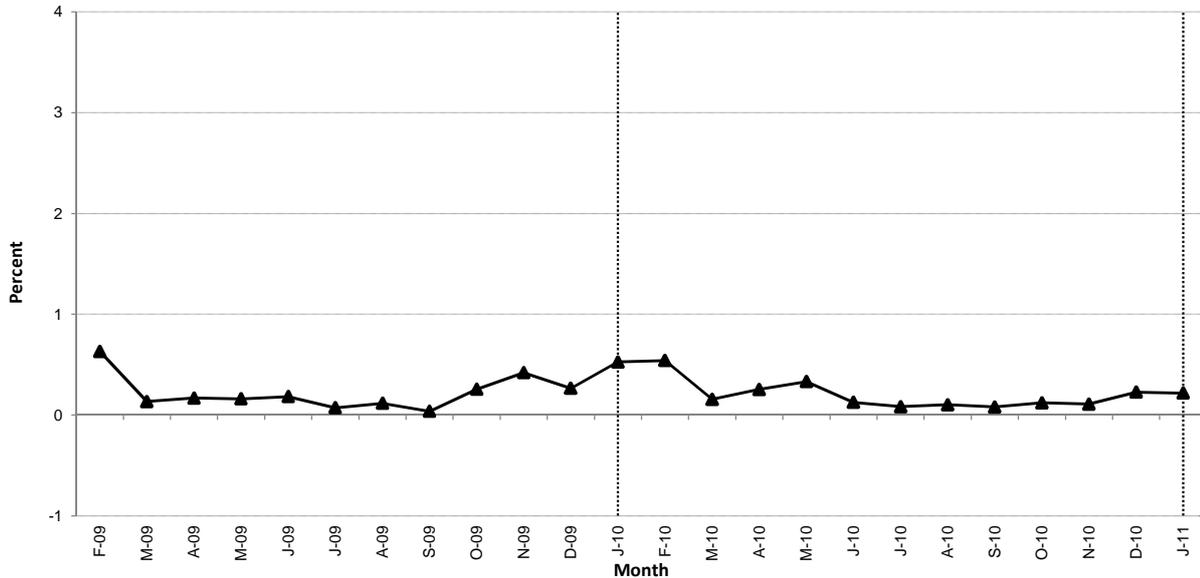
**Figure 9: Share of employees shifting income as a function of liquidity**



Note: The graph shows the share of individuals shifting income in the treatment group as a function of liquidity using a local polynomial regression of the 50%-50% shifting indicator on a measure of liquidity. The 50%-50% shifting indicator is equal to one if the income of the employee in January 2010 is at least 50 percent above the average monthly income level in 2008 and income in December 2009 is at least 50 percent below the 2008 average monthly income level. The liquidity measure is constructed as the value in 2008 of stocks, bonds and deposit accounts relative to disposable income and have been censored at 0 (192 individuals) and 0.5 (50,955 individuals). The sample includes 219,252 individuals, while 346 individuals have been dropped from the treatment group due to missing liquidity information.

Source: The monthly payroll (elincome) register from the Danish tax authority (SKAT) and socio-economic information from administrative registers at Statistics Denmark.

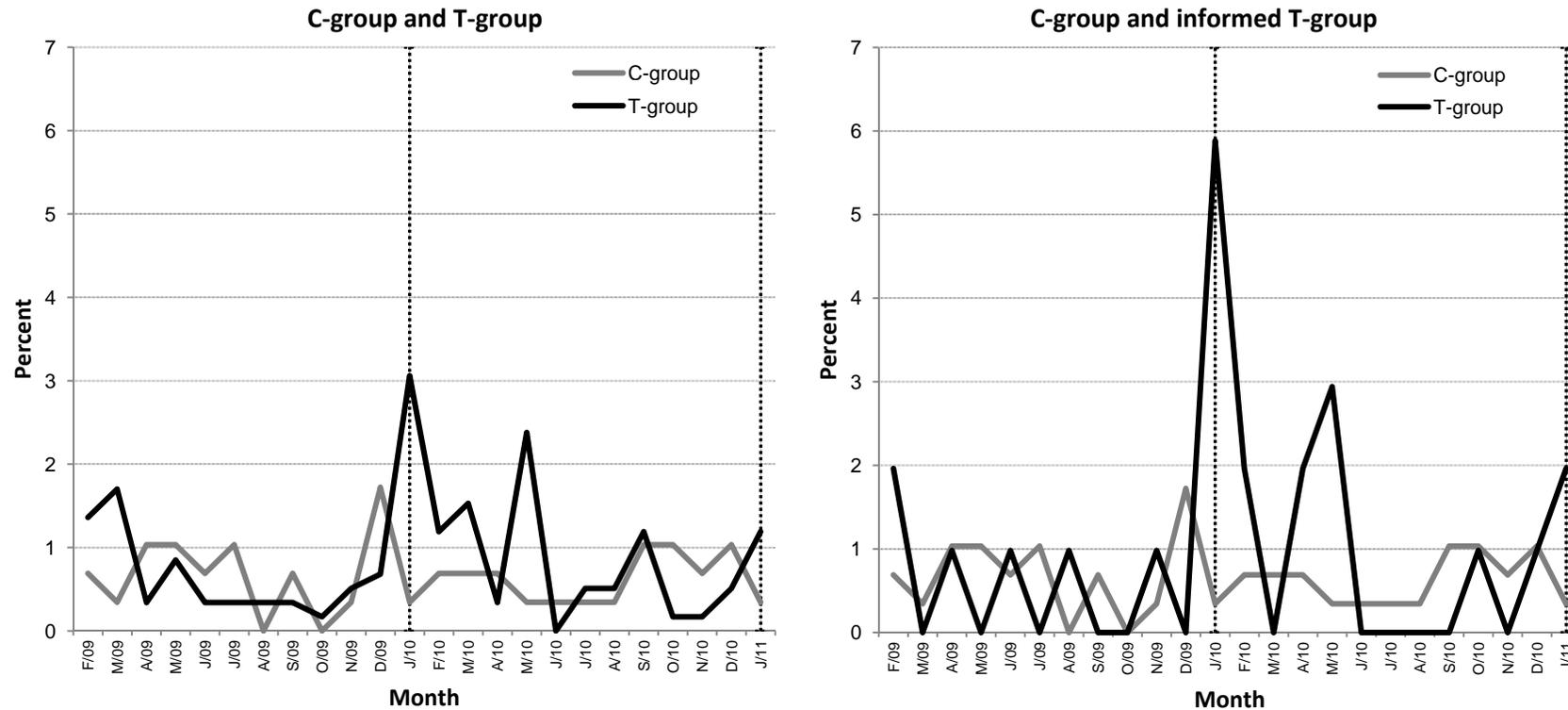
**Figure 10: Share of employees shifting income in local government**



Note: The graph shows the share of shifters, according to the 50%-50% shifting indicator, in local government. The construction of the graph corresponds to Panel B of Figure 4. The T-group (32,099 individuals) consists of local government employees with an average monthly wage income above DKK 35,000 in 2008 and positive wage income in 2009 and 2010. The C-group (49,010 individuals) consists of local government employees with an average monthly wage income in the range DKK 30,000-35,000 in 2008 and positive wage income in 2009 and 2010. The shifting indicator is constructed separately for all months and is equal to one if the income of the employee in January 2010 is at least 50 percent above the average monthly income level in 2008 and income in December 2009 is at least 50 percent below the 2008 average monthly income level. The liquidity measure is constructed as the value in 2008 of stocks, bonds and deposit accounts relative to disposable income and have been censored at 0 (192 individuals) and 0.5 (50,955 individuals). The sample includes 219,252 individuals, while 346 individuals have been dropped from the treatment group due to missing liquidity information.

Source: The monthly payroll (elincome) register from the Danish tax authority (SKAT).

**Figure 11: Share of income shifters among survey respondents**



Note: The left panel replicates the graph in Panel B of Figure 4 but includes only the 588 employees in the treatment group and the 290 individuals in the control group who participated in the survey described in Table 4. The right panel is constructed in the same way as the left panel but the T-group is confined to those respondents who are informed about the opportunity to shift income, defined as the group with Q1 = 'After New Year' & Q2 = 'Legal' (see Table 4). The 'share of shifters' is estimated using the 50%-50% shifting indicator, which is constructed separately for all months and is equal to one if the income of the employee in that month is at least 50 percent above the average monthly income level in 2008 and income in the preceding month is at least 50 percent below the 2008 average income level. The graphs show the difference in the share of employees fulfilling the 50%-50% criteria between the T-group and the C-group.

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT) and telephone survey information from a random subsample of the adult population.

**Table 1: Importance of shifting for diff-in-diff estimates of the elasticity of taxable income**

Income group	All months All individuals (1)	All months Non-shifters (2)	Only D09 & J10 All individuals (3)	Excl. D09 & J10 All individuals (4)	Excl. N09, D09 & J10 All individuals (5)
Full sample	0.10 [0.08;0.11]	0.05 [0.03;0.06]	0.85 [0.81;0.89]	0.03 [0.01;0.04]	0.01 [-0.00;0.03]
income ≤ P80	0.02 [-0.01;0.04]	0.01 [-0.02;0.03]	0.17 [0.12;0.22]	0.00 [-0.02;0.03]	-0.01 [-0.03;0.02]
P80 ≤ income < P90	0.06 [0.05;0.08]	0.04 [0.02;0.05]	0.49 [0.45;0.54]	0.02 [0.01;0.04]	0.01 [-0.00;0.03]
P90 ≤ income < P95	0.12 [0.11;0.14]	0.07 [0.05;0.09]	0.89 [0.84;0.94]	0.06 [0.04;0.08]	0.04 [0.02;0.06]
P95 ≤ income < P99	0.16 [0.14;0.18]	0.06 [0.04;0.08]	1.47 [1.40;1.54]	0.04 [0.02;0.06]	0.01 [-0.01;0.03]
P99 ≤ income	0.26 [0.21;0.31]	0.10 [0.05;0.15]	3.19 [2.90;3.50]	-0.01 [-0.06;0.05]	-0.06 [-0.12;-0.01]

Note: The table reports estimates of the ETI, using formulas (2) and (3), and the 95% confidence intervals on these estimates in the brackets. The construction of the T-group (219,598) and C-group (109,672) is described in the note to Figure 3. The column label "non-shifters" refers to estimations where employees shifting income around New Year 2010, according to the 50%-50% criteria, described in the note to Figure 4, are excluded from the sample. This excludes 9088 taxpayers from the total sample of 329,270 taxpayers. The ETI estimates under the column label "Only D09 & J10" are computed using formula (3) and include only wage observations from December 2009 and January 2010 in the estimation. The ETI estimates under the column label "Excl. D09 & J10" are computed by excluding wage observations in December 2009 and January 2010 from the estimation. The ETI estimates under the column label "Excl. N09, D09 and J10" are computed by excluding wage observations in November 2009, December 2009 and January 2010 from the estimation.

Source: The monthly payroll (elIncome) register from the Danish tax authority (SKAT).

**Table 2: Share of employees shifting across industry sectors**

Industry sector	Percent	95% conf.
1. Agriculture, Forestry and Fishing	3.8	[1.2;6.4]
2. Manufacturing, Mining, Quarrying and Utility Services	2.6	[2.4;2.7]
3. Construction	2.5	[2.1;2.8]
4. Trade and Transport etc.	3.2	[3.1;3.4]
5. Information and Communication	2.4	[2.1;2.7]
6. Financial and Insurance	1.5	[1.2;1.7]
7. Real Estate	4.3	[3.1;5.4]
8. Other Business Services and activity not stated	3.2	[2.8;3.5]
9. Public adm., Education and Health	2.1	[1.3;2.9]
10. Arts, Entertainment and Other Services	2.6	[1.5;3.7]
All sectors	2.7	[2.6;2.8]

Note: The table reports the share of income shifters, according to the 50%-50% shifting indicator, across industry types and 95 percent confidence intervals in brackets. For each industry, the estimate measures the difference in the share of employees fulfilling the 50%-50% criteria between the T-group and the C-group. The 50%-50% shifting indicator is equal to one if the income of the employee in January 2010 is at least 50 percent above the average monthly income level in 2008 and income in December 2009 is at least 50 percent below the 2008 average monthly income level. The construction of the T-group and the C-group is described in the note to Figure 3.

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT).

**Table 3: Income shifter characteristics**

	----- Shifting indicator dummy (LPM) -----			
	(1)		(2)	
	Beta Coeff.	Conf 95%	Beta Coeff.	Conf 95%
Tgrp	2.7	[2.6;2.8]	2.4	[2.3;2.5]
Sector 1: Agriculture, Forestry and Fishing - omitted -				
Sector 2: Manufacturing, Mining, Quarrying and Utility Services			-0.2	[-1.6;0.9]
Sector 3: Construction			-0.4	[-1.9;0.7]
Sector 4: Trade and Transport etc.			-0.4	[-1.8;0.7]
Sector 5: Information and Communication			-0.1	[ 1.6;1.0]
Sector 6: Financial and Insurance			-0.7	[-2.1;0.4]
Sector 7: Real Estate			0.0	[-1.6; 1.3]
Sector 8: Other Business Services and activity not stated			0.4	[-1.0;1.6]
Sector 9: Public adm., Education and Health			-0.2	[-1.7;0.9]
Sector 10: Arts, Entertainment and Other Services			-0.6	[-2.1;0.7]
500 < Company Employees - omitted -				
100 < Company Employees ≤ 500			0.0	[-0.2;0.1]
25 < Company Employees ≤ 100			0.4	[0.2;0.5]
Company Employees ≤ 25			0.6	[0.3;0.9]
Company top5 wage earner			0.3	[0.0;0.6]
Liquidity			0.9	[0.5;1.2]
Tgrp x (sector 1 - m(sector 1)) - omitted -				
Tgrp x (sector 2 - m(sector 2))			1.0	[-1.6;3.5]
Tgrp x (sector 3 - m(sector 3))			0.3	[-2.4;2.8]
Tgrp x (sector 4 - m(sector 4))			1.0	[-1.6;3.6]
Tgrp x (sector 5 - m(sector 5))			0.8	[-1.8;3.4]
Tgrp x (sector 6 - m(sector 6))			0.4	[-2.3;2.9]
Tgrp x (sector 7 - m(sector 7))			1.0	[-1.8;3.8]
Tgrp x (sector 8 - m(sector 8))			1.3	[-1.4;3.9]
Tgrp x (sector 9 - m(sector 9))			0.7	[-2.1;3.3]
Tgrp x (sector 10 - m(sector 10))			0.3	[-2.6;3.1]
Tgrp x (Employees500 - m(Employees500)) - omitted -				
Tgrp x (100Employees500 - m(100Employees500))			0.9	[0.7;1.1]
Tgrp x (25Employees100 - m(25Employees100))			1.4	[1.1;1.6]
Tgrp x (Employees25 - m(Employees25))			1.2	[0.7;1.7]
Tgrp x (top5 - m(top5))			3.6	[3.2;4.1]
Tgrp x (liquidity - m(liquidity))			2.2	[1.6;2.7]
Additional controls			X	
Constant	0.9	[0.9,1.0]	1.3	[0.1;2.7]
Observations	324,571		324,571	

Note: The table reports the estimates from the LPM specification in formula (4) and the 95% confidence intervals of these estimates. The confidence intervals in model 2 are based on bootstrapped standard errors with 1,000 replications. The dependent variable is the 50%-50% shifting indicator, which is equal to one if the income of the employee in January 2010 is at least 50 percent above the average monthly income level in 2008 and income in December 2009 is at least 50 percent below the 2008 average monthly income level. The additional control variables include gender, age dummy variables, marital status and geographic location of residence, and m(.) denotes the mean of a variable. The construction of the T-group (219,598) and C-group (109,672) is described in the note to Figure 3.

Source: Monthly payroll (elIncome) register from the Danish tax authority (SKAT) and socio-economic information from administrative registers at Statistics Denmark.

**Table 4: Share of survey answers on shifting awareness**

	All	T-group	C-group
	----- Percent -----		
Q1 = 'Equally beneficial'	56	51	67
Q1 = 'After New Year'	35	41	23
Q2 = 'Legal'	40	39	43
Q1 = 'After New Year' & Q2 = 'Legal'	15	17	11
Number of respondents	878	588	290

Notes: The table reports answers to two questions on income shifting from survey respondents across treatment status. The table is based on answers in a telephone survey of a random sample of the adult population and conducted for the researchers by Capacent Epinion in February 2010. The T-group consists of private sector employees with average monthly wage income above DKK 35,000 in 2008 and positive wage income in 2009 and 2010. The C-group consists of private sector employees with average monthly wage income in the range DKK 30,000-35,000 in 2008 and positive wage income in 2009 and 2010.

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT) and telephone survey information from a random subsample of the adult population.

**Table A1: Importance of shifting for diff-in-diff estimates of the elasticity of taxable income**

Income group	All months All individuals (1)	All months Non-shifters (2)	Only D09 & J10 All individuals (3)	Excl. D09 & J10 All individuals (4)	Excl. N09, D09 & J10 All individuals (5)	T-group Number of individuals	C-group Number of individuals
A. Baseline	0.10 [0.08;0.11]	0.05 [0.03;0.06]	0.85 [0.81;0.89]	0.03 [0.01;0.04]	0.01 [-0.00;0.03]	219,598	109,672
B. Narrow C-group	0.08 [0.07;0.09]	0.03 [0.02;0.04]	0.81 [0.77;0.85]	0.01 [-0.00;0.03]	-0.01 [-0.02;0.01]	219,598	59,848
C. Wide C-group	0.13 [0.12;0.14]	0.08 [0.07;0.09]	0.92 [0.88;0.95]	0.06 [0.05;0.07]	0.04 [0.03;0.05]	219,598	277,910
D. Doughnut sample	0.12 [0.11;0.14]	0.06 [0.05;0.08]	1.00 [0.96;1.04]	0.04 [0.03;0.06]	0.03 [0.01;0.05]	187,284	71,482
E. Baseline year 2009	0.09 [0.07;0.10]	0.04 [0.03;0.05]	1.07 [1.04;1.11]	-0.01 [-0.02;0.01]	-0.03 [-0.04;0.02]	219,269	105,408

Note: The table reports estimates of the ETI, using formulas (2) and (3), and the 95% confidence intervals on these estimates in the brackets. The first row repeats the baseline estimates from Table 1. The baseline construction of the T-group and C-group is described in the note to Figure 3. The rows labeled 'narrow' and 'wide' refer to C-group selections with an average monthly 2008 earnings level in the range 32,000-35,000 and 24,000-35,000, respectively. The 'doughnut' sample excludes individuals with an average monthly 2008 earnings level in the range 33,000-37,000. The row labeled '2009 income' refers to estimates where 2009 is used as the baseline year to separate individuals into treatment group and control group, and where income differences are measured relative to 2009 income.

Source: The monthly payroll (eIncome) register from the Danish tax authority (SKAT).

