

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

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Abstract

This paper uses monthly payroll records for all Danish employees to identify widespread intertemporal shifting of labor 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 elasticity of taxable income to equal 0.1 and find that the elasticity is increasing in the level of earnings. When removing the shifting component, we obtain an elasticity close to zero at all earnings levels. The evidence also indicates that tax salience, liquidity constraints and firm willingness to cooperate in shifting are important factors in explaining shifting behavior.

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1 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.¹ 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.² It is also relevant for the burgeoning literature, pioneered by Feldstein (1995) and recently surveyed by Saez, Slemrod and Giertz (2012), that exploits tax reforms to identify the elasticity of taxable income (ETI) used to quantify the welfare loss from taxation. It is well-known that short-run income shifting responses around the implementation of tax reforms may cause the estimate of the (short-run) ETI to differ from the (long-run) elasticity relevant for evaluating the distortionary effects of taxation (e.g. Slemrod, 1998).

Our empirical analysis is based on new Danish administrative records with monthly information about wages and salaries that allow us to identify intertemporal income shifting 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

¹A 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.

²For 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 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.

since 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 passed in parliament at the end of May 2009 and changed the tax scheme for income earned from 2010 and onwards, thereby creating an incentive for high-wage earners to shift wage payments from the end of 2009 to the beginning of 2010. However, this requires the cooperation of the employer, who reports 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 graphical evidence revealing income shifting taking place around the implementation of the tax reform. We observe a clear negative spike in reported earnings of high-income individuals at the last months of 2009 and a positive spike in the beginning of 2010, and at the individual level we detect taxpayers with a significant drop in reported earnings at the end of 2009 followed by a jump up in the beginning of 2010. We detect no systematic effects in other months and for a group of middle-income individuals with only negligible changes in incentives, confirming 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 observed pattern in reported earnings is difficult to reconcile with models of real behavior, indicating 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 the average level of reported wage income is nearly 10 percent higher in January 2010 and correspondingly lower in November and December 2009, revealing 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 it was close to 30 percent.

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 so the short-run elasticities—after removing the shifting component—are close to zero at all earnings levels. This conclusion is robust to the introduction of a rich set of control variables and a number of other sensitivity tests.

The aggregate shifting response masks substantial heterogeneity. Among the employees with an incentive to shift income, we find less than 5 percent exploit the opportunity to shift income but these individuals shift large amounts. The low propensity to engage in shifting activity is consistent with other types of evidence showing taxpayers engage less in tax avoidance than what is predicted by a standard economic model (Andreoni, Erard and Feinstein, 1998).

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. 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. This may suggest that 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, we find that shifting is less pronounced for individuals with a low level of liquid assets relative to income before the reform, consistent with the explanation that liquidity constraints prevent some tax taxpayers from shifting income forward. Third, by conducting a telephone survey of a randomly selected group of individuals and combining the responses with the register data, we show that taxpayer information and attention are important, in line with recent studies of other types of behavioral responses to taxation (Chetty, Loony and Kroft, 2009; Chetty, Friedman and Saez, 2013). Of those who have an incentive to shift income only 1 out of 5 is aware of the tax incentive and know it is

legal to shift their wage payments. The 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 conclude on this part of the analysis, the results do not point to a single explanation but rather to several reasons 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 compliance (Chetty, Friedman, Olsen and Pistaferri, 2011; Kleven, Knudsen, Kreiner, Pedersen and Saez, 2011; Kleven and Schultz, 2013; le Marie and Schjerning, 2013; Kleven, Landais, Saez and Schultz, 2014). 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.

Goolsbee (2000) looked at intertemporal income shifting of the five highest-paid employees in US public companies in response to the marginal tax rate increase implemented by President Clinton in 1993. He applied a standard difference-in-difference type setup on annual income but allowed tax-reform variation across treatment and control groups to affect income already in the year before the reform in order to detect income shifting. The results indicate that most of the variation in taxable income of these very highly paid individuals seems to be driven by retiming in the realization of stock options, implying that most of the ETI is driven by intertemporal income shifting rather than by permanent income responses. He 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 the shifting behavior documented in our study is not related to the realization of stock options. Heim (2009) used a similar

approach as Goolsbee but without detecting significant intertemporal effects in income responses to the US tax reforms in 2001 and 2003, while Giertz (2010) found evidence of intertemporal shifting effects in response to the US tax reforms in the 90s. Compared to these studies based on annual income, the monthly frequency of our data offers a unique possibility to obtain more precise empirical identification of intertemporal income shifting responses.

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 analyses how much of the short-run elasticity of taxable income may be attributed to temporary income shifting. Section 7 provides a more detailed analysis of shifting behavior and the underlying explanatory factors. Finally, Section 8 concludes.

2 The Danish 2010 tax reform and the scope for intertemporal income shifting

In practical tax policy, it is difficult to avoid that changes in tax rules are known to taxpayers before the date of implementation, which gives taxpayers an opportunity to save taxes through intertemporal income shifting. This was also the case for the Danish 2010 tax reform, which 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 2010.³

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 government revenue constant (before behavioral responses).⁴

³It 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.

⁴Below we follow most of the existing literature by only including the direct taxation on labor income when computing marginal tax rates. In principle, we would like to compute effective marginal tax rates taking into account, e.g., that taxes on firms are passed on to workers through reduced wages or higher consumption prices. Note that this does not affect the incentive to shift income, as long as the timing

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 377,000 Danish kroner (DKK),⁵ which was the income cut-off applying to both the middle tax and the top tax, faced a marginal tax rate of around 63 percent. This includes labor market contributions (LC = 8% of LI), a regional tax (32.8% of LI-LC in the average municipality), a 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).⁶ 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 (τ_H) dropped from 63 percent in 2009 to 56 percent in 2010, equivalent to an increase in the net-of-tax rate, $1 - \tau_H$, of 19 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 an increase in the net-of-tax rate, $1 - \tau_L$, of only 2 percent.

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 net-of-tax earnings. 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

of consumption is unaffected by shifting. It should also be noted that the financing components did not change the tax base for labor income, which is often a challenge when trying to measure taxable income responses (Kopczuk, 2005).

⁵These 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.

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

shifted (the slope in Panel A), giving a sizable economic gain corresponding to nearly 20 percent of the monthly net-of-tax earnings (see Panel B). Note that the changes displayed in Panel B correspond to the changes in the net-of-tax rate of 2 percent and 19 percent for individuals below and above, respectively, of the top/middle tax cut-off, with the exception of individuals in a small income range where the incentive is affected by the change in the top/middle tax income cutoff.

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 when 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 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.

3 Data

In the empirical analysis we use a new data resource with records of gross 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, containing 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 data set covers the entire Danish population from 2008 to 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 2008–2010.⁷ 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.

4 Empirical identification of shifting behavior

In order to identify intertemporal shifting behavior, we first divide our sample into taxpayers with a strong economic incentive to shift income (treatment group) and taxpayers with only a negligible incentive (control group). This is done by 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 the tax bracket 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 treat-

⁷The sample includes individuals who are both wage earners and self-employed at the same time. Removing self-employed completely from the sample has only negligible effects on the results.

ment group (T-group) as the employees in the private sector with monthly gross 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.⁸ This leaves us with 329,270 individuals out of which 219,598 belong to the treatment group.

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

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

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

⁸The 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 very low salaries and irregular wage payments.

denotes the month, and $\bar{z}_{2008,i}$ denotes the average monthly gross earnings 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 around zero before it drops down in November and December of 2009, the last two months 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 of 2010. 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, and these differences 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 some noise. There are, for example, positive spikes in April, August and October of 2010, but note that these spikes are not systematically preceded by negative spikes in the previous months, which is a characteristic of intertemporal shifting. 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, our main identification strategy exploits 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 the following shifting indicator dummy variable for each individual and each month

$$D_{y,m,i} = \begin{cases} 1 & \text{if } \frac{z_{y,m,i} - z_{2008,m,i}}{\bar{z}_{2008,i}} > 50\% \quad \wedge \quad -\frac{z_{y,m-1,i} - z_{2008,m-1,i}}{\bar{z}_{2008,i}} > 50\% \\ 0 & \text{otherwise} \end{cases}, \quad (2)$$

which is equal to one if income in a month is high compared to its (counterfactual) level in the same month of 2008 *and* income in the preceding month is low compared to its level in the same month of 2008. The shifting indicator is equal to one in January 2010 for an individual who defers his payment of regular earnings from December 2009 to January 2010 and an individual that normally receives a bonus in December but postpone the December

2009 bonus to January 2010 in order to save taxes.⁹ The shifting indicator may also equal one because of large random income movements at the individual level but the average value of the shifting indicator at all other months may be used to evaluate the size of this effect because, by construction, December 2009 to January 2010 is the only consecutive bimonthly period where tax-motivated shifting of income can take place. Note, finally, that this identification strategy is not very sensitive to differences in income trends across treatment and control groups, as is the case for the measure based on (1) and for studies of intertemporal shifting based on annual observations (Goolsbee, 2000; Heim, 2009; Giertz, 2010).

Figure 4, Panel A plots the average value of the shifting indicator 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.¹⁰ If, in addition, we impose the criteria that the November 2009 income is unusual low (50%) compared to November 2008 then the result indicates that around 1.5 percent of the taxpayers in the T-group shift income from both November and December. Finally, if we extend the period of the analysis to October 2009 then it indicates that only around 0.4 percent shift three months of income.¹¹

⁹In a follow-up paper, we provide evidence on the relative importance of these two types of avoidance strategies for year-end tax planning of top managers (Kreiner, Leth-Petersen and Skov, 2014).

¹⁰The 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. Another concern is whether the results are affected by changes in bonus patterns and in exit rates from the labor market due to the financial crisis during this period. In a sensitivity analysis, we have restricted the sample to employees without any exit to unemployment during 2009 and 2010. This did not have any significant effect on the results. Some employees may not have received a bonus, that they would otherwise have received, because of the crisis. This may imply that we underestimate the degree of income shifting in a normal business cycle situation.

¹¹There may be different reasons why tax payers did not shift more than two months of income: (i) There was a discussion in the media about the shifting possibility but it was not before mid-October it became completely clear that shifting was not against any legal rules as described in Section 7.6. (ii) Some

5 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% 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), (iii) [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 takes 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 among the top earners. These estimates are striking as they only concern wage and salary income. People at the highest end of the income distribution may 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.

6 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 (long run) ETI that may be used to compute the permanent tax distortions of a given tax structure.

of the shifting reflects postponement of a year-end bonus. (iii) Liquidity constraints may have a role to play as indicated by the evidence in Section 7.3. (iv) Some taxpayers may be worried of losing their wage payment, e.g. if the firm goes bankrupt or if they are fired before receiving the money.

The transitory income movements due to income shifting may have implications for the estimation of ETI that exploits reform-driven variation in tax rates for identification (Saez, Slemrod and Giertz, 2012). If taxpayers temporarily shift income from a period with a high tax rate to a period with a low tax rate then this effect may enter into the empirical estimate, implying the estimated short run ETI is an upward biased estimate of the long run elasticity.¹² Goolsbee (2000) studied this potential effect in a standard regression specification where he allowed tax-reform variation across treatment and control groups to affect income in the year before the reform. 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 long run elasticity. Similar approaches on annual income data have been used by Heim (2009), who studied the income responses to US tax reforms in 2001 and 2003 without detecting significant intertemporal shifting effects, and by Giertz (2010), who studied US tax reforms in the 90s and found evidence of shifting effects.

In this section, we exploit the monthly frequency of our data to identify in a new way the extent to which the short run ETI may be attributed to income shifting responses. We start by computing a simple, traditional difference-in-difference estimate of the ETI:

$$\text{ETI} = \frac{\frac{1}{n^T} \sum_{i \in T} \frac{\bar{z}_{2010,i} - \bar{z}_{2009,i}}{\bar{z}_{2008,i}} - \frac{1}{n^C} \sum_{i \in C} \frac{\bar{z}_{2010,i} - \bar{z}_{2009,i}}{\bar{z}_{2008,i}}}{\frac{\Delta \tau_T}{1 - \tau_T} - \frac{\Delta \tau_C}{1 - \tau_C}}. \quad (3)$$

The numerator is the percentage change in yearly gross 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, while the denominator is the percentage change in the net-of-tax rate of the T-group due to the reform (19%) minus the corresponding change of the C-group (2%) described in Section 2.¹³ This overall ETI estimate, reported in the top-left

¹²Note that an estimate of the short run ETI may also underestimate the long run ETI because of short-run adjustment costs implying that behavioral responses are larger in the long run than in the short run. We return to this later in this section and in Section 8.

¹³We measure the income differences relative to 2008 rather than 2009 income levels because the latter

corner of Table 1, equals 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 estimate that 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 9,000 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 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

$$\text{ETI} = \frac{\frac{1}{n^T} \sum_{i \in T} \frac{[z_{2010,i}^{\text{Jan}} - z_{2008,i}^{\text{Jan}}] - [z_{2009,i}^{\text{Dec}} - z_{2008,i}^{\text{Dec}}]}{\bar{z}_{2008,i}} - \frac{1}{n^C} \sum_{i \in C} \frac{[z_{2010,i}^{\text{Jan}} - z_{2008,i}^{\text{Jan}}] - [z_{2009,i}^{\text{Dec}} - z_{2008,i}^{\text{Dec}}]}{\bar{z}_{2008,i}}}{\frac{\Delta\tau_T}{1-\tau_T} - \frac{\Delta\tau_C}{1-\tau_C}}. \quad (4)$$

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 then we can remove shifting from the ETI estimate by basing the estimation only on the remaining

is influenced by the shifting behavior and in order to keep consistency with the remaining part of the analysis. The sensitivity analysis in Table A2 shows that the ETI results are similar if we instead use 2009 as the baseline year for the analysis.

22 months. This gives an estimate equal to 0.03 (column 4). However, the evidence in Section 4, for example Figure 3, shows that some individuals also shift their November 2009 income, and in column 5 we therefore also exclude November 2009 from the estimation. In that case, the point estimate of the ETI without shifting 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 short run 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.

The standard difference-in-difference approach relies on a strong assumption of a common trend of the T-group and the C-group. This assumption may be problematic, for example, because young wage earners have a more step income profile and are more dominant in the control group. In Table A1 in the appendix, we repeat the ETI estimates in Table 1 but from a regression where we allow income growth to be explained by cohort dummies, gender, marital status, region dummies, industry type dummies and firm size dummies. All the estimates change only a little and the conclusions are therefore the same (this is also the case if including only a subset of the control variables). Unobserved heterogeneity may still imply that top income individuals have experienced another income development than the control group but the fact that top income shares have been almost constant for two decades in Denmark, unlike many other countries, indicate that this is not the case (Kleven and Schultz, 2013).

A number of sensitivity analyses reported in Table A2 show that the results are also robust to changing the size of the control group, to changing the baseline year and to the removal of taxpayers around the top tax threshold. The removal of taxpayers within an income range around the top tax threshold (the Doughnut sample) is a way to reduce the importance of mean reversion, which can lead to a downward bias in the ETI estimates. The estimates increase only a little suggesting that mean-reversion is not a major problem

for our overall ETI estimate.¹⁴

It is common in the literature to look at three-year income differences, using annual income in the year before the reform and annual income observed two years after the reform. The idea is that the use of a longer period may be better at overcoming adjustment costs in short-run decision-making run and thereby provide a better estimate of the long run ETI.¹⁵ This procedure also reduces the bias from income shifting because now it is only the year before the reform that is affected by shifting. The last row of Table A2 reports the results if we use data from 2011 (the last year in our data) instead of 2010 for our analysis, i.e. a two-year window, also implying that only the year before the reform is affected by shifting. In this case, the baseline ETI estimate drops from 0.10 to 0.08. As expected, the shifting component also becomes smaller, implying that the ETI estimates after controlling for shifting are now slightly higher and significant (although still rather small), but shifting may still account for more than half of the ETI estimates.

7 The anatomy of shifting behavior

Our results indicate that shifting activity is concentrated among a small group of employees in the treatment group, i.e., around 3 percent according to the 50%-50% criteria. This is consistent with other types of evidence showing that taxpayers engage less in tax avoidance than what is predicted by a standard economic model (Andreoni, Erard and Feinstein, 1998). There may be different reasons why an employee does not engage in intertemporal income shifting: he may not be fully aware of the opportunity; he may not be willing to shift because of moral sentiments, guilt or social norms; he may have insufficient savings, or access to credit, to maintain living expenses during the period where income is shifted forward; he may be worried that he might loose the wage payment, for example if the firm

¹⁴This approach tests only mean-reversion effects around the top tax threshold and the selection into treatment and control group but does not control for mean-reversion effects within the treatment group. Such effects may be important when looking at particular income groups, especially the top 1% group where mean-reversion effects could be large.

¹⁵Potential problems of extending the observation period in order to obtain better estimates of the long run ETI are 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. New reforms may also limit the observation window that can be used.

goes bankrupt before he receives the postponed payment; his employer may be unwilling to cooperate in organizing income shifting, for example because of the effect it may have on the public reputation of the firm if the activity becomes public information.

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.

7.1 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 out across the various industry groups, suggesting that shifting conditions, for example the willingness of employers to cooperate about shifting, are similar across industries. 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.¹⁶

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, Accountants—a small subgroup within Other Business Services—is 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.

¹⁶ A reason may be it is common in the financial sector to receive bonuses in April, which were impossible to shift, rather than at the end of the year.

7.2 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 becomes small and insignificant when we remove shifting in the same way as done in Table 1.

7.3 Liquidity constraints

The decision to engage in income shifting likely also depends on the financial position of the employee. 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).¹⁷ 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.

7.4 Multivariate analysis

So far we have provided evidence based on bivariate correlations of the 50%-50% shifting indicator with industry type workplace, firm size, top 5 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

$$y_i = \beta_0 + d_i\beta_1 + \mathbf{x}_i\beta_2 + d_i(\mathbf{x}_i - \bar{\mathbf{x}}_i)\beta_3 + \varepsilon_i, \quad (5)$$

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, \mathbf{x}_i is a vector of explanatory factors, $\bar{\mathbf{x}}_i$ is the sample mean of the explanatory variables, and ε_i is an error term. In this specification, β_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 β_3 captures

¹⁷A 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.

variation in the share of shifters across observables around the mean effect (Wooldridge, 2002). Column 1 of Table 3 displays the estimate of β_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, we have added explanatory variables, \mathbf{x} , corresponding to the factors studied in the partial analyses presented in the previous subsections. The first conclusion from this exercise is that the β_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 β_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 none-binding liquidity constraints.¹⁸

7.5 Private sector versus public sector

A natural presumption is that public sector employers are 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.

7.6 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. There was a fairly intense debate in the popular press, including countrywide newspapers and on the webpage of the news

¹⁸We 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.

programs of the two major nationwide TV channels (DR and TV2), about the possibility of shifting earnings, and in mid-October a tax official from the Danish tax agency was cited in a newspaper article saying that income shifting is legal. In order to get a better 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 it is most beneficial to obtain extra wage income after New Year, and most people state 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 payment after New Year. Around 40 percent of the respondents stated 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 publicly 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 suggest 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.

8 Concluding Remarks

Our results contribute in several ways to the empirical literature on the behavioral effects of taxation. First, using high-frequency income data we show that intertemporal income shifting is a significant issue for regular wage income and not only for more exotic types of compensation.¹⁹ Second, shifting may well account for all the income variation used to estimate the short run ETI and may explain why estimates become increasing in 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

¹⁹The effect of the financial crisis, if any, is probably to underestimate the degree of income shifting in a normal business cycle situation because some employees lose a bonus that they would normally receive. In a sensitivity analysis, we have examined whether differences across T-group and C-group in exit to unemployment during 2009 and 2010 have an effect on the results without finding any significant effect.

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.

Our finding of a short run ETI close to zero after removing the shifting component may potentially reconcile why Chetty, Friedman, Olsen and Pistaferri (2011) find elasticities 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.

It is important to recognize that our results concerning the short-run ETI do not necessarily imply that the long-run elasticity relevant for tax policy analyses is negligible. As shown in Chetty (2012), small frictions may imply that the long run elasticity is of a considerable size, although the estimated short run ETI is small or even zero. Consistent with this view, studies have found larger ETI estimates when considering a longer time horizon (e.g. Giertz, 2010). Other types of evidence also point to a non-trivial long run elasticity, for example the compelling non-parametric evidence of longer run effects in Kleven and Schultz (2013) and the structural analysis of labor mobility in Kreiner, Munch and Whitta-Jacobsen (2014). Moreover, while we have focused on wage income responses as also done in other studies (e.g. Chetty, Friedman, Olsen and Pistaferri, 2011), it is important to keep in mind that ETI analyses often includes other important income sources that may be more responsive to taxation and therefore important for economic efficiency.

Our results indicate that information and salience is important for income shifting behavior but our analysis cannot establish a causal relationship, as it is done by 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 remarkable that so few engage in shifting among those who seem to be informed. Our evidence points to the importance of liquidity constraints and firm

cooperation but we cannot rule out other explanations, for example tax moral and social norms.

Significant intertemporal 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.²⁰ Thus, from a standard equality-efficiency trade-off perspective, social welfare would increase if income shifting was prevented or reduced. One way to reduce shifting could be to require taxes 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. On the other hand, it may not be very effective because it is difficult for the tax authorities to detect and prove that intertemporal income shifting has taken place when, say, a bonus payment is received in January instead of December.

References

- Andreoni, J., B. Erard, and J. Feinstein (1998). "Tax Compliance." *Journal of Economic Literature* 36, 818-860.
- Banks, J. and P. Diamond (2011). "The Base for Direct Taxation." in J. Mirrlees, S. Adam, T. Besley, R. Blundell, S. Bond, R. Chote, M. Gammie, P. Johnson, G. Myles, and J. Poterba (eds), *Dimensions of Tax Design: The Mirrlees Review*. Oxford: Oxford University Press.
- Chetty, R. (2012). "Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply." *Econometrica* 80(3): 969-1018.

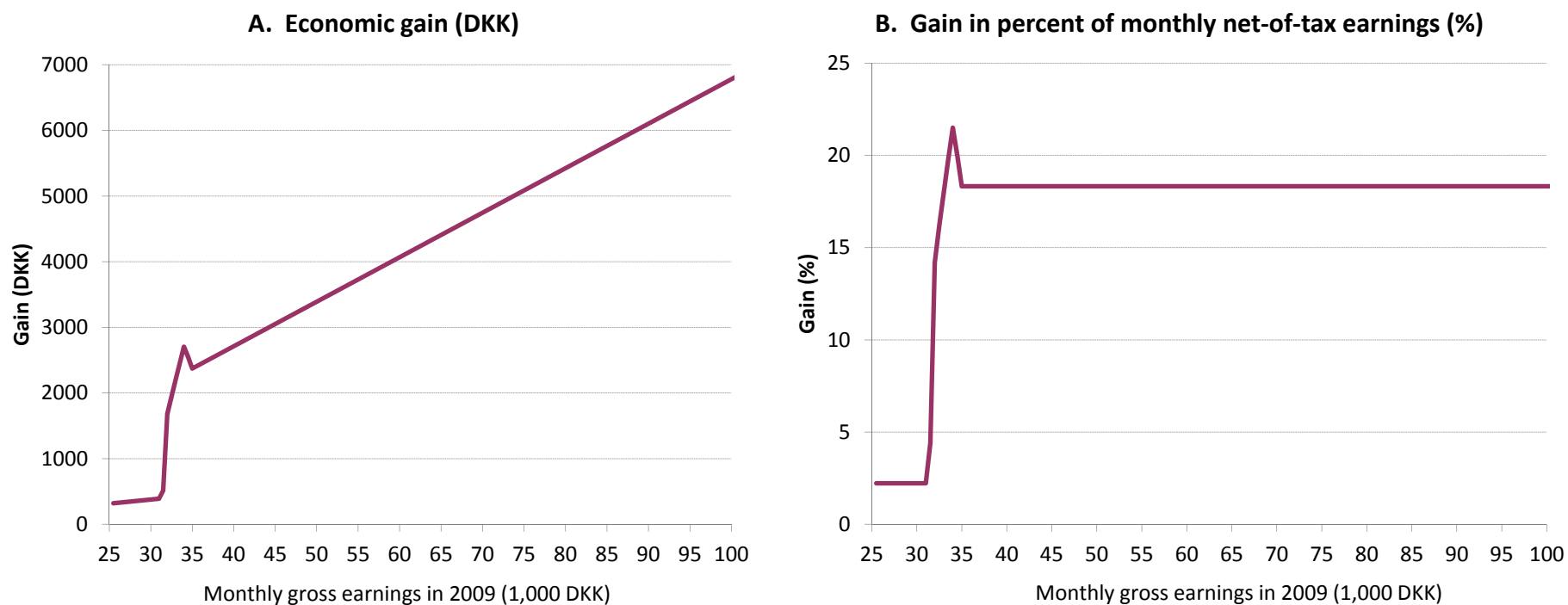
²⁰The effect on economic efficiency is negative in a standard neoclassical setting. The change in economic efficiency from a (small) tax reform is approximately equal to the behavioral effects on government revenue, which is negative because shifting behavior reduces tax revenue.

- Chetty, R., J. Friedman, T. Olsen, and L. Pistaferri (2011). "Adjustment Costs, Firm Responses, and Micro vs. Macro Labor Supply Elasticities: Evidence from Danish Tax Records." *Quarterly Journal of Economics* 126, 749-804.
- Chetty, R., J. Friedman and E. Saez (2013). "Using Differences in Knowledge Across Neighborhoods to Uncover the Impacts of the EITC on Earnings." Forthcoming in the *American Economic Review*.
- Chetty, R., A. Looney and K. Kroft (2009). "Salience and Taxation: Theory and Evidence." *American Economic Review* 99, 1145-77.
- Congressional Budget Office (2013). "The Budget and Economic Outlook: Fiscal Years 2013 to 2023." February 2013. Congress of the United States.
- Feldstein, M. (1995). "The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act." *Journal of Political Economy* 103, 551-572.
- Giertz, S.H. (2010). "The Elasticity of Taxable Income during the 1990s: New Estimates and Sensitivity Analyses." *Southern Economic Journal* 77(2), 406-433.
- Goolsbee, A. (2000). "What Happens When You Tax the Rich? Evidence from Executive Compensation." *Journal of Political Economy* 108, 352-378.
- Immervoll, H., H.J. Kleven, N. Verdelin, and C.T. Kreiner (2011). "Optimal Tax and Transfer Programs for Couples with Extensive Labor Supply Responses." *Journal of Public Economics* 95, 2011, 1485-1500.
- Johnson, D.S., J.A. Parker, and N.S. Souleles (2006). "Household Expenditure and the Income Tax Rebates of 2001." *American Economic Review* 96(5), 1589-1610.
- Heim, B.T. (2009). "The Effect of Recent Tax Changes on Taxable Income: Evidence from a New Panel of Tax Returns." *Journal of Policy Analysis and Management* 28(1), 147-163.
- Kleven, H.J., M. Knudsen, C.T. Kreiner, S. Pedersen, and E. Saez (2011). "Unwilling or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark." *Econometrica* 79, 651-692.
- Kleven, H.J., C. Landais, E. Saez, and E.A. Schultz (2014). "Migration and Wage Effects

- of Taxing Top Earners: Evidence from the Foreigners' Tax Scheme in Denmark". *Quarterly Journal of Economics* 129, 333-378.
- Kleven, H.J. and E.A. Schultz (2013). "Estimating Taxable Income Responses using Danish Tax Reforms." Forthcoming in the *American Economic Journal: Economic Policy*.
- Kopczuk, W. (2005). "Tax Bases, Tax Rates, and the Elasticity of Reported Income." *Journal of Public Economics* 89, 2093-2119.
- Kreiner, C.T., J.R. Munch and H.J. Whitta-Jacobsen (2014). "Taxation and the Long Run Allocation of Labor: Theory and Danish Evidence." Forthcoming in *Journal of Public Economics*.
- Kreiner, C.T., S. Leth-Petersen and Peer Ebbesen Skov (2014). "Year-End Tax Planning of Top Management: Evidence from High-Frequency Payroll Data." *American Economic Review: Papers and Proceedings* 104, 154-158.
- le Maire, D. and B. Schjerning (2013). "Tax Bunching, Income Shifting and Self-employment." *Journal of Public Economics* 107, 1-18.
- Leth-Petersen, S. (2010). "Intertemporal Consumption and Credit Constraints: Does Consumption Respond to an Exogenous Shock to Credit?" *American Economic Review* 100, 1080-1103.
- Saez, E. (2010). "Do Taxpayers Bunch at Kink Points?" *American Economic Journal: Economic Policy* 2 (3), 180-212.
- Saez, E., J. Slemrod, and S.H. Giertz (2012). "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review." *Journal of Economic Literature* 50(1), 3-50.
- Sammartino, F. and D. Weiner (1997). "Recent Evidence on Taxpayers' Response to the Rate Increases in the 1990's." *National Tax Journal* 50, 683-705.
- Slemrod, J. (1995). "Income Creation or Income Shifting? Behavioral Responses to the Tax Reform Act of 1986." *American Economic Review Papers and Proceedings* 85, 175-180.
- Slemrod, J. (1998). "Methodological Issues in Measuring and Interpreting Taxable Income Elasticities." *National Tax Journal* 51, 773-88.

- Slemrod, J. and S. Yitzhaki (2002). "Tax avoidance, evasion and administration," in A. J. Auerbach and M. Feldstein (eds.), *Handbook of Public Economics* III, Amsterdam, Elsevier.
- Wooldridge, J.M. (2002). "*Econometric Analysis of Cross Section and Panel Data*." Cambridge, Massachusetts: MIT Press.
- Zeldes, S.P. (1989). "Consumption and Liquidity Constraints: An Empirical Investigation." *Journal of Political Economy* 97(2), 305-346.

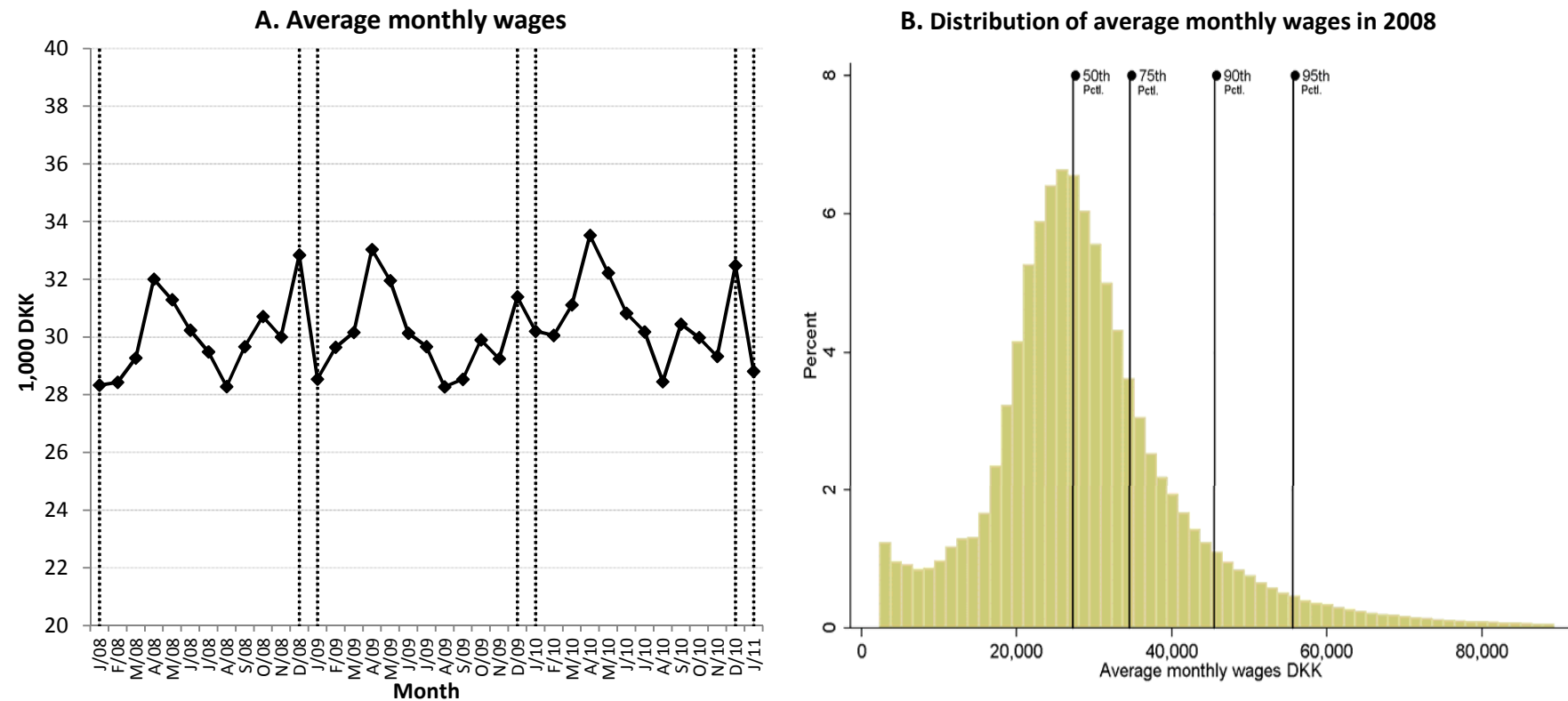
Figure 1: Incentive to shift one month's salary from 2009 to 2010



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. The top tax bracket starts around the income level of the 75th percentile.

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

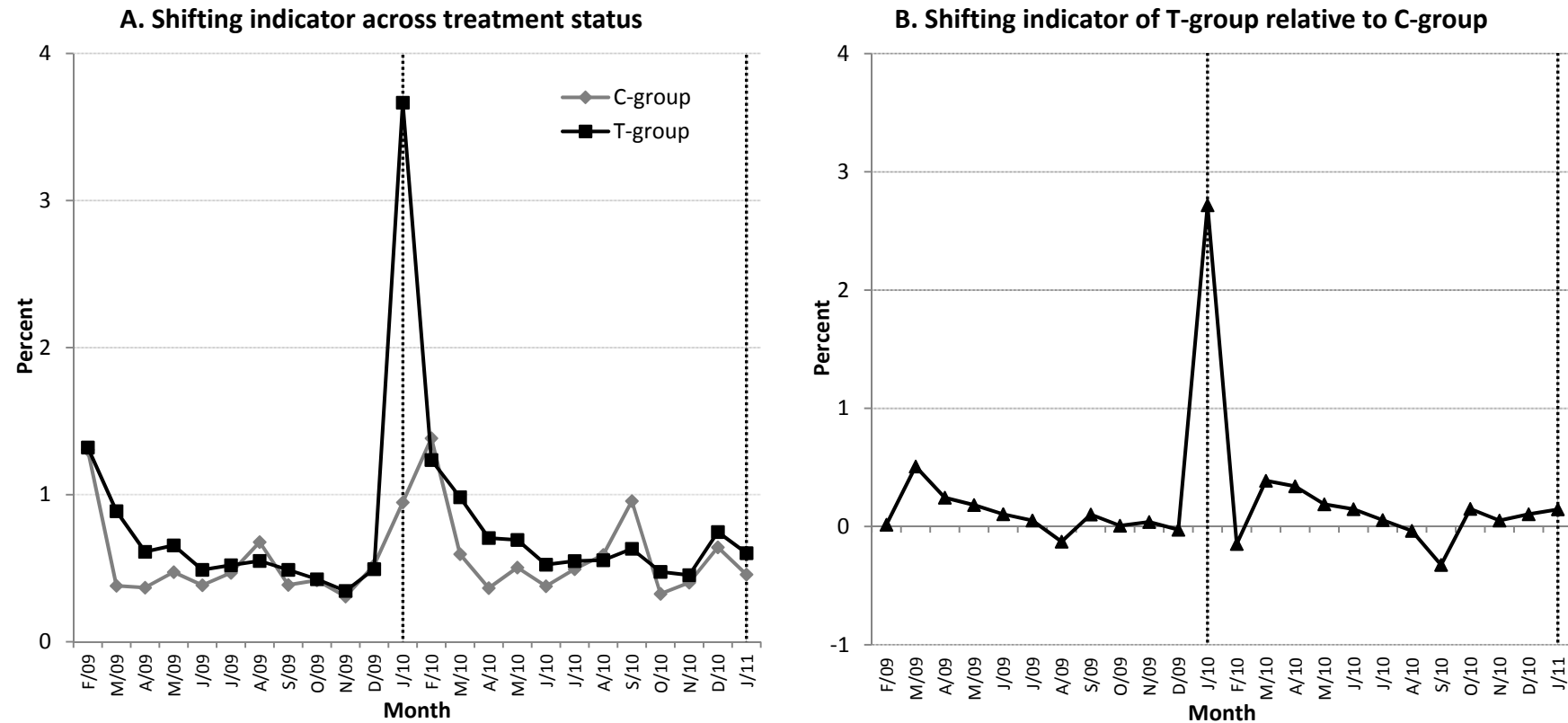
Figure 3: Share of income shifted



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).

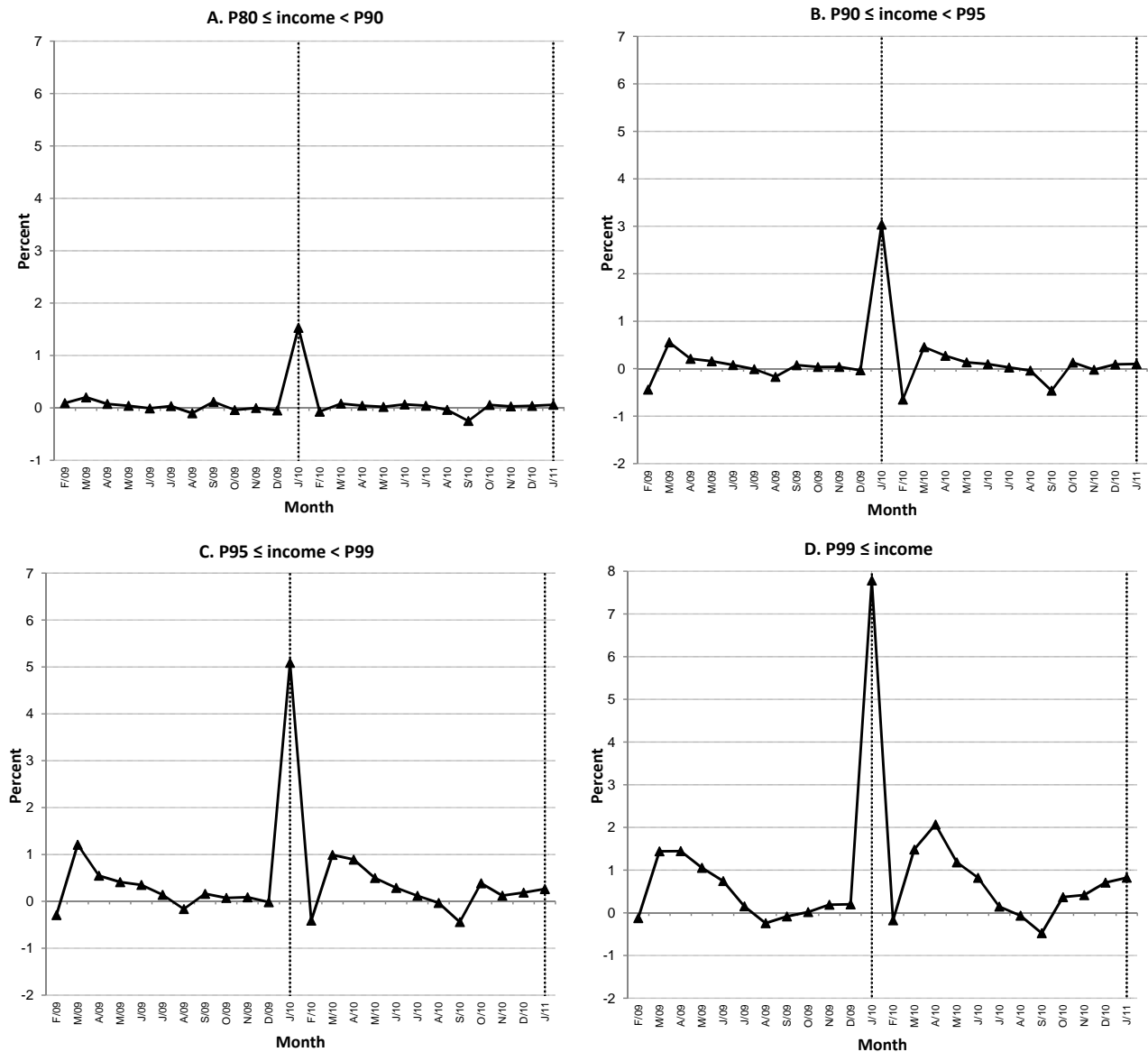
Figure 4: Share of employees shifting income



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, see equation 2. 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).

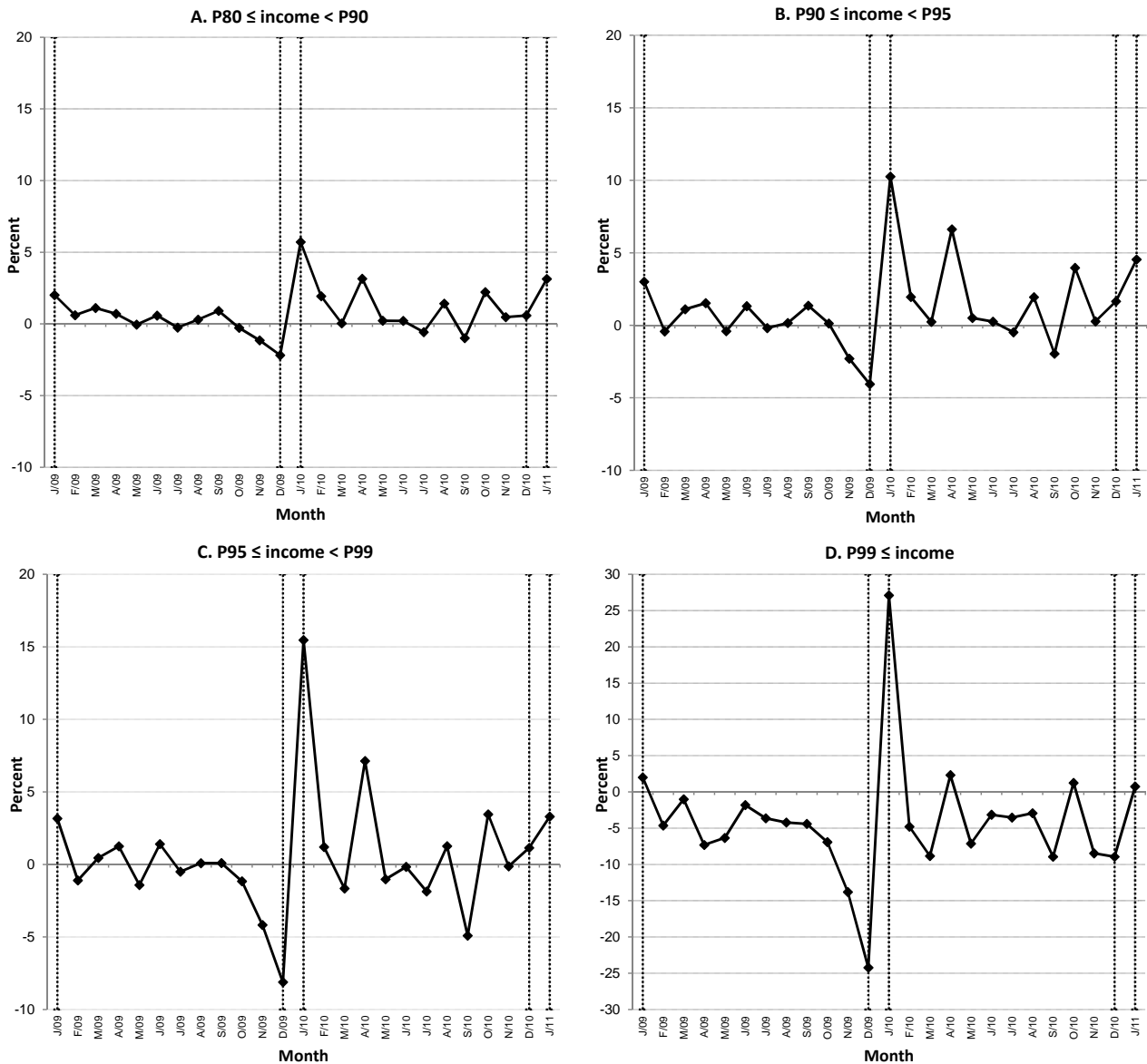
Figure 5: Share of employees shifting income across income groups



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, see equation 2. 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).

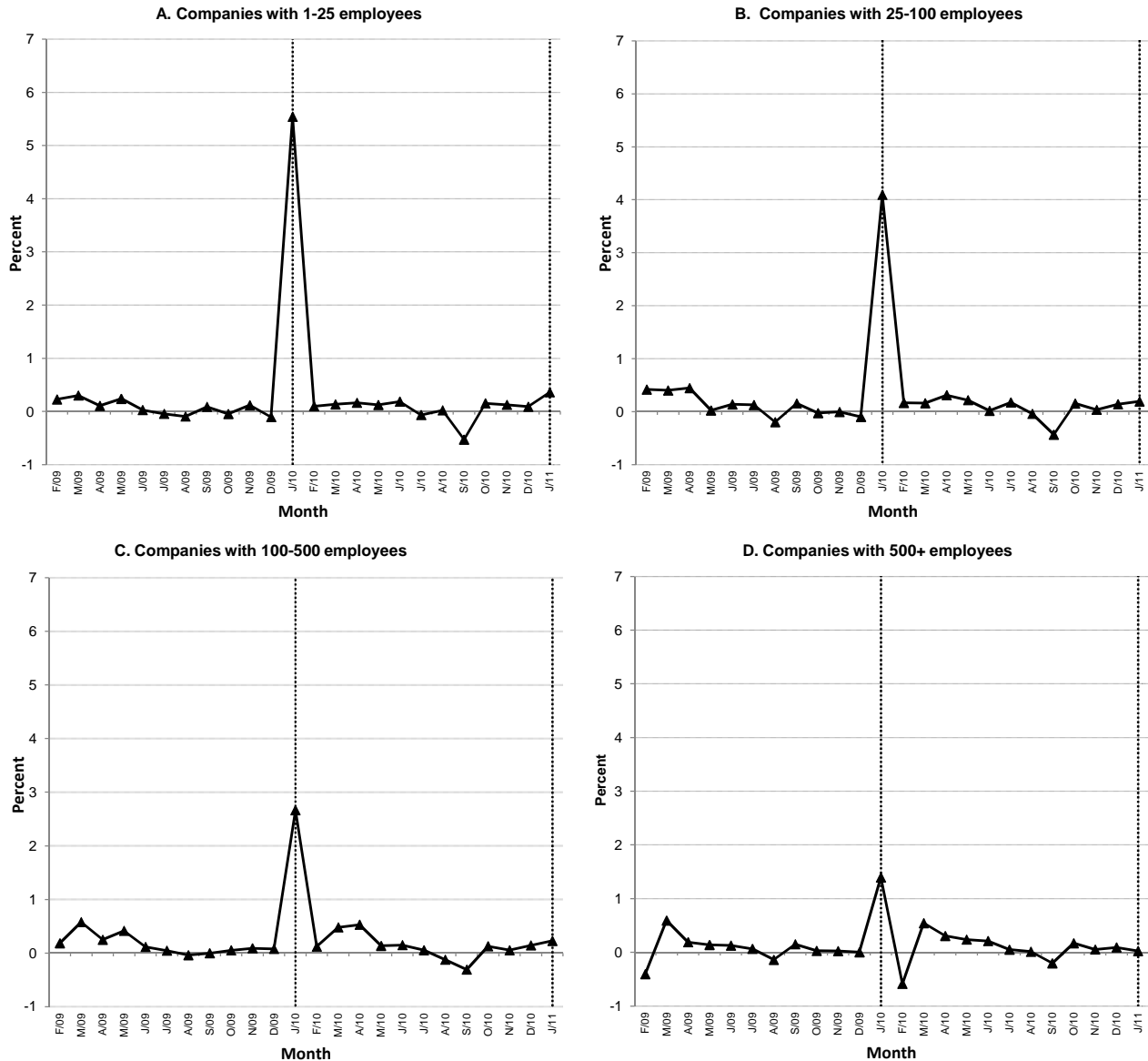
Figure 6: Share of income shifted across income groups



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 (elincome) register from the Danish tax authority (SKAT).

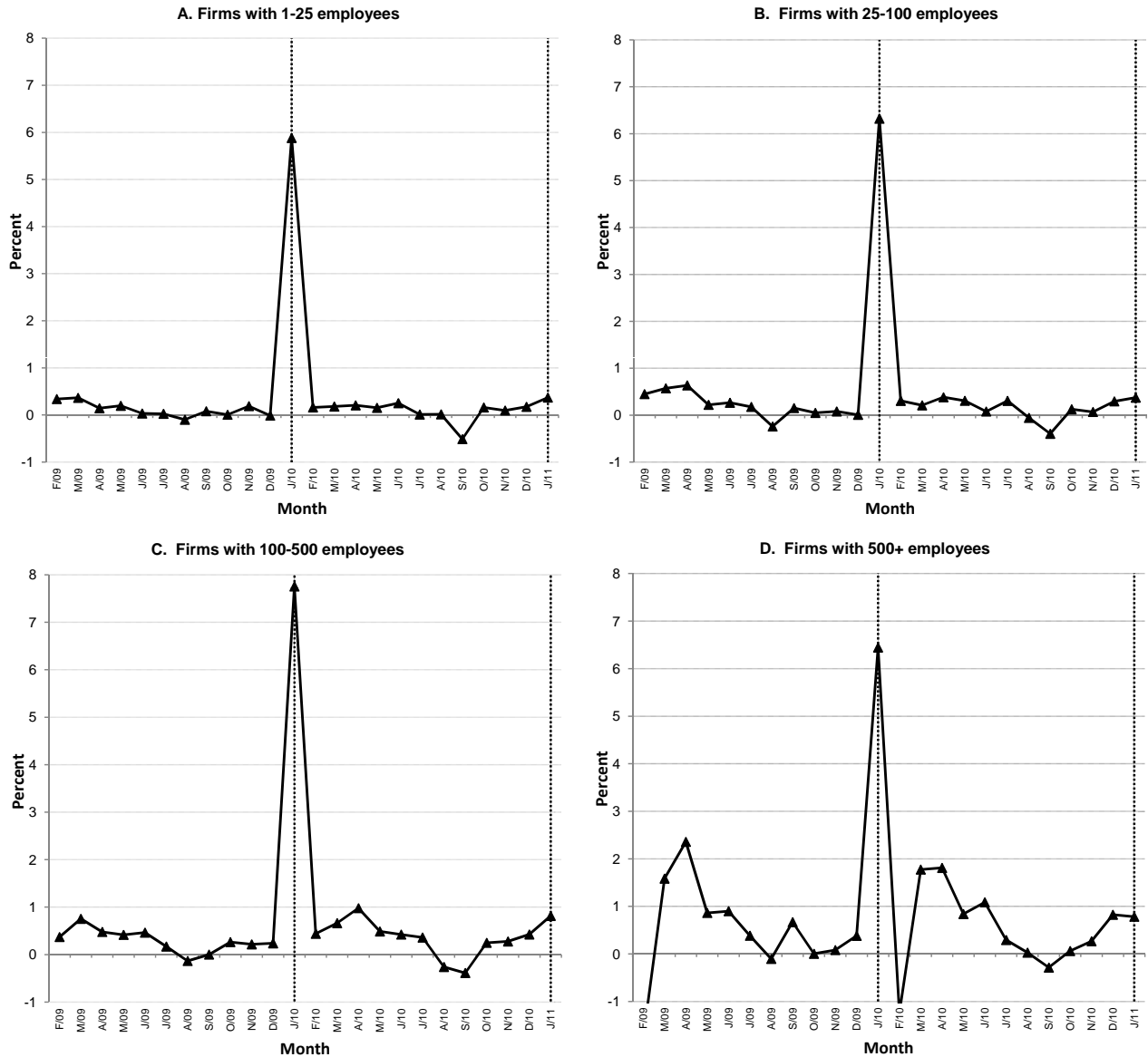
Figure 7: Share of employees shifting income across firm size



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).

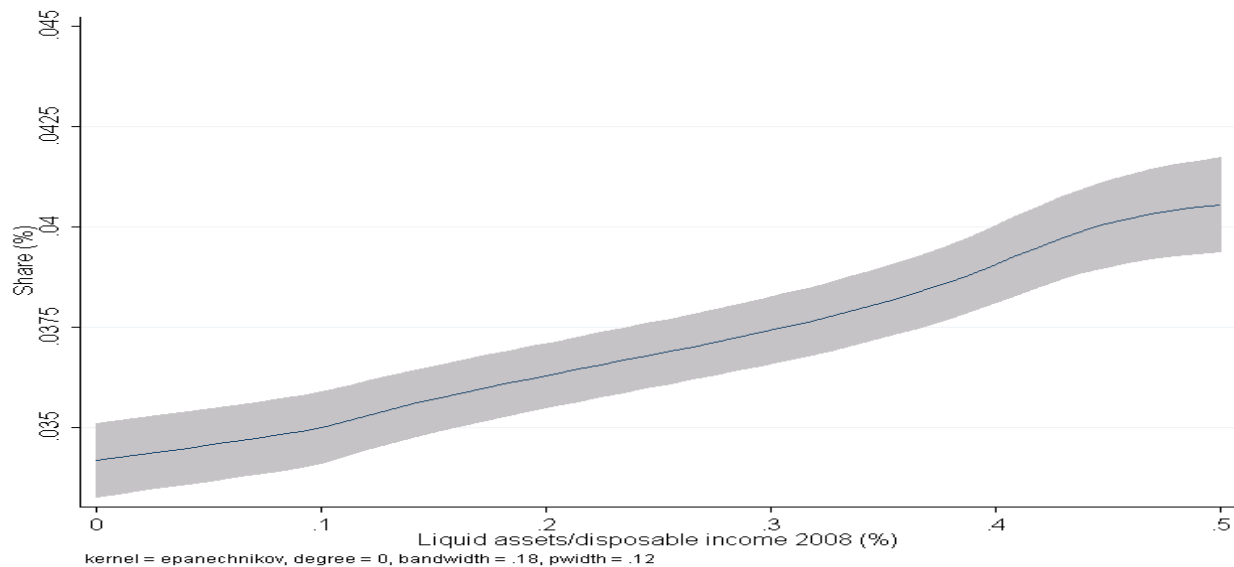
Figure 8: Share of top-five employees shifting income across firm size



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 (elincome) register from the Danish tax authority (SKAT).

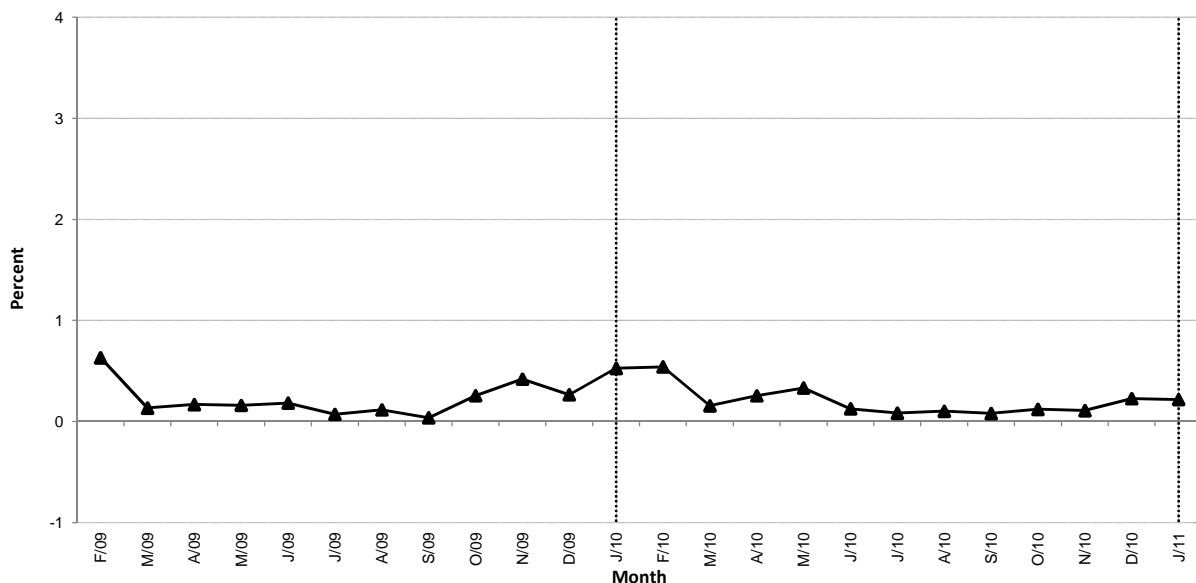
Figure 9: Share of employees shifting income as a function of liquidity



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.

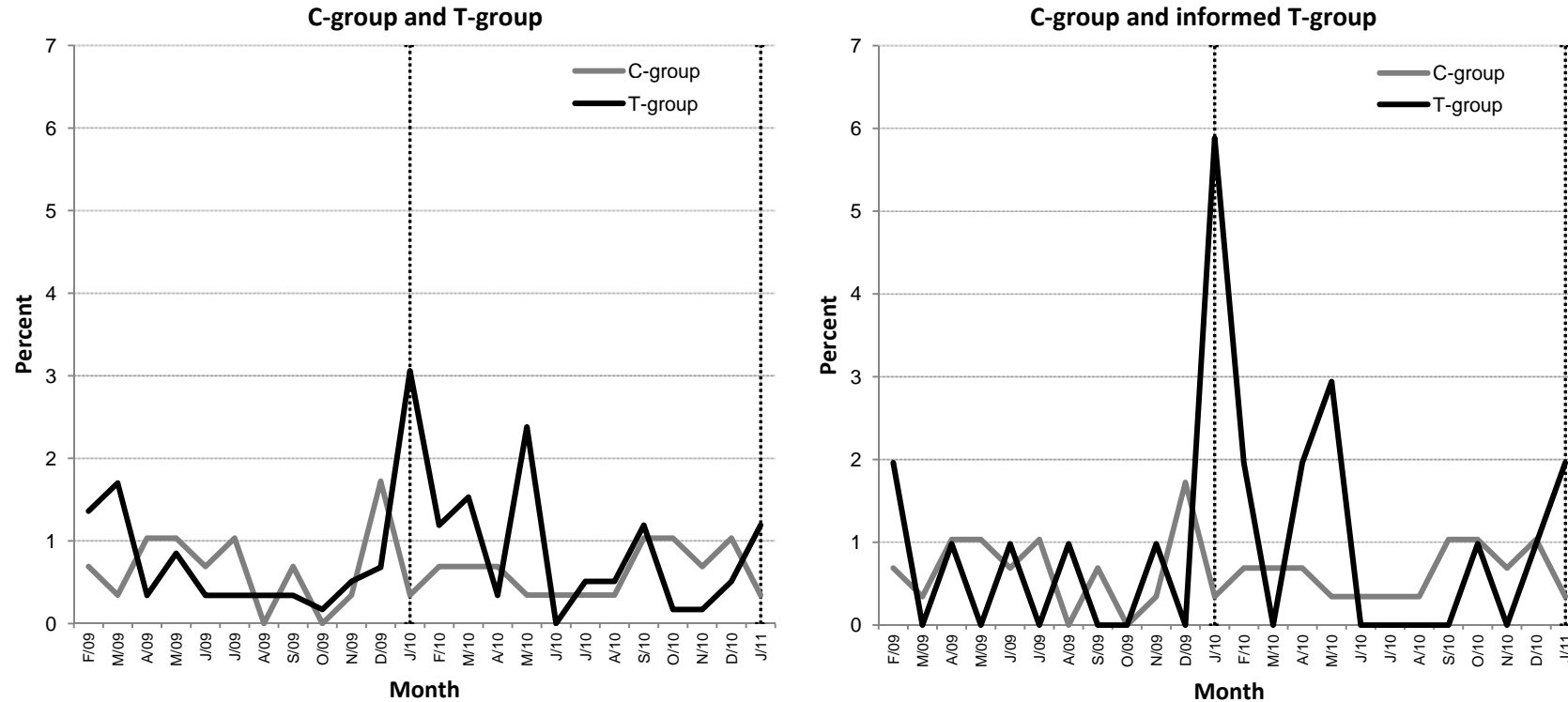
Figure 10: Share of employees shifting income in local government



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

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 \leq 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 \leq 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 \leq 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 \leq 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 \leq 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 (3) and (4), 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 and formula (2), are excluded from the sample. This excludes 9,088 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 (see formula (2)) 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 () and C-group () 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 A1: Diff-in-diff estimates of the elasticity of taxable income when including covariates

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	0.08 [0.07;0.10]	0.03 [0.02;0.05]	0.79 [0.76;0.83]	0.02 [0.00;0.03]	0.00 [-0.02;0.02]
income \leq P80	0.01 [-0.01;0.04]	0.00 [-0.02;0.03]	0.18 [0.13;0.24]	-0.00 [-0.03;0.02]	-0.01 [-0.04;0.02]
P80 \leq income < P90	0.05 [0.03;0.07]	0.02 [0.00;0.04]	0.48 [0.44;0.53]	0.01 [-0.01;0.03]	0.00 [-0.02;0.02]
P90 \leq income < P95	0.11 [0.09;0.14]	0.06 [0.03;0.08]	0.91 [0.85;0.97]	0.04 [0.02;0.06]	0.02 [-0.00;0.05]
P95 \leq income < P99	0.16 [0.13;0.18]	0.06 [0.04;0.08]	1.50 [1.42;1.57]	0.03 [0.01;0.06]	0.01 [-0.02;0.04]
P99 \leq income	0.26 [0.20;0.32]	0.10 [0.04;0.15]	3.26 [2.95;3.57]	-0.01 [-0.07;0.04]	-0.07 [-0.13;-0.01]

Note: This table of ETI estimates is identical to Table 1 with the only exception that we have included a large number of control variables in the regressions thereby allowing for differences in income growth based on observables. The table reports the ETI estimate of each regression and the 95% confidence intervals on these estimates in the brackets. All reported estimates include the following covariates: age dummies, gender dummy, marriage dummy, 5 regional dummies, 10 sector dummies (see Table 2) and 4 company size dummies (see Figure 7).

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

Table A2: 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. 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
C. 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
D. 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
E. 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
F. Post reform year 2011	0.08 [0.06;0.10]	0.05 [0.03;0.07]	0.45 [0.42;0.49]	0.05 [0.03;0.06]	0.03 [0.01;0.05]	212.874	105.600

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 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. The 'doughnut' sample excludes individuals with an average monthly 2008 earnings level in the range 33,000-37,000. Finally, the row 'Post reform year 2011' refers to estimates based on post reform income observations from 2011 instead of from 2010 used in the baseline.

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