

Ebbesen Skov, Per

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Essays in Empirical Public Finance: Tax Incentives and Taxpayer Behavior

PhD dissertation by
Peer Ebbesen Skov

November 2013

Presented at the
Department of Economics
Faculty of Social Sciences, University of Copenhagen

Acknowledgments

First and foremost I owe thanks to both my supervisors, Professor Claus Thustrup Kreiner and Professor Søren Leth-Petersen. You have both been excellent supervisors: highly inspiring, thoroughly demanding, and very encouraging. During our shared project on income shifting you have taught me by example just how high you set the bar for serious empirical work and at the same time showed me how much fun dedicated researchers have whilst working. And you have done it all while treating me as your peer (no pun intended); I couldn't have asked for anything more from the two most influential people in my academic life.

As part of my PhD I spent a semester at the Office of Tax Policy Research at the University of Michigan. I am grateful to Professor Joel Slemrod for giving me that opportunity and taking time out from a very busy schedule to meet with me and discuss my research. The easy access for a PhD student of economics to high profiled academic professionals continues to amaze me. During my research visit in Ann Arbor I shared an office with fellow PhD student Christian Gillitzer. From one of our many somewhat academic post-lunch discussions grew a joint project, which is now the second paper in my thesis. Working with Christian has been very rewarding and I hope we get more chances to collaborate in the future.

All my PhD projects build on administrative data from the Danish tax authority (SKAT) and I am very grateful they so generously shared their database with me. Receiving data access at SKAT I was, perhaps typical for a PhD-student, overly optimistic in estimating the time cost involved when working with new (raw) data. The potential serious effect of my lowball time estimates was only avoided thanks to Søren Pedersen and Morten Ravn Appelsø who both tirelessly answered all of my many questions on SKAT's data structure, variables and (non-secret) audit details etc. You have both gone well beyond the call of duty for any friend let alone government official, and I'm truly thankful.

Almost six years ago, I began working as a research assistant at the Rockwool Foundation Research Unit (RFF). Working for RFF research director Torben Tranæs showed me the crossroad between empirical research and policy relevance; the

intersection quickly turned out to be exactly where my research interest lies. After I completed my master's degree in economics, research director Torben Tranæs offered to finance my PhD. Naturally, I feel extremely privileged and am very thankful for his willingness to invest time and money in me.

In close to all of my six years at RFF I have been fortunate enough to share an office with Lars Højsgaard Andersen, who quickly progressed from colleague to friend and whose delicious cooking, good sense of humor, and very solid music taste certainly have made the long hours at the office substantially more worthwhile. To my two other fellow RFF PhD-students Peter Fallesen and Rasmus Landersø, you both made the time to come visit me in New York, US for my 30th birthday and survived a long night of karaoke singing and pickleback shots: I am forever indebted to both of you for not sharing any video recording of my efforts!

Finally, Sarah Chamberlin; you have been the voice that has kept me sane when data matrices threatened to suck me in, and your smile provided me with the best incentive I could have ever asked for to get through this PhD bonanza. And while I have learned a tremendous amount of economics over the course of the last three years, you taught me the only thing that is ever likely to save my life in the real world: ocean swimming. I can't wait for our next chapter together!

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Peer Ebbesen Skov.

Summary

The following three papers constitute my PhD thesis. The three papers are self-contained and I never thought of them as being part of a bigger picture (despite, of course, the thesis itself). Yet, from the broader perspective of economics there is likely a lot more that unite the papers than set them apart: they are all papers on the topic of public finance, and they are all empirical papers using administrative data, in fact as unit of observation they all use Danish taxpayers, and all the exogenous variation under study is provided by changes to the Danish tax law.

In the first paper *Tax Reforms and Intertemporal Shifting of Wage Income: Evidence from Danish Monthly Payroll Records*, which is joined with both my supervisors Professor Claus Thustrup Kreiner and Professor Søren Leth-Petersen, we show how Danish taxpayers shifted wage income from 2009 into 2010 to reduce their tax payments. 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.

In the second paper *Evidence on Unclaimed Charitable Contributions from the Introduction of Third-Party Information Reporting in Denmark*, which is joined with fellow PhD Student Christian Gillitzer, we show how the introduction of 3rd party reporting of charity contributions led to a surge in tax deductions claimed. The

introduction of information reporting and pre-population of charitable tax deductions in Denmark in 2008 coincided with a doubling in the number of tax deductions claimed, and a 15 percent rise in the value of claims. We attribute this change to incomplete claiming of eligible charitable tax deductions under the prior self-reporting regime: a pre-reform randomized audit shows a negligible amount of charitable overreporting, and we present evidence that there was no change in giving behavior around the time of the reform. We estimate the per-year average amount of forgone tax benefits to be small, but find that many taxpayers repeatedly failed to claim eligible charitable tax deductions under the self-reporting regime. We provide evidence on information frictions from taxpayer behavior due to a notched subsidy scheme.

In the third paper *Pay now or pay later: Danish Evidence on Owed Taxes and the Impact of Small Penalties*, I show how the introduction of a small interest penalty on owed taxes caused a significant advancement in the payment timing of owed taxes. Owed taxes arise when the sum of the foregoing tax year's preliminary tax payments falls short of the total tax liability. In 2009 the Danish tax authority (SKAT) introduced a small interest penalty amounting to a daily price of approximately DKK0.5 (US\$0.1) for the median amount of owed taxes. Using administrative tax data I show that the penalty introduction led to a 50-day advancement in payment timing. The evidence further indicates liquidity access as an important factor behind the taxpayer response.

Resumé (Danish summary)

Denne afhandling består af tre selvstændige artikler. Papirerne er selvstændige i den forstand, at resultaterne og konklusionerne i én artikel ikke har nogen sammenhæng til de to øvrige artikler. Artiklerne kan (bør) altså læses uafhængig af hinanden. I et bredere perspektiv er papirerne dog alligevel relativt ens, idet de alle tre beskæftiger sig med skatteyderadfærd, og hvordan denne bliver påvirket af ændringer i skatteincitamenter, som for eksempel en reduktion af marginals-katten: skatten på den sidst tjente krone. Faktisk er udgangspunktet for alle tre artikler ændringer i skatteloven, mens formålet er at vise, hvordan skatteyderne reagerede på disse lovændringer. Dermed falder alle tre artikler også ind under analysebetegnelsen *positiv*, som står i modsætning til *normativ* analyse, og som bl.a. handler om at vise effekterne af, ændringer i, (skatte-) lovgivningen. Ligeledes gør alle tre artikler også brug af, hvad der i dag populært kaldes *big data*: I alle tre artikler indeholder mit studie som udgangspunkt den fulde population af de danske skatteydere, mens observationensfrekvensen (hvor mange observationer jeg har per skatteyder) svinger mellem årlige, månedlige og per indbetaling. Endelig, og nok lidt mere diffust, følger alle tre artikler en nyere tendens i *public finance* litteraturen hvor resultaterne hovedsagligt rapporteres grafisk.¹ Således vil jeg mene, at den primære historie i hver af mine artikler kan fortælles (og forstås) ved en nøglefigur per artikel: figur 3 i artikel 1, figur 1 i artikel 2, og figur 4 i artikel 3.

I det første kapitel, som har titlen: *Tax Reforms and Intertemporal Shifting of Wage Income: Evidence from Danish Monthly Payroll Records*, viser mine to medforfattere (Professor Claus Thustrup Kreiner og Professor Søren Leth-Petersen) og jeg, hvordan den danske 2010-skattereform fik nogle skatteydere til at udskyde deres lønudbetaling fra slutningen af 2009 til januar 2010. Skattereformen i 2010 (forårspakken v.2.0) fjernede mellemskatten og medførte dermed en reduktionen i skatten på den sidst tjente krone fra 63 % i 2009 til 56 % i 2010. Reduktionen af marginals-katten i forårspakken v. 2.0 betød, at en lønmodtager med en månedlig indkomst på 75.000 kr. sparede ca. 5.000 kr. i skat ved at udskyde udbetalingen af decemberlønnen fra 1. december 2009 til 1. januar 2010. På trods af, at denne form for udskydelse af lønindkomst (indkomstperiodisering) er lovlig ifølge skatteloven, så finder vi, at kun ca. 6.000

¹ Public finance er den amerikanske betegnelse for studier af offentlig økonomi

skatteydere udnyttede muligheden for at spare i skat. Vi finder yderligere, at andelen, der indkomstperiodiserer, stiger med indkomsten, er højest for de toplønnede (lederne) i virksomhederne, er konstant over brancher, er størst for mindre virksomheder og hænger positivt sammen med en høj likviditet. Endelig finder vi ikke tydelige tegn på indkomstperiodisering blandt offentlige ansatte. Denne form for skatteyderadfærd er spændende i sig selv og repræsenterer et klassisk eksempel på skatteundvigelse, som er betegnelsen for på lovlig vis at udnytte en utilsigtet mulighed i skatteloven for dermed at reducere sin skattebetaling (mens skatteunddragelse er betegnelsen for at reducere sin skattebetaling på ulovlig vis, for eksempel ved sort arbejde). Derudover viser de udskudte lønudbetalinger sig også at være afgørende for en beregning af skattereformens effekt på arbejdsudbuddet. Den politiske motivation for reduktionen af marginals-katten var, at den lavere skat på lønindkomst ville medføre et øget arbejdsudbud. Traditionelt måles arbejdsudbudseffekten af en skattereform ved at sammenligne årsindkomster over tid og indkomstgrupper. Følger vi den klassiske beregningsmetode, finder vi effektestimater, der er tilsvarende tidligere resultater: når vi sænker marginals-katten (t) og derved hæver $(1-t)$ den disponible marginal indkomst med 1 %, så hæver skatteyderne deres (arbejdsudbud) lønindkomst med 0,1 %. Det resultat forsvinder, når vi tager højde for indkomstperiodisering. Med andre ord, så viser vores resultater, at hele kortsigtseffekten af skattereformen på den skattepligtige indkomst (arbejdsudbuddet) skyldes indkomstperiodisering (flytning af månedslønninger). Det er klart, at når skatteydere flytter indkomst på tværs af kalenderår for at spare i skat, så mister SKAT noget skatteprovenu. Overordnet er der dog tale om relativt små størrelser for der bliver, jo trods alt, betalt skat af månedslønningerne – det mistede skatteprovenu kommer af forskellen mellem marginals-kattesatsen på 56 % i 2010 i stedet for satsen på 63 % i 2009. Samtidig er der tale om en én gangs besparelse (per skattereform der sænker marginals-katten). Adfærd (indkomstperiodiseringen) har dog også (utilsigtede) fordelingsmæssige konsekvenser, idet vores analyser viser, at indkomstperiodiseringen (skattebesparelsen) primært fandt sted for individer med meget høj indkomst.

I det andet kapitel, som har titlen *Evidence on Unclaimed Charitable Contributions from the Introduction of Third-Party Information Reporting in Denmark*, undersøger jeg, sammen med Christian Gillitzer (Ph.d.-studerende fra University of Michigan),

betydningen af tredjeparts indberetning for antallet af ligningsmæssige fradrag for velgørhedsbidrag. Baggrunden er, at den danske skattelov indeholder mulighed for, at skatteyderne kan opnå et såkaldt ligningsmæssigt fradrag for indbetalinger til godkendte velgørhedsforeninger. Før 2008 fungerede det således, at skatteyderne modtog deres årsopgørelse i løbet af marts herefter udfyldte skatteyderne så selv rubrik 55 (felt 412) med deres fradrag, dernæst modtog skatteyderne en ny (endelig) årsopgørelse, som også indeholdt skatteydernes (selv-rapporterede) oplysninger om bidrag til velgørhed. I alt fik ca. 150.000 skatteydere fradrag for velgørhedsbidrag i 2007. Fra 2008 blev velgørhedsbidrag rapporteret til SKAT direkte fra velgørhedsorganisationerne: tredjeparts indberettet. Formålet med denne ændring af skatteloven var at nedbringe skatteydernes såkaldte *compliance* (regelefterlevelses) omkostninger samt at reducere evt. skattesnyd: overrapportering af velgørhedsbidrag for dermed at opnå et uberettiget skattefradrag. I alt fik ca. 300.000 skatteydere fradrag for velgørhedsbidrag i 2008, antallet med fradrag blev altså fordoblet på bare et år. Vores resultater viser, at langt hovedparten af de nye fradrag var små beløb. Vi estimerer, at værdien af det gennemsnitlige fradrag, der ikke blev indberettet i 2007, var 786 kr. hvilket, på grund af satsen (ca. 33 %) for ligningsmæssige fradrag, svarer til 262 kr. efter skat. Hvis vi ser på de skatteydere, som fik fradrag for et velgørhedsbidrag i 2008, men som ikke fik i hverken 2006 eller 2007 (ca. 150.000 skatteydere), så finder vi, at 68 % fik et fradrag for velgørhed hvert efterfølgende skatteår 2009-2011. Med andre ord tyder det på at mange faste donorer ikke fik fradrag under selv-rapporteringsregimet frem til 2007. I forhold til SKAT er det oplagt at når antallet af skatteydere der får fradrag for velgørhedsbidrag stiger, så mindskes skatteprovenuet. Ifølge vores beregninger mistede SKAT ca. 40 mio. kr. årligt på 2007/2008-overgangen fra selv- til tredjeparts-rapporterede velgørhedsbidrag. I den sammenhæng er det dog værd at holde sig for øje, at reduktionen af skatteprovenuet på ca. 40 mio. kr. skyldes en udgift til skatteydere, velgørheds donorer, der ikke selv rapporterede deres fradrag under selv-rapporteringsregimet frem til 2007.

I det tredje kapitel *Pay now or pay later: Danish Evidence on Owed Taxes and the Impact of Small Penalties*, undersøger jeg effekten af 2009-introduktion af en daglig rentestraf på betalingstidspunktet for restskat. Skatteåret følger kalenderåret og restskat opstår, når summen af skatteyderens løbende skatteindbetalinger (fx via arbejdsgiveren)

er mindre end hans samlede skattepligt. SKAT modtager i slutningen af hvert kalenderår information fra banker og arbejdsgivere omkring skatteyderens indkomstforhold. Disse oplysninger bruger SKAT til at beregne skatteyderens samlede skattepligt, som så holdes op imod skatteyderens samlede skatteindbetalinger. Resultatet af beregningen, årsopgørelsen, sendes til skatteyderne i begyndelsen af marts hvert år (dvs. ca. 3 måneder efter det aktuelle skatteår er slut). Når beregningen i årsopgørelsen viser, at skatteyderne har betalt mere skat i løbet af året end sin samlede skattepligt, så modtager skatteyderen den overskydende betaling på sin nemkonto. Når beregningen i årsopgørelsen viser, at skatteyderen har betalt mindre skat i løbet af året end sin samlede skattepligt, så skylder skatteyderen restskat. Før skatteåret 2009 informerede årsopgørelsen skatteydere med restskat om, at såfremt deres indbetaling faldt senest d.1. juli, så pågik der ikke renter på deres restskat. Med andre ord ydede SKAT skatteydere med restskat op til 6 måneders rentefri kredit. Reglerne medførte, at op mod 70 % af restskatteindbetalingerne fandt sted i ugen op til d. 1. juli, altså godt et halvt år efter skatteårets afslutning. Fra skatteåret 2009 blev der indført en strafrente på 4,6 % p.a. med første rentedag d. 1. januar, altså ca. 3 måneder før SKAT udsendte skatteyderens årsopgørelser. For langt hovedparten af skatteyderne var rentestrafpen dog minimal: medianrestskatten var på ca. 2.800 kr. Under det nye rentestraf-regime afhang den endelige restskat af betalingsdatoen. Således skulle en skatteyder med en restskat på 2.800 kr. betale 2.800 kr. d. 1. januar, ca. 2.825 kr. d. 1. marts og ca. 2.875 kr. d. 1. juli. Omregnet betyder det, at den daglige pris for ikke at betale lød på under 50 øre. Alligevel medførte 2009-introduktion af den daglige rentestraf, at den gennemsnitlige betalingsdato blev fremrykket med ca. 50 dage. Groft sagt ændrede skatteyderne betalingsdatoen fra slutningen af juni til midten af marts. Årsagen til at restskattebetalingen ikke blev fremrykket til d. 1. januar (den første rentedag), skyldes formentlig, at det ville medføre, at skatteyderne selv skulle udregne deres årsopgørelse, hvilket formentlig har en betydelig tids-/ressourceomkostning for de fleste skatteydere. Mine resultater viser yderligere, at restskatte-betalingsdatoen frem til 2009 var uafhængig af skatteyderens likviditet, stort set alle betalte den sidste uge i juni. Mens der efter 2009 er en positiv sammenhæng mellem at have høj likviditet og betale tidligt, skatteydere med *let* adgang til likviditet betaler deres restskat tidligere. Af måske særlig interesse for SKAT viser studiet, at de danske skatteydere reagerer på selv små

økonomiske incitamenter, men at *omgivelserne*, hvori disse incitamenter introduceres, er vigtig for skatteydernes respons: betalingsdatoen blev ikke rykket frem til før, skatteyderne automatisk modtager deres årsopgørelse (marts) – det ville simpelthen være for omkostningsfuldt (besværligt) for skatteyderne.

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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.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), 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

¹ 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.

² 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 2010.³ 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

³ 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).⁴

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) 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.⁵

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

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

⁵ 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.⁶ This leaves us with 329,270 individuals out of which 219,598 belong to the treatment group.

⁶ 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.⁷

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%

⁷ 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.⁸ 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

⁸ 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.⁹

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.

⁹ 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).¹⁰ 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 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 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,

¹⁰ 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 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 little liquidity.¹¹

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 understanding about the level of information and awareness, we included two

¹¹ 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.

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.¹² Thus, from a standard equality-efficiency trade-off perspective, social welfare would increase if income shifting was prevented or reduced. One way to

¹² 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.

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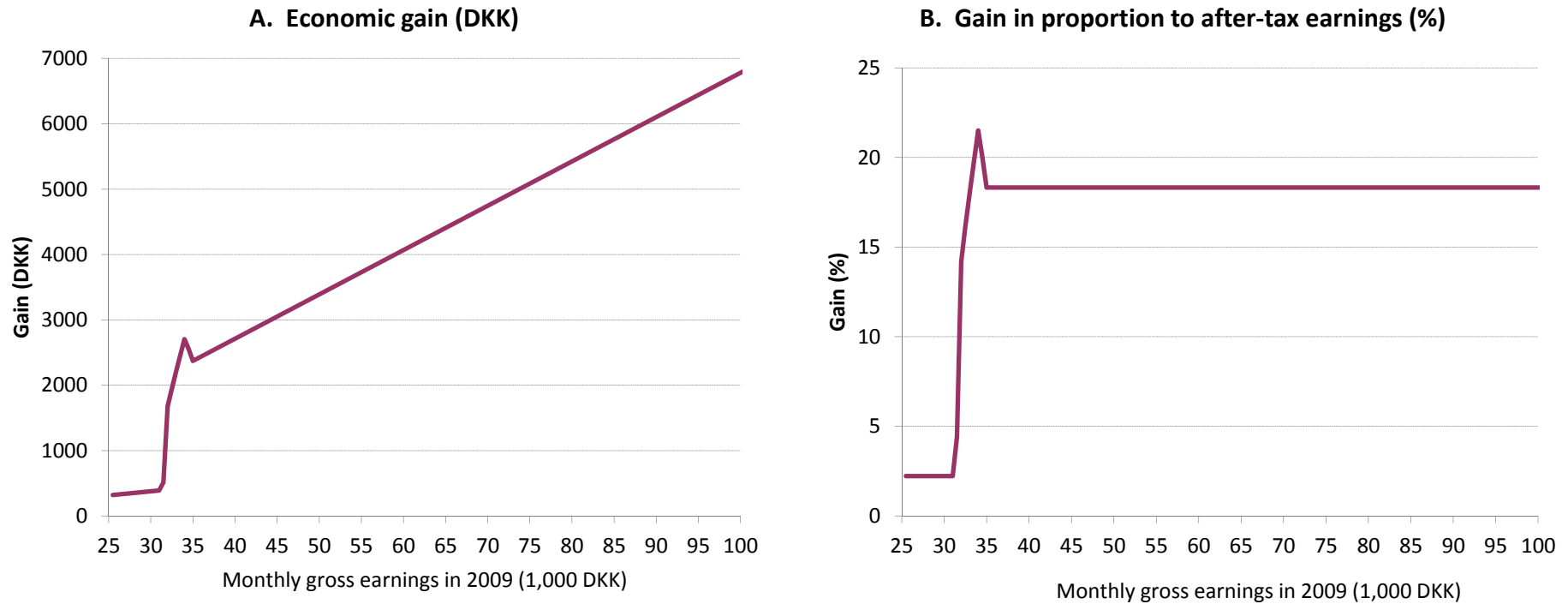
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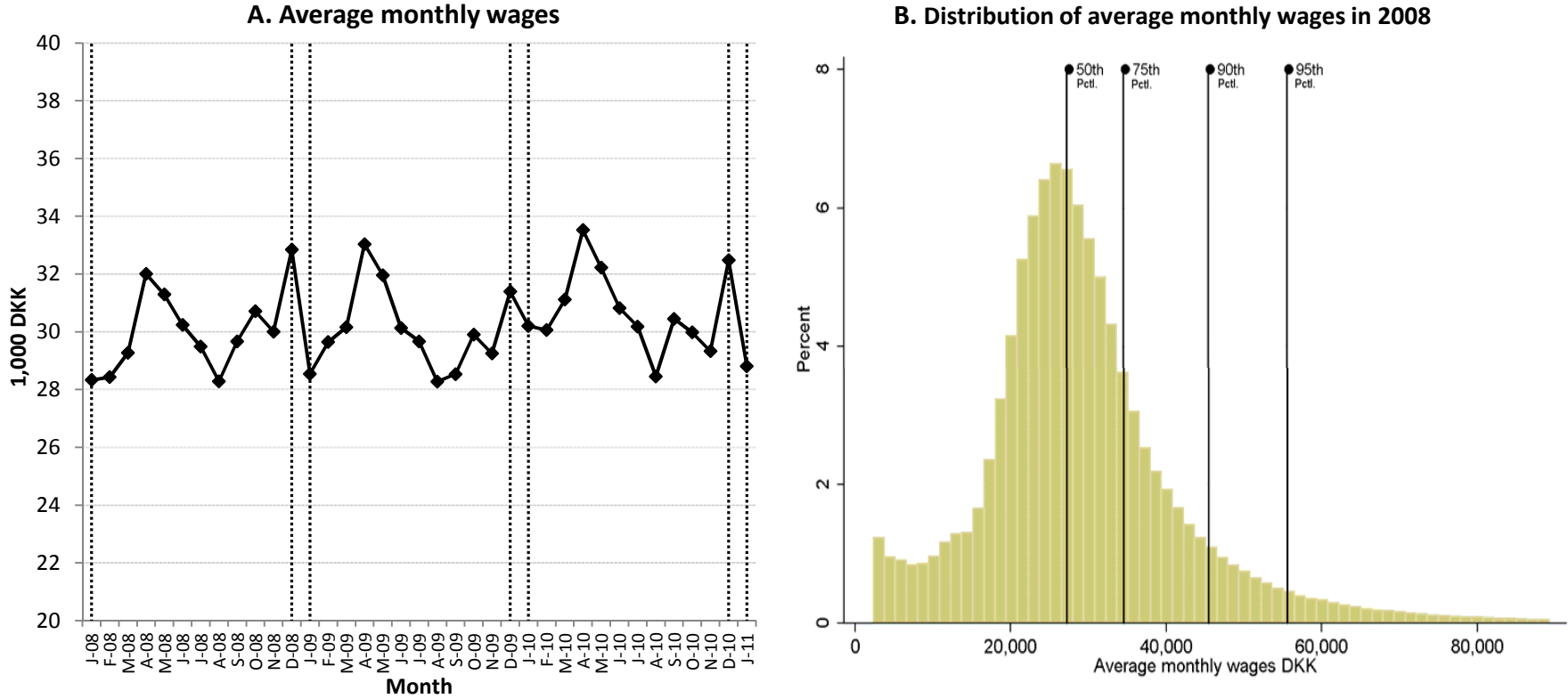
Figure 1: Incentive to shift one month's salary from 2009 to 2010



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).

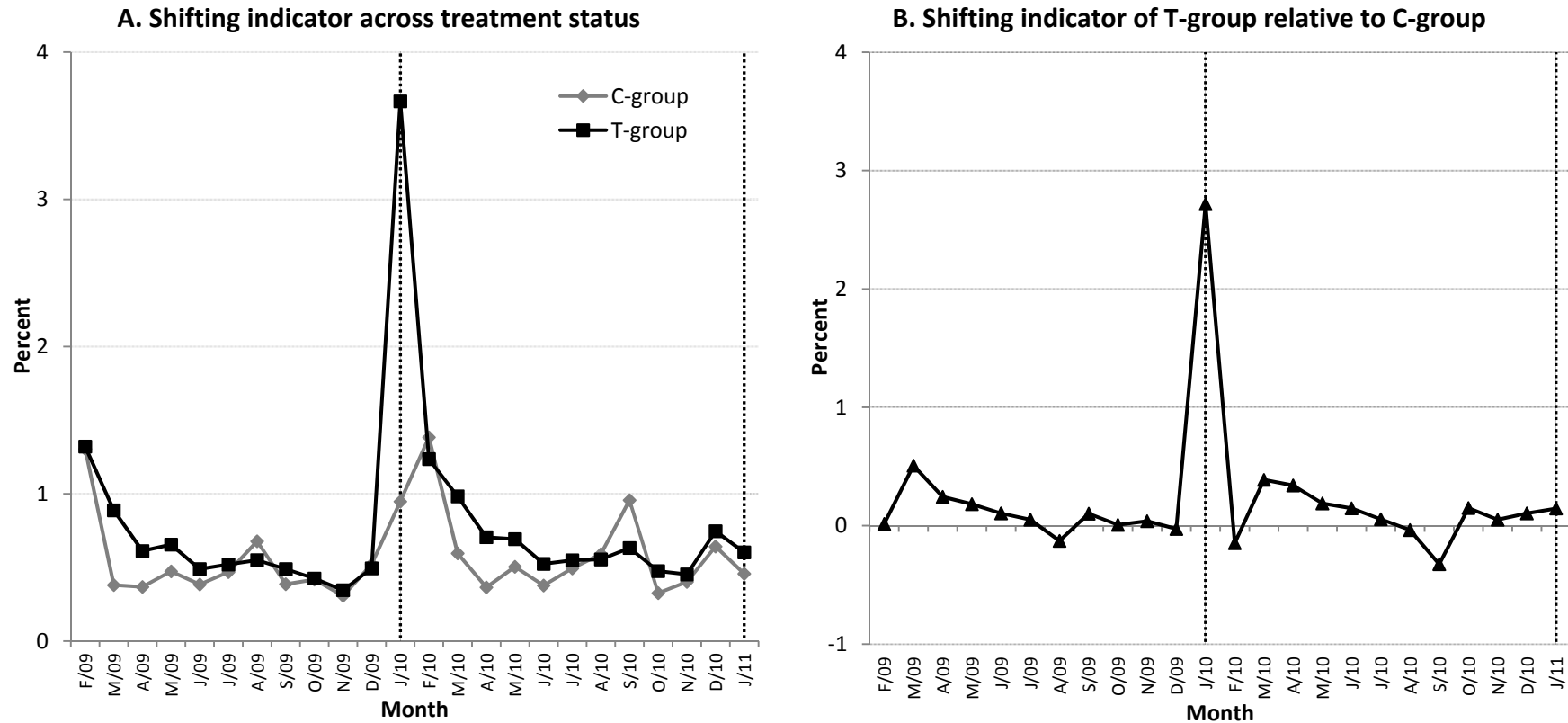
Figure 3: Share of income shifted



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).

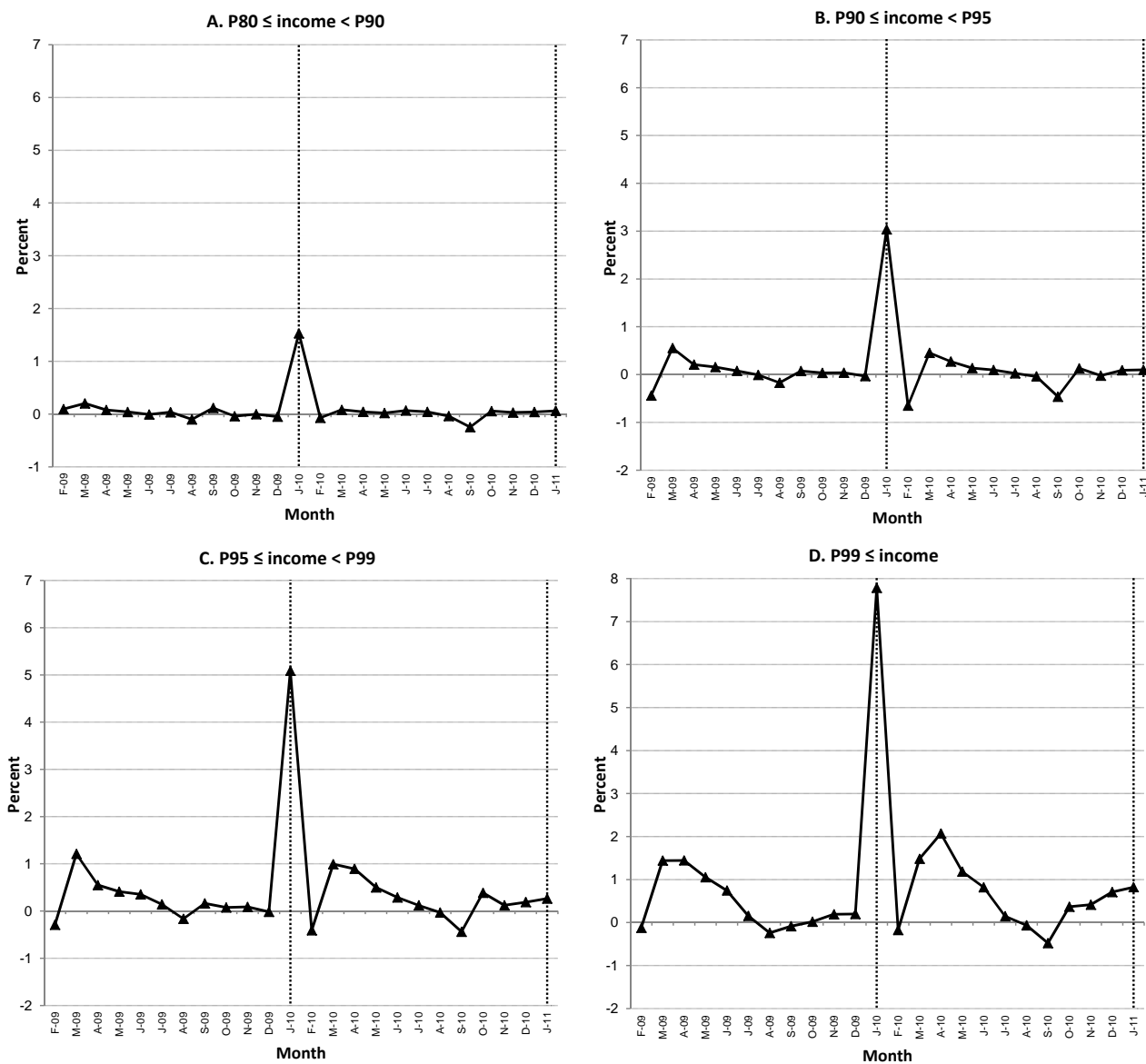
Figure 4: Share of employees shifting income



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).

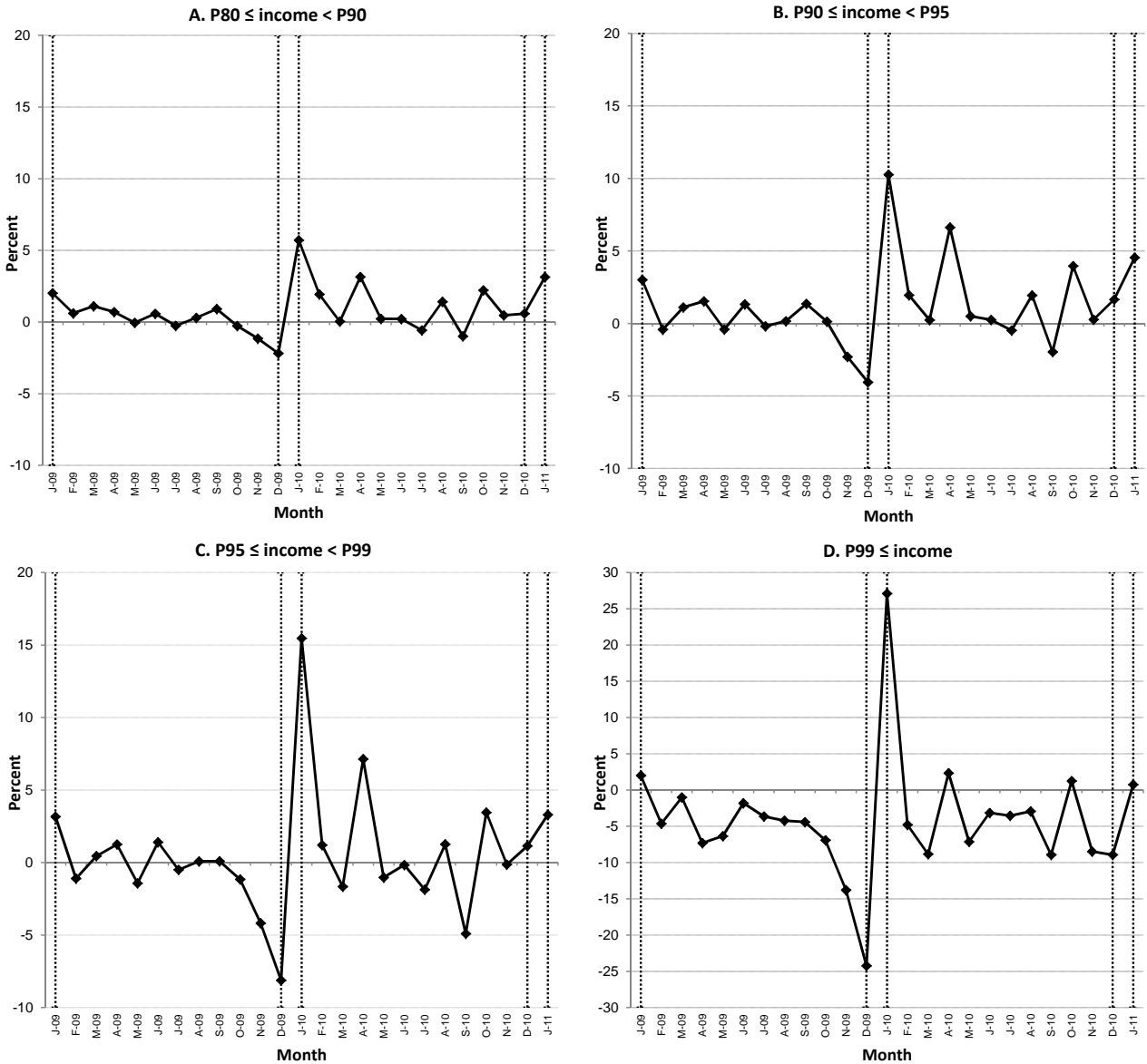
Figure 5: Share of employees shifting income across income groups



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).

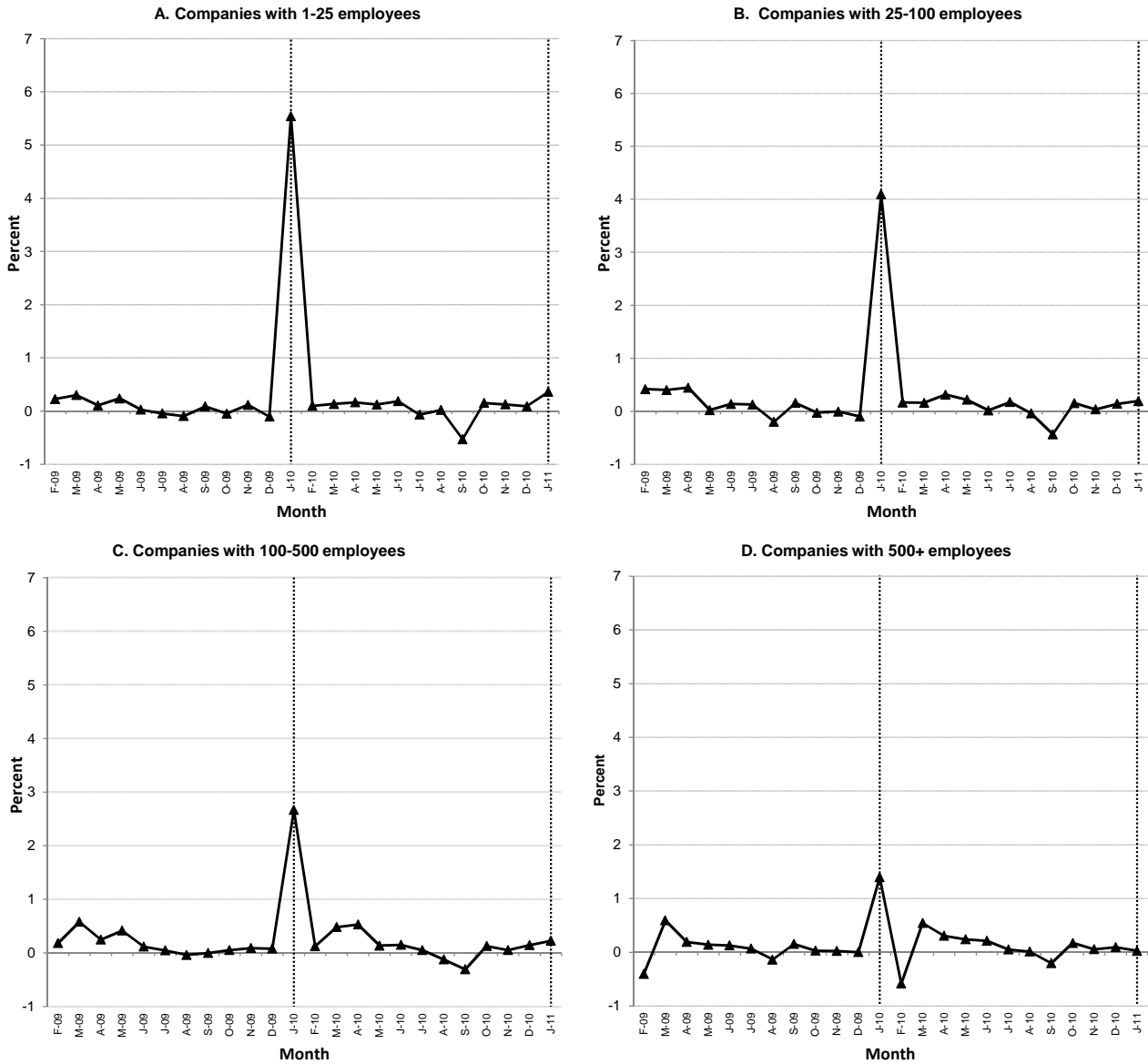
Figure 6: Share of income shifted across income groups



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).

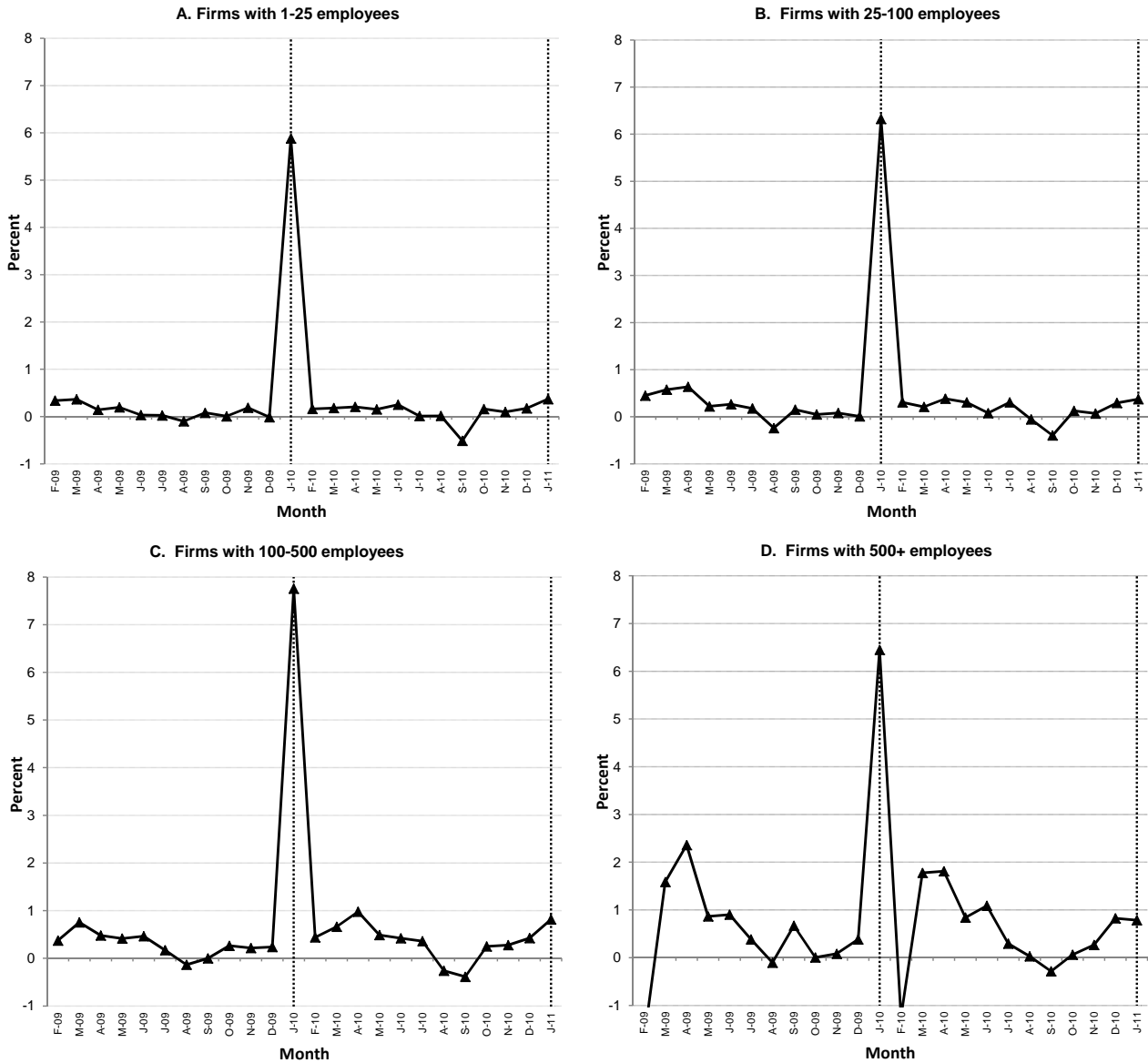
Figure 7: Share of employees shifting income across firm size



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).

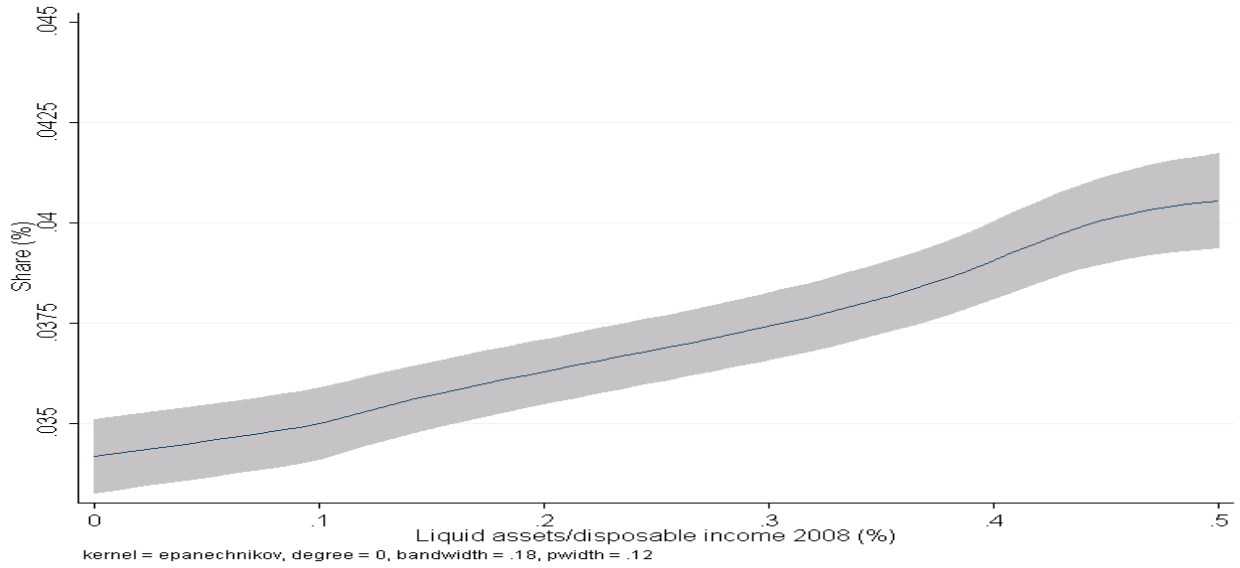
Figure 8: Share of top-five employees shifting income across firm size



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).

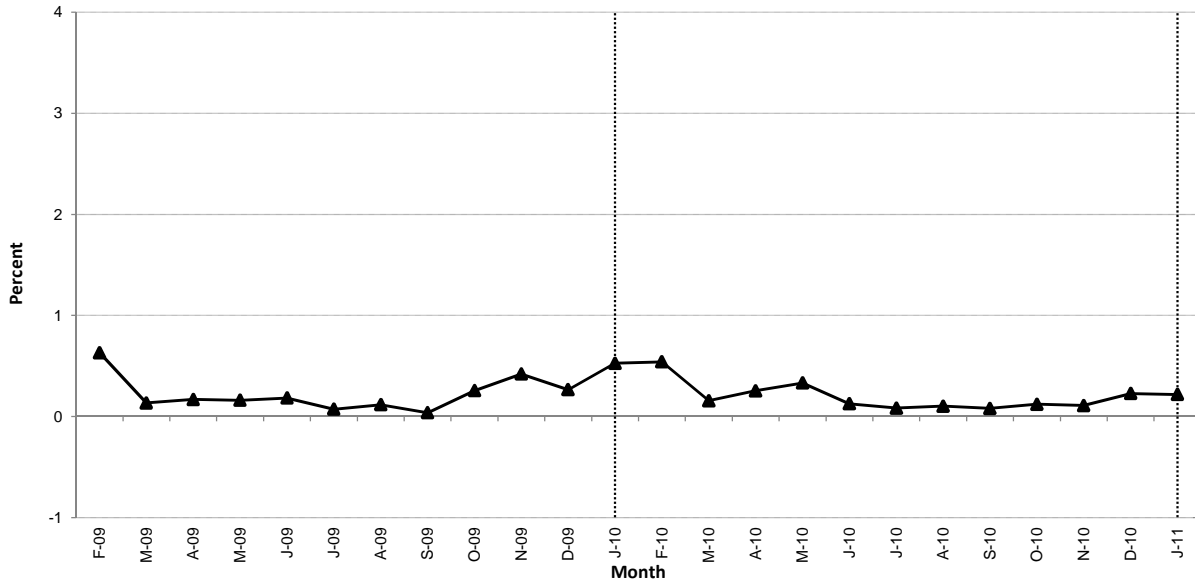
Figure 9: Share of employees shifting income as a function of liquidity



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.

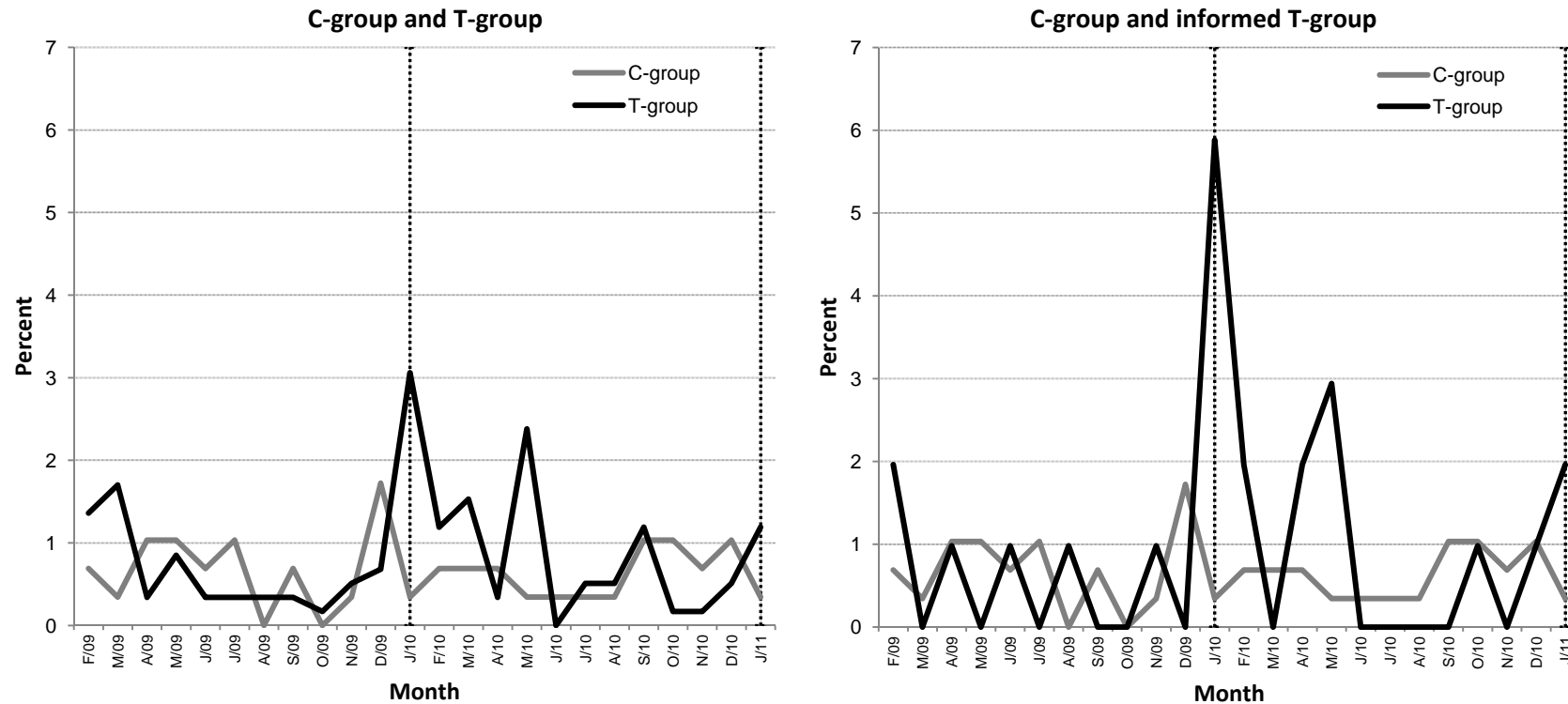
Figure 10: Share of employees shifting income in local government



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).

Evidence on Unclaimed Charitable Contributions from the Introduction of Third-Party Information Reporting in Denmark*

CHRISTIAN GILLITZER
UNIVERSITY OF MICHIGAN

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

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Abstract

The introduction of information reporting and pre-population of charitable tax deductions in Denmark in 2008 coincided with a doubling in the number of tax deductions claimed, and a 15 percent rise in the value of claims. We attribute this change to incomplete claiming of eligible charitable tax deductions under the prior self-reporting regime: a pre-reform randomized audit shows a negligible amount of charitable overreporting, and we present evidence that there was no change in giving behavior around the time of the reform. We estimate the per-year average amount of forgone tax benefits to be small, but find that many taxpayers repeatedly failed to claim eligible charitable tax deductions under the self-reporting regime. We provide evidence on information frictions from taxpayer behavior due to a notched subsidy scheme.

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I. Introduction

For the 2008 tax year, Denmark's tax authority (SKAT) introduced third-party information reporting for tax-deductible charitable contributions, where previously these deductions were self-reported and subject to verification only upon an audit. Under the new system, charitable organizations report contributions received from each taxpayer directly to the tax authority. These information reports are used by SKAT to pre-fill charitable deductions on taxpayers' annual declarations (referred to as pre-population). While information reporting is now widely used for sources of income tax return line items in advanced countries, the use of information reporting and pre-population for a tax return deduction line item is relatively new.¹

The effect of the policy change on reported deductions was immediate, large, and in some respects surprising; the number of taxpayers claiming a charitable deduction doubled. The total value of contributions also rose, but by only by 15 percent, due to a fall in the mean charitable tax deduction of 42 percent.

Using data from a recent large-scale audit experiment in Denmark, we document that pre-reform overreporting of charitable contributions was negligible. This is somewhat unexpected, because evasion rates for self-reported sources of income are often large (see Slemrod 2007). The same audit experiment estimated an evasion rate of 42 percent for total self-reported net income, but only 0.3 percent for third-party reported income (see Kleven et al. 2011). There is good reason to trust the accuracy of these audits in identifying overclaiming of charitable deductions: unlike self-reported sources of income, the burden of proof falls on the taxpayer, who under the self-reporting regime was required upon audit to produce receipts to justify all deductions claimed. For reasons discussed in detail in Section 3, audits did not appear to identify unclaimed charitable deductions.

Administrative reports on total donations collected by charities enable us to separately identify the effect of the policy change on charitable giving and reporting behavior. We find no evidence of a change in giving behavior coinciding with the introduction of information reporting and pre-population of deductions. Accordingly, we argue that the rise in the value of reported deductible contributions—and the near doubling in the number of reporting contributors—is due to taxpayers with modest tax-deductible contributions who

¹ See OECD (2006) for a survey of pre-population in OECD countries.

neglected to report their deductions under the self-reporting regime in place before 2008.²

We estimate that the average unclaimed charitable tax deduction under the self-reporting regime was worth about DKK786, which, given the one-third subsidy rate, translates to DKK262 in forgone after-tax income.³ There was little change in the number of tax deductions of more than DKK2,500 – indicating that few taxpayers left large sums of money on the table in any given year. But over a period of years, the cumulative amount of foregone benefits appears to have been economically significant for many taxpayers; more than two-thirds of the taxpayers who claimed a deduction in 2008 under the information reporting and pre-population regime, but who did not claim a deduction in either 2006 or 2007 under the self-reporting regime, claimed a deduction in each of the years 2009-2011.

Our finding of negligible charitable overreporting under the self-reporting regime is interesting in light of work by Fack and Landais (2011), who find that reforms in the U.S. and France that tightened enforcement of charitable tax deductions resulted in a fall in reported donations, which they attribute to evasion. In France, a 1983 reform required taxpayers to attach receipts to their tax return for all charitable deductions claimed, whereas previously the tax authority only sought to inspect receipts during an audit. The rule change coincided with a 75 percent fall in the value of charitable tax deductions claimed between 1982 and 1983. In the U.S., a 1969 law change reduced opportunities for top-income earners to use private charitable foundations as a tax sheltering or evasion scheme. Following the law change, creation of private charitable foundations fell by 80 percent. They estimate that 30 percent of charitable tax deductions claimed by the top 0.1 percent of income earners before the policy change was due to tax avoidance or evasion behavior. The reform in France studied by Fack and Landais (2011) is more relevant in our setting because we study behavior for the population of donors, rather than just top-earner taxpayers.

Our findings are consistent with Rehavi (2010), who uses survey reports of U.S. taxpayers to provide suggestive evidence of incomplete claiming of eligible charitable deductions. She goes on to argue that as much as one-third

² Examining a policy experiment in Finland in the 1990s, Kotakorpi and Laamanen (2013) argue that unclaimed deductions may be particularly prevalent when many sources of income line items are pre-filled for taxpayers.

³ DKK1 is approximately US\$0.18.

of the response of charitable tax deductions to the subsidy rate is due to changes in reporting rather than giving behavior.⁴ In contrast to the survey evidence used by Rehavi (2010), the administrative panel data available to us provides arguably more credible evidence because it is less susceptible to systematic misreporting (providing incorrect information to the tax authority has an expected penalty, whereas misreporting on a household survey does not).

A related literature on incomplete enrollment in benefit programs has found evidence of sizable unclaimed benefits. Bhargava and Manoli (2011) estimate that about one-quarter of taxpayers apparently eligible for the U.S. earned-income tax credit (EITC) do not claim the EITC. However, we recognize that the type of taxpayers who are eligible for the EITC and those who make charitable gifts are likely to differ in important ways that affect their claiming behavior. Elsewhere in the literature, stigma is often cited as a reason for incomplete take-up of welfare benefits (see, for example, Besley and Coate, 1992), but there should be no stigma attached to claiming charitable deductions. Pre-population is akin to default enrollment – taxpayers are automatically credited with their eligible charitable tax benefits – and the post-reform surge in charitable tax deductions claimed attests to the power of defaults (see, for example, Carroll et al., 2009 or Chetty et al., 2012).

Some taxpayers may have rationally decided not to claim charitable tax deductions because the private compliance cost exceeds the forgone tax benefits. For 1982 U.S. taxpayers, Pitt and Slemrod (1989) estimated the compliance costs of itemizing deductions by estimating how much taxpayers claiming the standard deduction could have saved from instead itemizing their deductions. They estimated a compliance cost of \$43, which is, after adjusting their estimate in 1982 dollars for inflation, about double our preferred estimate of the average value of charitable deductions forgone under the self-reporting regime. But the Pitt and Slemrod (1989) estimate of compliance costs should be larger because it measures the compliance costs associated with all deductions for which a taxpayer is eligible, not just charitable contributions; differences in tax-system design between Denmark and the U.S. may also affect the comparability of these estimates.

More generally, this paper contributes to a growing literature that takes optimization frictions seriously: Kleven and Waseem (2013) find that a

⁴ Slemrod (1989) finds, based on analysis of audited U.S. income tax returns, that charitable giving overstatement is less sensitive to the subsidy rate than is actual giving behavior.

majority of the income taxpaying population in Pakistan face optimization frictions affecting their taxable income choice of at least 2.5 percent of gross income; Chetty (2012) shows that it is possible to reconcile high-quality intensive-margin labor supply elasticity estimates from the labor and public finance literatures given an assumption of frictions equal to about one percent of income; and Saez (2010) finds kinks in the U.S. Earned Income Tax Credit insufficiently powerful to create bunching, except at the first kink, and only for self-employed taxpayers.⁵ The attenuated response of taxable income to marginal tax rates reflects taxpayer frictions such as inattention, misperception, and inertia, but also adjustment costs faced by taxpayers in finding employers offering desired combinations of hours of work and compensation. Unsurprisingly, the magnitude of frictions affecting claiming of charitable tax deductions appear to be much smaller than is required in other recent work to reconcile observed behavior of taxable income with a frictionless benchmark.

Theoretical work by Kleven and Kopczuk (2011) argues that differential response by type of taxpayer to compliance costs can be exploited to discriminate between deserving and undeserving welfare program recipients. If hassle costs are more burdensome for undeserving than for deserving applicants, the introduction of a hassle cost, such as a paperwork requirement, may facilitate a higher benefit level, that in the absence of the hassle cost would induce substantial additional take-up by undeserving applicants. The reform we study is interesting in light of this (mostly) theoretical literature because it provides empirical evidence on taxpayer response to a change in a paperwork requirement (taxpayers had to maintain receipts and process their own charitable deductions under the self-reporting regime). Although we find the increase in the share of taxpayers claiming a deduction in the post-reform period to be particularly large for some groups of taxpayers, this variation appears related to underlying giving propensity, rather than a differential effect of hassle cost across taxpayer types.

Our findings suggest that the use of information reports to pre-populate tax-deduction line items may result in a loss in revenue. The use of information reports alone need not though: a tax authority could use third-party reports to flag for further investigation taxpayers who overclaim on their charitable contributions, but not amend tax returns for underclaiming. Unlike pre-

⁵ Saez (2010) attributes the bunching of self-employed taxpayers at the first kink in the EITC schedule to tax evasion.

population of sources of income line items, automatic crediting of deductions increases tax expenditures on taxpayers who would otherwise neglect to claim deductions for which they are eligible. The introduction of information reporting and pre-population of charitable deductions in Denmark coincided with an increase in the value of charitable tax expenditures of DKK39.4 million.

In what follows, section 2 provides background information on relevant aspects of Denmark's tax system, section 3 uses data from a pre-reform tax audit experiment to investigate reporting behavior before the policy change, and section 4 discusses the change in reporting behavior when information reporting and pre-population of charitable deductions was introduced in 2008. Section 5 presents evidence indicating that there was no change in charitable giving – as opposed to reporting of charitable gifts – around the time of the policy change, and section 6 uses a notch created by the pre-2012 charitable gift eligibility rules to investigate taxpayer awareness of incentives for charitable giving. We offer some concluding remarks in section 7.

II. Background

Denmark's individual-income tax system features broad use of information reporting across various sources of income. For most taxpayers, information reports made by third parties for the tax year ending in December arrive at the tax authority for processing by late January. Most information reports correspond to payments from which tax has been withheld, but some do not. Making use of the information in these reports, and other known information such as place of residence, SKAT prepares pre-populated (pre-filled) returns that are mailed to taxpayers each year in mid-March.⁶ Taxpayers have until May 1 to amend their pre-populated return to reflect sources of income not subject to information reports, any income for which information reports were not received in a timely manner by the tax authority, and any self-reported deductions for which the taxpayer is eligible.⁷ All income-tax-liable people in Denmark are required to file a tax return, which is approximately 88 percent of the population (Kleven et al., 2011).⁸

All taxpayers file as individuals, unlike in the U.S. where married couples generally elect to pool their income and file a joint tax declaration. The

⁶ Taxpayers can also access their pre-filled tax returns electronically.

⁷ Taxpayers can amend their pre-populated return electronically, by phone, or by mail. Self-employed filers have until July 1 to submit their final tax return.

⁸ The bulk of those not required to file are children under the age of 16.

subsidy rate for tax deductible charitable contributions varies only (slightly) by region of residence – and so does not depend on a taxpayer's marginal tax rate. Assuming married couples live in the same tax region, this means that there is no tax advantage gained from shifting the claiming of charitable deductions between husband and wife depending on who faces the higher marginal tax rate. Because there is no difference in tax treatment of charitable deductions between singles and couples, our unit of analysis is individual taxpayers. Even if taxpayers have no tax liability, they are able to receive tax benefits for their charitable contributions.

According to government documents, the principal stated motivation for the introduction of information reporting and pre-population for charitable deduction was a desire to limit perceived abuse of charitable deductions and to lower taxpayer compliance costs. The tax authority also appears to have been aware that pre-population would lead to some taxpayers receiving tax benefits they previously neglected to claim. No net change in charitable tax expenditures was expected prior to the reform. To ease their transition to the new policy regime, charitable organizations received a subsidy for expenses associated with implementing the new compliance procedures.

Charitable deductions fall into three tax-relevant categories, each with different requirements for tax favored treatment. The bulk of charitable contributions are regular gifts, for which there was a somewhat complicated eligibility requirement before 2012. Only total annual gifts to each eligible charity of DKK500 or more qualified for tax deductibility, and in calculating the total tax deduction for each taxpayer the first DKK500 in gifts was excluded.⁹ We discuss the incentives created by this policy design in detail in Section 6. Information reporting and pre-population of deductions for regular gifts was introduced in 2008. With the introduction of information reporting and pre-population for regular gifts, the tax authority also locked this line item for most taxpayers. This means taxpayers are prevented from changing the charitable deduction recorded on their pre-populated return. If the taxpayer finds an error on their pre-populated return they must contact the relevant charity and request a revised message be sent to the tax authority. Deductions are also capped, and thus so is the maximum value of charitable tax benefits. The maximum value of regular deductions eligible for tax deductibility has increased over time: from 1997-2004 the cap was DKK5,000, but the cap was

⁹ In 2012 the lower threshold was abolished, making gifts of less than DKK500 eligible for tax deductibility. In addition, the 2012 reform no longer requires subtracting the first DKK500 in gifts from total eligible deductions.

lifted to DKK6,400 in 2005, and to DKK6,600 in 2006; in 2007 the upper threshold more than doubled to DKK13,600, and has increased modestly since, to DKK14,000 in 2008, and to its current DKK14,500 level in 2011.

The second category of charitable donations corresponds to giving contracts with a minimum 10-year length, for which information reporting and pre-population of deductions was also introduced in 2008. This category permits donors to deduct the larger of DKK15,000 or 15 percent of taxable income each year. A third category was introduced in 2008 for gifts to cultural and research organizations, and for which information reporting was introduced in 2010. Because this type of gift was not tax deductible before 2008, we exclude this category from our analysis entirely. For the two categories of gift we study (regular and long-term charitable gifts), only cash contributions are eligible for a tax deduction.¹⁰

In 2011 the number of taxpayers claiming a deduction for regular, long-term, and cultural and research gifts was 360,527, 44,399, and 23,477, respectively. Total gifts for each category were DKK747m, DKK261m, and DKK20m, respectively. Before 2008 regular and long-term gifts were self-reported together on one tax return line item, but from 2008 forward each category corresponds to a separate line item. Because we do not observe each category of donation separately before 2008, we group regular and long-term gifts together to form one consistent series for charitable giving.

There was little change in the number of charities reporting charitable gifts in the years before and after the 2008 policy change. In 2008 there were 796 organizations approved by SKAT to receive tax-deductible contributions, only slightly higher than 790 in 2007 (see Table 1). This represents the equal second smallest year-to-year increase for the years 1998-2011. In both 2007 and 2008 the fraction of eligible organizations making an annual report to the tax authority was 93 percent. This fraction has been stable, but had an upward trend over our sample period.

Most donations were collected from the following groups of charitable organizations: international aid organizations (e.g., UNICEF, Red Cross); religious organizations (e.g., Catholic Church); national social and

¹⁰ Non-monetary gifts to cultural organizations have been eligible for a tax deduction since 2005. There was no upper threshold for these gifts, but as for regular gifts only contributions with a value greater than DKK500 were eligible to receive tax-deductibility. In 2008, the first year in which we observe data specifically for cultural and research organization gifts, there were only 11 such gifts made.

humanitarian organizations (e.g., Blue Cross Denmark); nature, environment, and animal welfare organizations (e.g., Danish Society for Nature Conservation); and disease fighting and disability organizations (e.g., Cancer Society).

In the next section we investigate reporting behavior prior to the introduction of information reporting and pre-population of deductions.

III. Pre-Reform Misreporting of Charitable Gifts

Before investigating the effect of the policy change in the next section, we first draw on data from the Kleven et al. (2011) audit experiment to ascertain the level of misreporting of charitable gifts in Denmark prior to the reform. A random sample of about 20,000 taxpayers was subjected in 2007 to an unannounced extensive and thorough audit of their 2006 tax returns. The overall misreporting rate for charitable contributions was small: of the 872 taxpayers in the audit sample who reported any charitable contribution, only 7 percent were found upon audit to have overclaimed charitable deductions, while 3 percent were found to have underclaimed, combining, with rounding, to give a gross misreporting rate of 11 percent. For the 7 percent of taxpayers who overclaimed, the median value of excess charitable deductions reported was DKK1,100, and for the 3 percent of taxpayers in the audit sample found to have underclaimed, the median value of missing deductions was DKK1,975. The value of underclaiming offset about half the value of overclaiming, giving a net evasion rate (net overclaiming as a share of deductions that should have been claimed) of 2.3 percent conditional on having initially reported a non-zero charitable gift, and about 0.1 percent as a share of all taxpayers in the audit sample. This evasion rate is trivial compared to the 37 percent evasion rate found by Kleven et al. (2011) for self-reported sources of income. Evidently, those seeking to evade income taxes do not view overstatement of charitable contributions as a high expected benefit-to-cost evasion opportunity.

In light of these audit results, our finding of a surge in reported tax-deductible charitable contributions following the introduction of third-party information reporting and pre-population may seem surprising. If so many taxpayers neglected to claim their tax deductible contributions under the self-reporting regime, why did the auditors in the Kleven et al. (2011) study detect such little underclaiming? We have ascertained from discussions with SKAT officials that auditors did not investigate line items for which no deductions were

claimed.¹¹ This is most probably a sensible audit policy rule for the tax authority: the social value of finding unclaimed deductions for taxpayers is arguably less than the social cost of auditors' time. But it means that the Kleven et al. (2011) audit sample results cannot be used to accurately measure the fraction of taxpayers with unclaimed tax-deductible charitable gifts. The only way in which the audit process could have resulted for a taxpayer in a higher post-audit than pre-audit charitable deduction was if the audit process prompted the taxpayer to review their records and discover charitable deductions they had not reported. However, we have been told by SKAT that some audits in the Kleven et al. (2011) audit study involved only computerized cross-checking of information reports, in which case the taxpayer was unaware that their tax return had been audited; for example, a taxpayer with no self-reported income or deductions would have had their third-party reported information cross-checked electronically, but would have only been contacted as part of the audit process if a discrepancy was discovered.

Having established that there was negligible charitable evasion under the pre-reform self-reporting regime, in the next section we describe the change in reporting behavior due to the introduction of information reporting and pre-population of charitable deductions in 2008.

IV. Effect of the Reform on Reporting Behavior

IV.A. Aggregate Data

Figure 1 reports the number and average size of charitable tax deductions reported over the period 1997-2011.¹² As foreshadowed in section 1, the introduction of information reporting and pre-population for charitable deductions coincided with a near doubling in the number of taxpayers claiming a charitable tax deduction: 150,311 taxpayers reported a charitable tax deduction in 2007 under the self-reporting regime, and 300,122 taxpayers had a charitable deduction in 2008 following the policy change (see Table 2). There was an accompanying rise in the value of tax deductions claimed between 2007 and 2008, but the rise was a relatively modest 15.3 percent. As

¹¹ We would like to thank Søren Pedersen for sharing this detail of SKAT's audit procedure with us.

¹² Before 1997 charitable gifts were reported on the same tax return line item as a standard deduction available to fishermen, and a special childcare deduction. Since 1997 these deductions have been reported separately from charitable gifts.

discussed in detail below, we find that the bulk of the new claims were small in value. Accordingly, the mean value of tax deductions claimed fell sharply between 2007 and 2008, from DKK4,671 to DKK2,697 (see Table 2).

Interestingly, the mean value of contributions was higher in the year before the reform than in earlier years. Between 1997 and 2006 the mean value of charitable tax deductions claimed was between DKK3,859 and DKK4,029, lower than the DKK4,671 mean value recorded in 2007. This change can be mostly explained by a relaxation in the upper threshold for eligible regular gifts: in 2007 taxpayers were permitted to deduct up to DKK13,600 in regular charitable tax deductions, compared to only DKK6,600 in 2006. As described in section 2, this threshold has increased over time, but the 2007 increase was by far the largest over our sample period. The number of taxpayers with total tax deductions greater than DKK10,000 rose by 6,344 between 2006 and 2007, and there was a corresponding 6,350 fall in the number of taxpayers with total tax deductions in the range DKK5001-10,000. There was a further modest rise in the upper eligibility threshold for regular tax deductions in 2008, but this does not meaningfully affect our analysis. The bulk of the increase in tax deductions due to the policy reform were small in value, so our focus is on the lower tail of the distribution of claims, that is largely unaffected by changes to the upper eligibility threshold.

We have access to taxpayer level microdata beginning in 2006, and can compute the median tax deduction reported in each year (see Table 2). Because most claims are small in value, the median value of claims is only a little more than half the mean contribution for the years 2007-2011. The relaxation in the upper threshold for regular gifts in 2007 was relevant for a relatively small number of taxpayers making large donations, explaining why the median deduction rose by only DKK70 between 2006 and 2007, compared to the DKK638 rise in the mean value of contributions.

To gain further insight on the effect of the reform, we investigate changes in tax deductions reported by claim size. Table 3 reports these data for each year 2006-2011, and Figure 2 presents these data graphically. Note that claim size is the tax deductible amount on individual tax returns, not the total value of contributions, which is larger because of the exemption limits that existed before 2012. For example, a taxpayer who gave a total of DKK600 to one charity would qualify for a tax deduction of DKK100 and be counted in the category DKK0-500 in Table 3 and Figure 2. As previewed earlier, the surge

in the number of charitable deductions claimed between 2007 and 2008 were primarily small in value; there was an almost ten-fold increase in the number of claims less than DKK500, and a more than doubling in the number of claims in the range DKK500-DKK1,500. In contrast, there was little change in the number of claims larger than DKK3,000.

For the two years before and after the policy change, Figure 3 presents a finer picture for the distribution of claims less than DKK5,000. The surge in small claims in 2008 when information reporting and pre-population of deductions was introduced is particularly evident here. Abstracting from the policy change, the distribution of claims is very stable: Figure 3 shows that the pre-reform 2006 and 2007 distribution of tax deductions claimed are almost identical, as are the post-reform 2008 and 2009 distributions. This makes us confident that the pronounced change in the left tail of the claim distribution between 2007 and 2008 is not in part accounted for by regular variation in the distribution of claims over time.

If we attribute all the change in charitable tax deductions between 2007 and 2008 to a decline in unreported claims, the value of forgone charitable deductions in 2007 was DKK717. However, this is an imprecise estimate of the value of deductions forgone under the self-reporting regime. Any change in the number of large tax deductions between 2007 and 2008 is probably unrelated to the policy change: those with large deductions forgo a substantial amount of money from not reporting their eligible deductions and so are unlikely to have not done so under the self-reporting regime. Informed by the distribution of claims data presented in Figure 3, we estimate the value of forgone deductions under the self-reporting regime by restricting our attention only to the increase in claims less than DKK2,500. Between 2007 and 2008 the total number of tax deductions claimed amounting to less than DKK2,500 increased from 77,046 to 226,855, and the total value of these deductions increased from DKK116 million to DKK234 million. This implies an average value of DKK786 for forgone deductions, which corresponds to DKK262 in after-tax income. This calculation is not particularly sensitive to the upper threshold of DKK2,500 used in this calculation (see Figure 11 in the appendix, and the notes therein for details on this calculation). Had the reform not occurred, our estimated value of previously unreported deductions implies that we would have observed a mean value of tax deductions equal to DKK4,601 in 2008, rather than the actual value of DKK2,697.

These estimates implicitly assume that there would have been no change in average giving behavior had the reform not occurred, which absent a control group (the reform affected all taxpayers at the same time) we cannot formally test. Although this assumption is almost certainly violated, the magnitude of the change in reporting behavior pre- and post-reform is several orders of magnitude larger than the usual year-to-year variation in reporting behavior (see Figures 1 and 3); hence, any error in our estimate due to trend changes in average giving behavior is likely to have only a minor effect on our estimate of the change in reporting behavior due to the reform.

Interestingly, the bulk of the increase in charitable deductions claimed after 2008 appear to be associated with regular, rather than occasional, donors who did not claim their eligible tax benefits under the prior self-reporting regime. Of the 152,857 taxpayers who claimed a charitable tax deduction in 2008 (under the information reporting and pre-population regime) but not in 2006 or 2007 (under the self-reporting regime), 68 percent claimed a deduction in each subsequent year 2009-2011. The share claiming zero, one, and two further tax deductions between 2009 and 2011 was 13, 9, and 10 percent, respectively (see Table 7). This suggests that foregone tax benefits under the self-reporting regime were concentrated among regular donors who systematically did not claim eligible charitable deductions, rather than a larger group of donors who occasionally did not claim their eligible deductions. Although the typical amount of forgone tax benefits appears to have been modest in any given year, our finding that many taxpayers repeatedly failed to claim eligible tax benefits indicates that the cumulative amount of forgone deductions and tax savings may have been substantial for a sizable fraction of charitable donors.

IV.B. Effect of the Reform by Type of Taxpayer

In this section we look for evidence of differential response to the policy change by type of taxpayer. We present estimates for the following OLS panel data regression using the universe of tax returns for the period 2006-2011:

$$(1) \quad D_{it} = \sum_{j=1}^k \beta_j X_{ijt} + \gamma_j \text{post}_t X_{ijt} + \varepsilon_{ijt}$$

where $D_{it} = \{0,1\}$ is an indicator for person i claiming a charitable deduction in year t , X_{ijt} is characteristic j for taxpayer i in year t , and post is an indicator

variable taking the value unity in the post-reform period 2008-2011.¹³ The vector of characteristics X_{ijt} includes the following variables: age, personal income (the sum of labor income, transfers, pensions, and other adjustments), gender, marital status, self-employment status, a Copenhagen location dummy variable, and a linear time trend. We do not include a taxpayer fixed effect because many of the covariates of interest are constant or vary little at the taxpayer level over our data sample. We report robust standard errors and, because we have access to the universe of tax returns, all but a few point estimates are highly statistically significant. The full set of regression results is reported in Table 7 in the appendix.

The coefficient on the *post* variable, shown in Figure 4, indicates the estimated pre- to post-reform change in probability of claiming a charitable tax deduction, for a taxpayer with the baseline set of characteristics (the baseline set of characteristics represents a male taxpayer aged 46-65, in 50-75th income percentile, single, residing outside Copenhagen, and not self-employed); the coefficients on the *post x income* interaction terms, also shown in Figure 4, indicate estimated variation in post-reform claiming behavior by income percentile. There is a clear positive income gradient evident for the *post x income* interaction terms shown in Figure 4, indicating that the increase in the share of high-income taxpayers claiming a charitable deduction in the post-reform period was large relative to low income groups. But, because high income earners were also more likely to claim a charitable deduction in the pre-reform period (shown by the main effect coefficients in Figure 4), the proportional increase in likelihood of claiming a deduction following the reform is similar for high income groups; the regression estimates are consistent with a roughly constant fraction of taxpayers in high-income groups neglecting to claim eligible deductions in the pre-reform period. For below-median income earners, the regression results indicate a small fall in the probability of claiming a deduction post-reform; this most likely reflects their underlying very low propensity to claim a charitable deduction, and variation unrelated to the reform.

Figure 5 displays the analogous coefficient estimates by age category. The likelihood of claiming a charitable deduction post-reform increased for each age category: the increase is estimated to have been largest for young

¹³ We restrict our analysis to the sample of taxpayers who filed a tax return in each year 2006-2011 (only two percent of taxpayers who claimed a charitable tax deduction in 2008 did not file a tax return in each year 2006-2011).

taxpayers (under 25), and smallest for taxpayers aged 26-45. The change in likelihood of claiming a deduction post-reform for selected other taxpayer characteristics is reported in Figure 6. The increase in post-reform claiming probability was particularly large for female taxpayers, and those residing in Copenhagen – both groups with a high propensity relative to other taxpayers of claiming a deduction in the pre-reform period (indicated by the main effect coefficients shown in Figure 6). Post-reform claiming behavior appears unrelated to employment status, and married taxpayers were a little less likely to claim a charitable deduction in the post- than pre-reform period.

In summary, the increase in the share of taxpayers claiming a charitable deduction in the post-reform period was particularly large for high income groups, female taxpayers, and those residing in Copenhagen. But because these groups of taxpayers had an above-average likelihood of claiming a deduction in the pre-reform period, the share of unclaimed deductions under the self-reporting regime is unlikely to have been particularly large for these groups of taxpayers.

V. Charitable Giving Propensity

To this point, we have not addressed the possibility that the policy change coincided with – or caused – a change in actual giving behavior, rather than the reporting propensity. One possibility is that the introduction of information reporting and pre-population of charitable deductions reduced the compliance cost for taxpayers, and so the effective cost of charitable giving, by enough to induce an increase in actual donations. To investigate whether there was a change in giving propensity coinciding with the policy change in 2008, we make use of annual administrative reports received by SKAT from charities eligible to collect tax-favored contributions. These filings are required in order for charities to maintain their tax-favored status, and contain, among other information, reports on the total value of contributions received and the number of contributing members (donations) for each charity. These data correspond to donations that, provided they were of at least DKK500, qualify for a charitable tax deduction.

Given our main finding – that there was a surge in the *number*, but less so in the *value*, of charitable tax deductions following the policy reform – we first investigate whether there was any change in the number of contributing members reported by charities following the policy change. We restrict our

attention here to the ten largest charities, measured by the number of information reports received by SKAT over the period 2008-2011. These ten charities together represent about 60 percent of the information reports received from all charities. We exclude small charities to avoid our findings being influenced by potentially misleading reporting behavior of some small charities: a few small organizations did not file reports in each year, and, in some circumstances, reported implausible year-to-year changes in their number of donors. The line labeled “Tax Return Data” in Figure 7 shows the number of information reports received (aggregated by charity for each taxpayer) from the top-ten charities for the period 2008-2011 (the information reporting period), and the line labeled “Charity Data” in Figure 7 reports the number of charitable donors reported by these top-ten charities for the period 2001-2011.¹⁴ The number of donors reported by these charities exceeds the number of information reports received by SKAT from these organizations, most probably because some charitable donors do not provide their tax identification together with their gift; for gifts less than DKK500 this is not surprising: they do not result in a tax deduction. A few other factors are likely to contribute to the divergence between these series: transfer of funds via cell phone SMS (short message service) has become widespread in Denmark for popular giving campaigns, for which donations appear in charity records, but not tax records; “tin rattling” and church day donations are collected without tax identification; and some taxpayers may prefer to give anonymously. Between 2007 and 2008, when information reporting and pre-population was introduced, the number of charitable tax deductions claimed doubled, but, as Figure 7 shows, the number of donations received by large charities was almost unchanged. This is consistent with the notion that the surge in the number of tax deductions claimed in 2008 was due to a change in reporting behavior, not actual giving behavior.

We are further persuaded that the policy change affected reporting but not giving behavior by the fact that there was no apparent change in the trend value of donations collected before and after the policy change. Mirroring Figure 7, the line labeled “Tax Return Data” in Figure 8 shows the total value of charitable contributions reported on information reports sent to SKAT by the top-ten charities (with charity size measured by the number of donors, as above), and the line labeled “Charity Data” shows the total value of donations

¹⁴ All results that follow are qualitatively the same if we consider instead the 25 largest charities, measured by the number of information reports received from each charity (per taxpayer) over the period 2008-2011.

collected by the top-ten charities for each year 2001-2011. Apart from the spike in donations in 2005 (see Figure 8), most likely due to giving campaigns following the Indian Ocean tsunami in December 2004, growth in the total value of donations has been stable. The fraction of total donations reported to SKAT via information reports has also been stable over the information reporting period 2008-2011. Given that there was almost no change in the number of donations made pre- and post- reform, the data in Figure 8 indicate that there was no intensive margin giving response coinciding with the policy change either.

Supporting our claim that the reform did not affect giving behavior, there was little difference in the growth rate of mean charitable deductions in the post-reform period between taxpayers who claimed a deduction in the pre-reform period and those who claimed for the first time in 2008. For the group of taxpayers who claimed a charitable tax deduction in 2008 (the first year of the reform), but not in either of 2006 or 2007 (the pre-reform period), growth in mean contributions over the period 2008-2011 averaged 2.2 percent, only slightly more than the 0.8 percent average growth rate for the group of taxpayers who claimed a charitable deduction in 2008 and in at least one of the two pre-reform years 2006 or 2007.¹⁵

Having established that there was no meaningful change in giving propensity around the time of the policy change, we attribute the surge in charitable tax deductions claimed between 2007 and 2008 to a change in reporting behavior. Before 2008, many taxpayers appear to have neglected to report their tax deductible charitable contributions, but since 2008 information reports have been used to automatically credit charitable deductions on taxpayers' behalf. Recall that the randomized audit experiment found only negligible amounts of charitable overclaiming.

VI. Awareness of Giving Incentives

Our finding of substantial underclaiming of eligible charitable tax benefits points to the existence of pervasive frictions affecting reporting behavior. One potential friction is a lack of awareness of the tax incentives created by

¹⁵ The calculation includes those who did not claim a charitable deduction in some years 2009-2011, for both groups. We also restrict the sample to those taxpayers who filed a return in each year 2006-2011.

charitable giving. We investigate this further by examining an aspect of Denmark's charitable giving rules, in existence before 2012, that created a region of strictly dominated giving choices.

We begin by formally describing the incentives created by the pre-2012 regime, under which only total annual gifts per charity of DKK500 or more were eligible to tax deductibility, and in calculating the total amount of eligible tax deductions, the first DKK500 in contributions was excluded. Supposing taxpayer i can donate to N charities eligible for regular charitable deductions, the amount of their total charitable deductions, up to a maximum of 14,500, is given by

$$(2) \quad S_i = \max\left\{\left[\sum_{n=1}^N g_{i,n} 1(g_{i,n} \geq 500) - 500\right], 0\right\}$$

where $g_{i,n}$ is taxpayer i 's total annual gifts to charity n , and $1(\cdot)$ is an indicator function taking the value one for gifts of DKK500 or more. The amount of tax benefits received is the tax deductible amount multiplied by the one-third subsidy rate.¹⁶ The examples provided in Table 5 are provided in order to help clarify this formula. For simplicity, we assume there are $N = 3$ charities in this example. Taxpayer A's gift is less than DKK500, so she receives no tax deductions for her charitable contributions. Taxpayer B makes one gift of DKK700, exceeding the DKK500 threshold, and so is eligible to receive tax preferences for this gift, but because the first DKK500 in gifts receives no tax benefit she has only DKK200 in charitable tax deductions. Taxpayer C is eligible to receive tax preferences on both her gifts of DKK500, and receives a total tax deduction of DKK500, after taking the exemption limit into account. Even though taxpayer D gave an additional DKK400 to charity number three compared to taxpayer C, and has given more than DKK500 in total, she receives no more tax deductions than taxpayer C because her gift to charity number three is less than DKK500.

For a taxpayer contemplating a gift to a single charity, the S_i function reduces to a kinked subsidy scheme with a DKK500 threshold. But once a taxpayer has made at least one charitable gift of DKK500 or more they face a notched subsidy for gifts to all other charities. The first gift meets the DKK500 exemption threshold, so all subsequent gifts to other charities are eligible for

¹⁶ In the text we refer to a one-third subsidy rate for simplicity, but there is slight variation based on the taxpayer's place of residence.

full tax deductibility if each gift is DKK500 or more. Suppose that a taxpayer's largest gift is $g_1 \geq 500$, Figure 9 shows the budget set facing the taxpayer for all subsequent gifts in the current tax year. Any second or subsequent gift to the value of $g \in (\underline{g}, \bar{g})$ is strictly dominated because a gift of $\bar{g} = 500$ affords a higher level of charitable contributions at no, or less, cost to the taxpayer. With the tax subsidy rate $\tau = \frac{1}{3}$ and $\bar{g} = 500$ then the lower limit on the strictly dominated region is $\underline{g} = \bar{g}(1 - \tau) = \text{DKK}333$

To illustrate the incentives created by this notched subsidy scheme with an example, consider taxpayer D in Table 5, whose gift of DKK400 to charity number three is a dominated choice: either of her first two gifts meets the DKK500 exemption threshold, so each subsequent gift is eligible for tax deductibility provided it is to the value DKK500 or more. If she raised her donation to charity number three by DKK100 to DKK500, this gift would be eligible for tax deductibility, giving her a tax saving of DKK166 (given the one-third subsidy rate), leaving her with DKK66 more in after-tax income (plus any utility gain from higher charitable contributions).

Fortunately, under the information reporting regime charities report to the tax authority all gifts above and below the DKK500 eligibility threshold for each taxpayer, allowing us to investigate taxpayer awareness of the incentives created by the kinked-and-notched subsidy scheme. Figure 10 plots the number of charitable gifts made in 2011 by claim size for taxpayers with a maximum gift of DKK500 or more. The distribution for the years 2008-2010 is similar to the distribution shown in Figure 10 for 2011. All of these taxpayers face the budget set shown by Figure 9: each second or *subsequent* gift qualifies for full tax deductibility if it is DKK500 or more. The black bars in Figure 10 indicate the number of gifts made in the strictly dominated region. Only a few taxpayers made more than one dominated giving choice, so almost all these observations represent unique taxpayers; in total, 11,624 taxpayers made a gift in the strictly dominated region in 2011. There is a clear mass point at DKK500, at the upper limit of the notch, suggesting that many taxpayers understood the budget set created by the subsidy scheme, and were induced to raise their donations to DKK500. As a share of all taxpayers claiming a charitable deduction, only about 2 to 3 percent of taxpayers made strictly dominated giving choices in each year 2008-2011. However, the number of gifts in the dominated region DKK333-500 in 2011 was about one-quarter the number in the range DKK500-666, and a little less in earlier years.

A clustering of donations in DKK100 multiples is evident, with the mass point at DKK600 even larger than that at DKK500. Because many taxpayers make gifts via automatic deduction on a monthly basis, we conjecture that the DKK600 mass point corresponds to taxpayers choosing an integer DKK50 per month charitable deduction: DKK50 is the smallest multiple of 10 that results in annual contributions qualifying for a subsidy, suggesting that the location of this mass point is influenced by the notch.

The economic significance of these dominated giving choices depends on the frequency with which individual taxpayers make such errors. Making a dominated choice in any one year results in a relatively small loss, and a taxpayer may make a mistake in any given year for idiosyncratic reasons. But for taxpayers making repeated mistakes, the cost may cumulate to a substantial amount, providing perhaps more persuasive evidence of ignorance of tax incentives for giving. To examine the frequency of dominated giving choices, Table 6 reports, for the data sample available 2008-2011, the number of taxpayers who made dominated choices in each given and subsequent year. For example, in 2008 5,927 taxpayers made a dominated choice, and of those 2,050 also made a dominated choice in 2009; 1,878 made a dominated choice in each year 2008-2010, and so on. For each year on the diagonal, about one-third of the taxpayers making a dominated choice do so again the following year. And of those taxpayers making a dominated choice in 2008, about 25 percent made a dominated choice in each of the next three years.

Taken together, these results provide evidence that a sizable minority of taxpayers did not understand the complex giving incentives created by the notched subsidy scheme in place before 2012. A non-trivial fraction of those making dominated choices did so repeatedly. However, a majority many taxpayers made giving choices just above the dominated region, indicating a high degree of awareness of the complex giving incentives in place before 2012.

VII. Conclusion

This paper provides evidence of substantial underclaiming of charitable tax deductions under the self-reporting regime that existed in Denmark before 2008; the introduction of information reporting and pre-population of charitable deductions coincided with a doubling in the number of deductions

claimed. We estimate the after-tax value of unclaimed charitable tax deductions to have been about DKK262 per taxpayer per-year, but that the total value of forgone benefits to be larger because many taxpayers systematically did not claim their eligible deductions under the self-reporting regime. We document that there was negligible evasion under the self-reporting regime, and that there was no change in giving behavior at the time of the reform. Most taxpayers making multiple charitable gifts appear to have understood the giving incentives created by the notched subsidy scheme in place before 2012, but a still sizable minority made dominated giving choices, in some cases repeatedly. Our results caution researchers using tax return data to measure real behavioral response to be aware of simultaneous (and possibly endogenous to the behavioral response) changes in reporting behavior; we have demonstrated that this is an important concern for low-value tax deductions. For tax administrators, perhaps the most surprising finding is that the introduction of information reporting for a tax deduction line item can result in a loss in revenue – unlike sources of income line items, for which information reporting has proven to be very successful at limiting evasion opportunities and thus raising revenue collections (see Kleven et al., 2011, and Slemrod, 2007).

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Table 1: Number of Charitable Organizations

	Approved Organizations	Reporting Organizations
2000	695	579
2001	716	642
2002	752	682
2003	772	704
2004	778	702
2005	792	715
2006	756	698
2007	790	736
2008	796	743
2009	813	780
2010	817	782
2011	833	809

Notes: Approved Organizations refers to the number of organizations SKAT recognizes as eligible to receive tax deductible charitable gifts. Reporting Organizations refers to the subset that made an annual declaration to SKAT in each year.

Table 2: Taxpayers Reporting a Charitable Deduction: Summary Statistics

	2006	2007	2008	2009	2010	2011
Number of Deductions	162,983	150,311	300,122	325,525	365,167	388,976
Regular gifts			270,826	294,912	336,571	360,527
Long-Term Contracts			44,381	46,069	44,676	44,399
Mean Value (DKK)	4,033	4,671	2,697	2,689	2,650	2,593
Regular gifts			2,026	2,071	2,098	2,074
Long-Term Contracts			6,009	5,740	5,850	5,879
Median Value (DKK)	2,400	2,470	1,500	1,500	1,500	1,375
Regular gifts			1,350	1,375	1,300	1,280
Long-Term Contracts			2,526	2,400	2,500	2,500
Total Value (DKK, '000)	657,310	702,103	809,429	875,337	967,693	1,008,615
Regular gifts			548,693	610,763	706,126	747,733
Long-Term Contracts			260,676	264,436	261,355	261,010

Notes: Number of Deductions is the number of taxpayers reporting a charitable deduction in each year shown. For 2008 and after, charitable gifts were reported in two categories. Information reporting and pre-population of deductions was introduced in 2008 for both regular and long-term gifts. The total number of taxpayers claiming a charitable tax deduction in each year is less than the sum of the two groups because some taxpayers claimed deductions in both categories.

Table 3: Number of Tax Deductible Claims: By Claim Size

Claim Size (DKK)	2006	2007	2008	2009	2010	2011
0-500	8,931	7,356	80,170	88,181	103,558	110,701
501-1,500	34,468	30,276	71,103	75,896	83,344	93,948
1,501-3,000	60,536	56,085	89,407	96,082	103,297	105,273
3,001-5,000	24,379	21,931	25,260	27,547	32,122	34,467
5,001-10,000	25,434	19,084	18,027	20,482	23,838	25,123
> 10,000	9,235	15,579	16,155	17,337	19,008	19,464
Mean	4,033	4,671	2,697	2,689	2,650	2,593
Median	2,400	2,470	1,500	1,500	1,500	1,375

Notes: Claim size is the amount of tax deductions received. Information reporting and pre-population was introduced in 2008.

Table 4: Charitable Tax Deductions Claimed: 2008

	Number
Total deductions claimed in 2008	300,122
Filed a return 2006-2011	293,134
No deduction 2006-2007	152,857
3 deductions 2009-2011	104,197
2 deductions 2009-2011	15,571
1 deductions 2009-2011	13,961
0 deductions 2009-2011	19,128

Notes: Filed a return is the number of taxpayers who claimed a charitable tax deduction in 2008 and filed a tax return in each year 2006-2011. No deduction 2006-2007 is the subset who did not claim a charitable tax deduction in 2006 or 2007. The No deduction 2006-2007 group is split into four mutually exclusive groups according to the number of charitable tax deductions claimed in the years 2009-2011.

Table 5: Tax Value of Regular Gifts

Taxpayer	Charity			Tax Deductible Amount
	1	2	3	
A	400	0	0	0
B	0	700	0	200
C	500	500	0	500
D	500	500	400	500

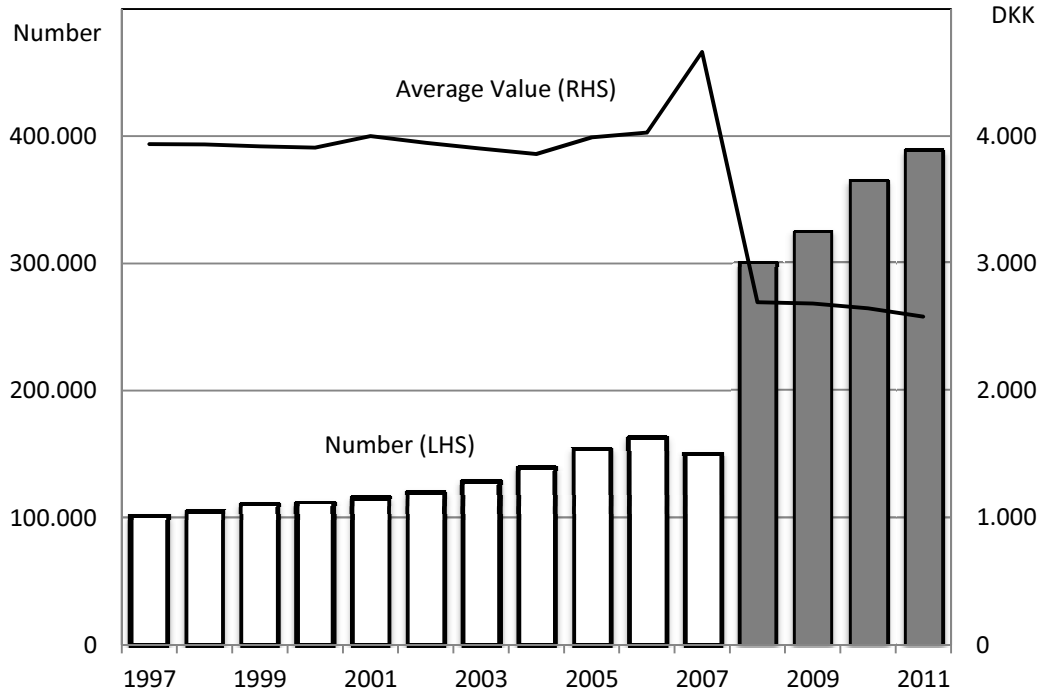
Notes: This table shows the amount of regular tax deductions received by four hypothetical taxpayers. Only annual gifts of DKK500 or more per charity qualified for a tax deduction before 2012, and the first DKK500 in total gifts is excluded in calculating the total value of regular tax deductions. The value of charitable deductions is equal to the deductible amount multiplied by the one-third subsidy rate.

Table 6: Dominated Giving Choices

	2008	2009	2010	2011
2008	5,927	2,05	1,878	1,48
2009		7,35	2,421	1,925
2010			9,743	3,168
2011				11,624
Total	270,826	294,912	336,571	360,527

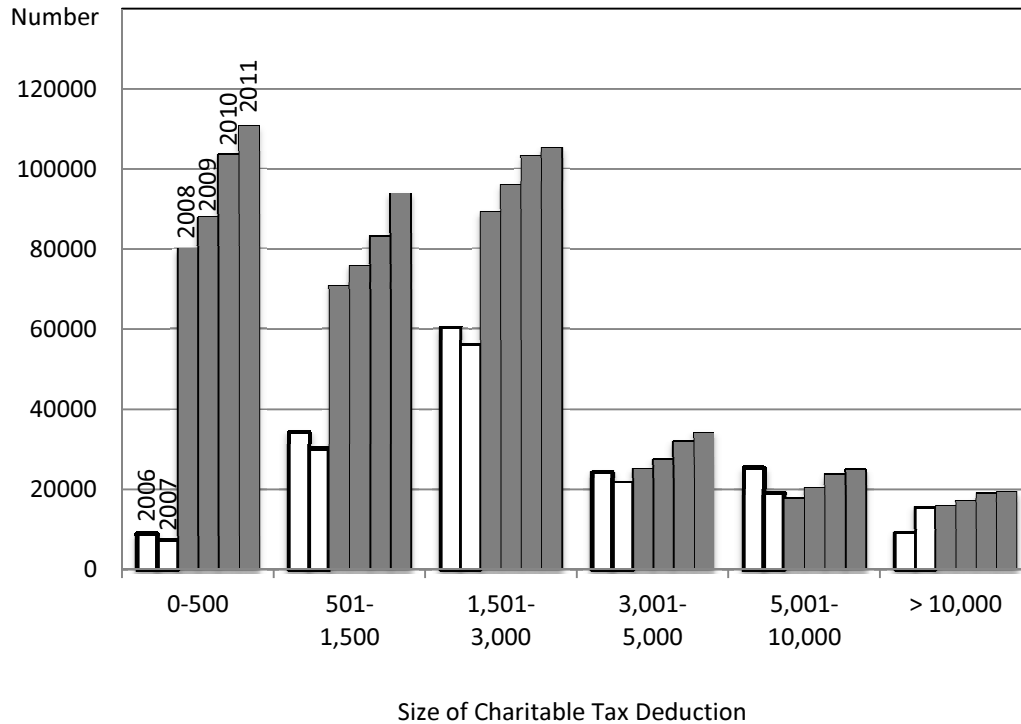
Notes: The diagonal elements report the number of taxpayers making a dominated giving choice in that year; the off-diagonal elements report the number of those taxpayers who made a dominated giving choice in each subsequent year. For example, 5,927 taxpayers made a dominated choice in 2008, and of those 1,878 also made a dominated choice in 2009 and 2010. Total is the number of taxpayers claiming a regular charitable tax deduction in each year.

Figure 1: Number and Average Value of Charitable Deductions Claimed



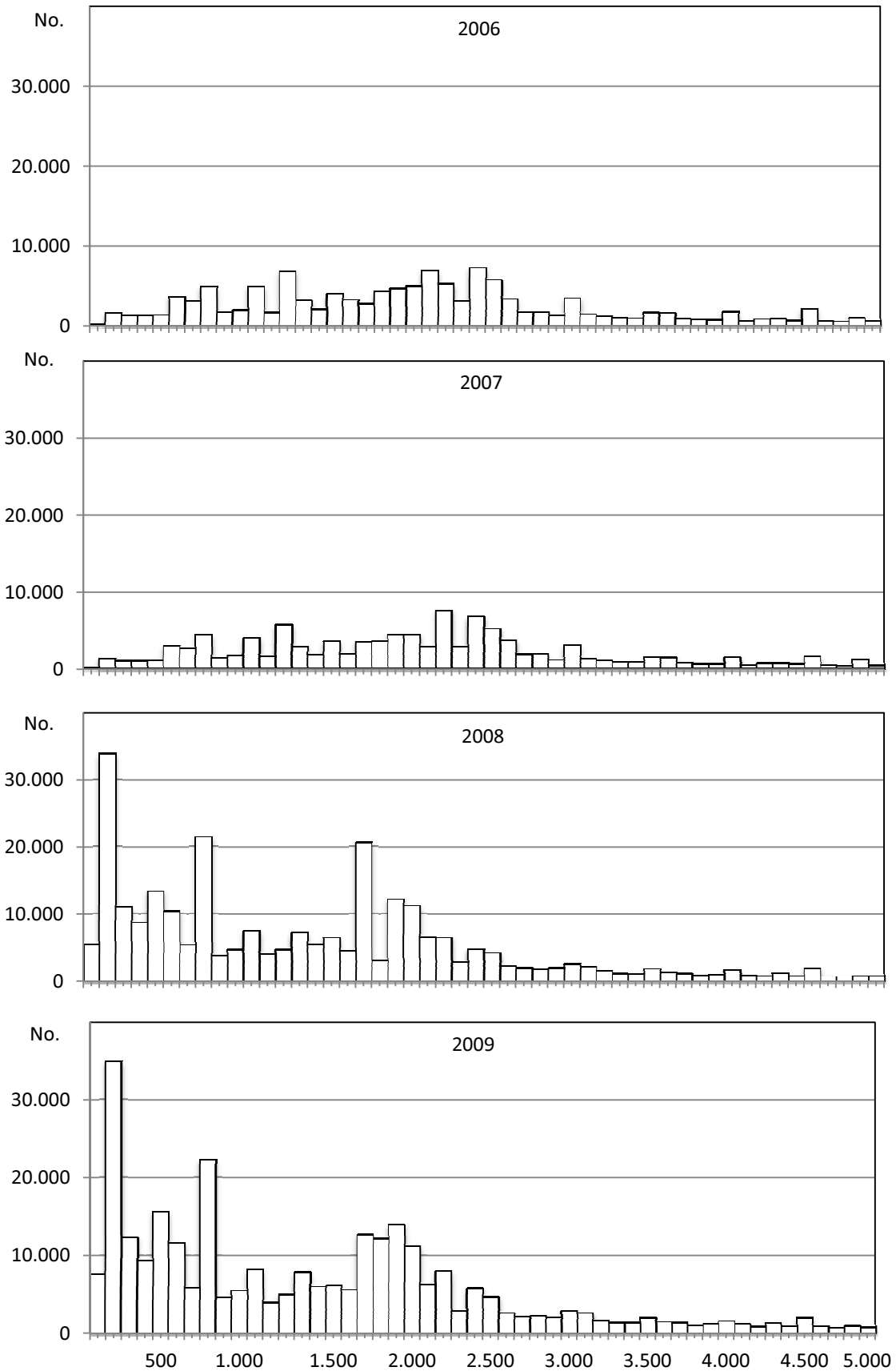
Notes: The columns in this figure show the number of taxpayers reporting a charitable deduction for the years 1997-2011, on the left-hand scale. The line shows the mean value of tax deductions claimed, on the right-hand scale. The shaded columns are for years in which there was information reporting and pre-population of deductions for regular and long-term gifts.

Figure 2: Number of Tax-Deductible Claims: By Claim Size and Year



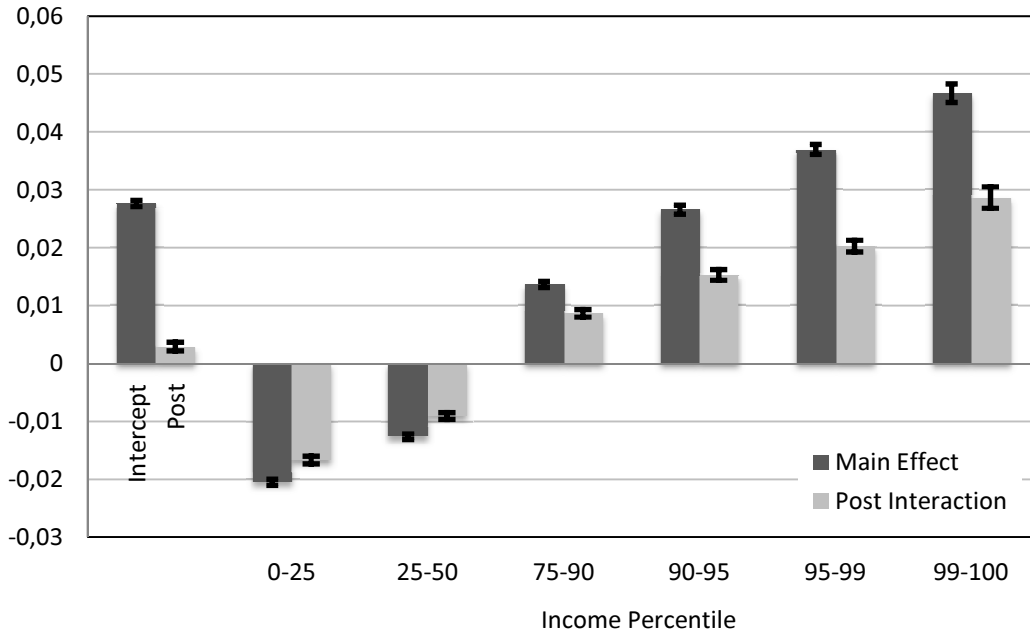
Notes: This figure shows the number of taxpayers reporting a charitable deduction for the years 2006-2011, by size of reported tax deduction. The claim size on the x-axis is the amount of tax deduction claimed, not the total value of charitable gifts made. Years for which there was information reporting and pre-population of deductions for regular and long-term gifts correspond to the shaded bars.

Figure 3: Distribution of Tax Deductions Claimed



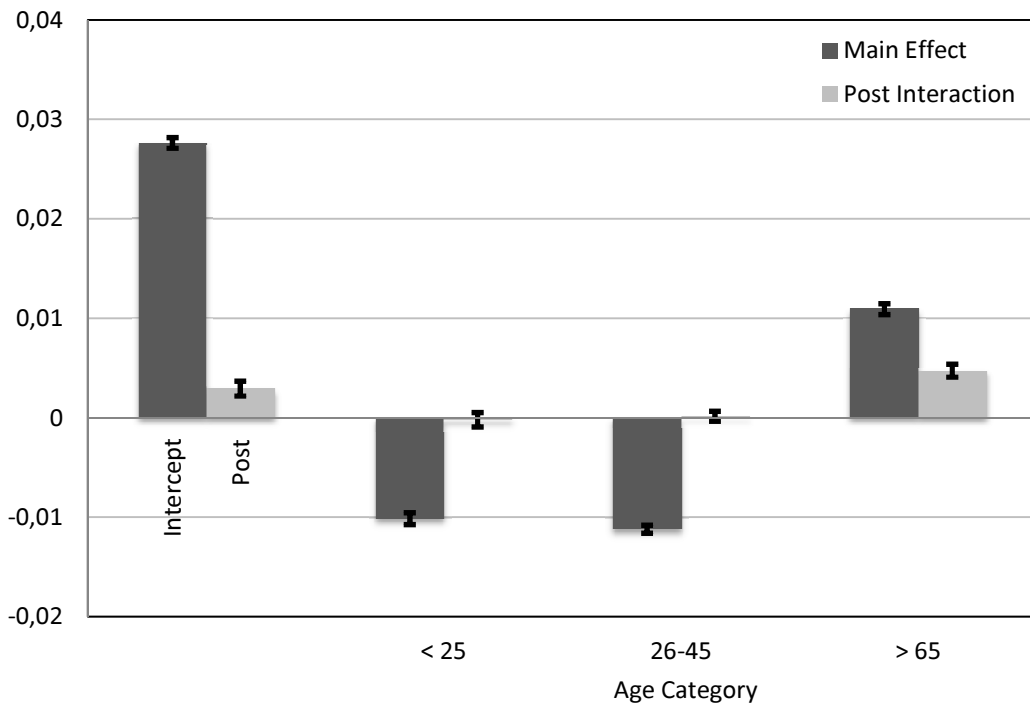
Notes: This figure shows the distribution of tax deductions claimed for the years 2006-2009. Information reporting and pre-population for regular and long-term charitable gifts was introduced in 2008.

Figure 4: Regression Parameter Estimates: Income Percentile



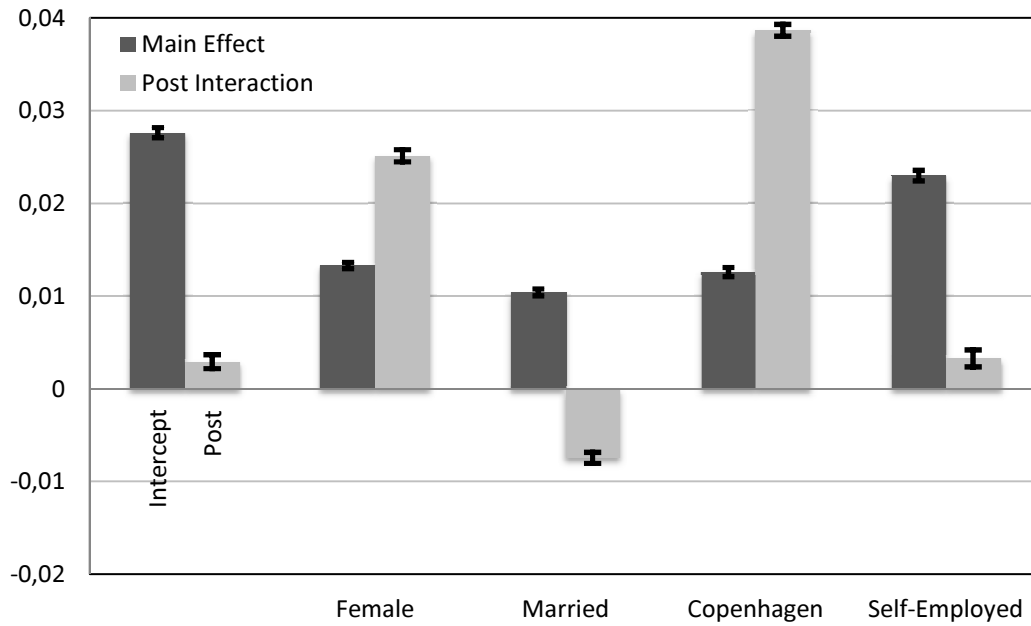
Notes: This figure reports OLS parameter estimates for the regression specification shown by Equation 1. The error bars show a 95 percent confidence interval for each parameter estimate. The intercept term indicates the probability that a taxpayer with the baseline set of characteristics claimed a charitable tax deduction in the pre-reform period: the baseline set of characteristics is a male taxpayer aged 46-65, in 50-75th income percentile, single, residing outside Copenhagen, and not self-employed.

Figure 5: Regression Parameter Estimates: Age



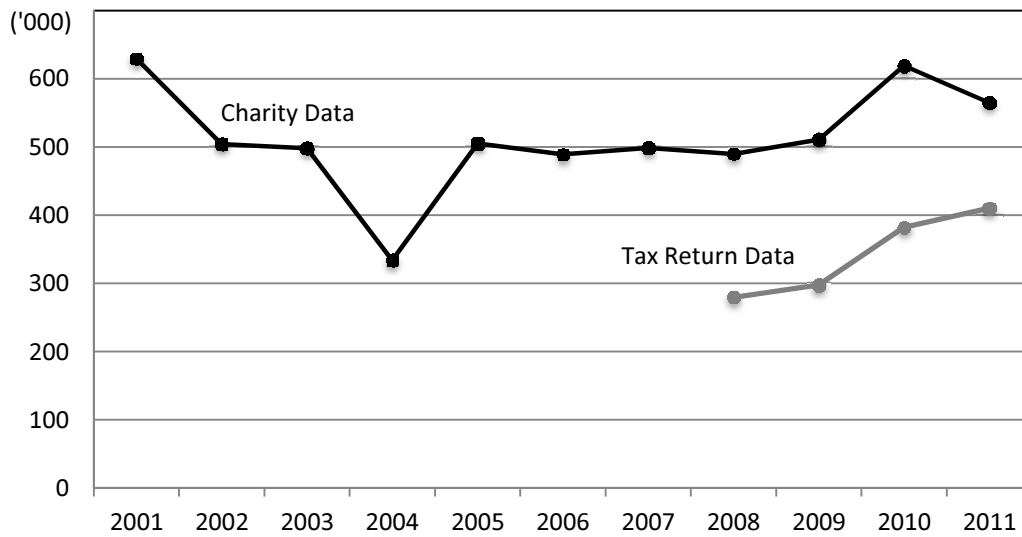
Notes: This figure reports OLS parameter estimates for the regression specification shown by Equation 1. The error bars show a 95 percent confidence interval for each parameter estimate. The intercept term indicates the probability that a taxpayer with the baseline set of characteristics claimed a charitable tax deduction in the pre-reform period: the baseline set of characteristics is a male taxpayer aged 46-65, in 50-75th income percentile, single, residing outside Copenhagen, and not self-employed.

Figure 6: Regression Parameter Estimates: Selected Characteristics



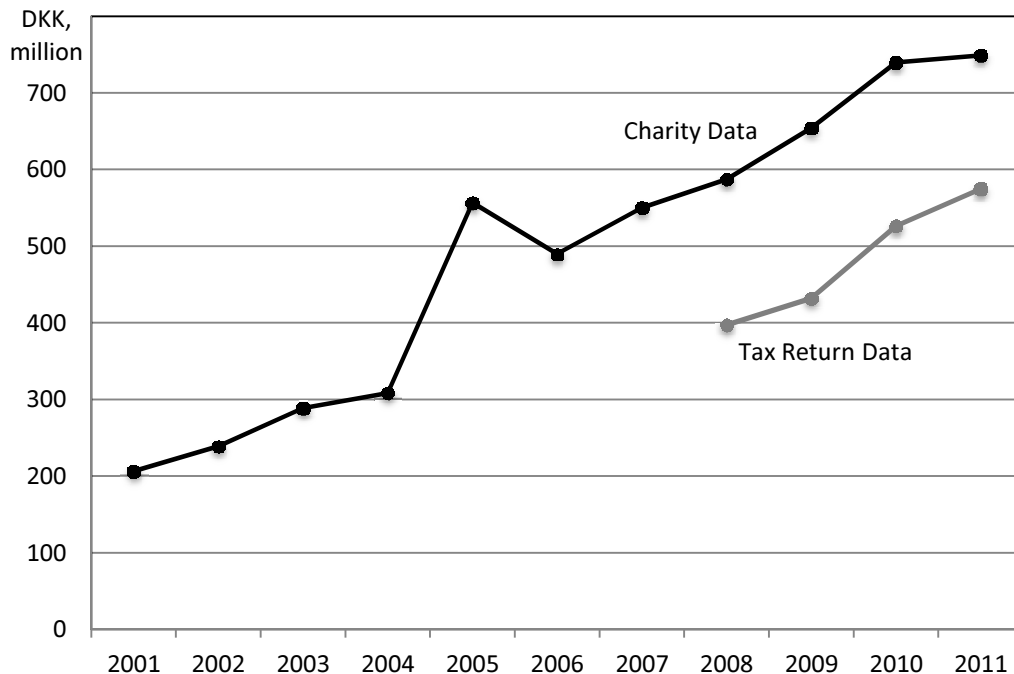
Notes: This figure reports OLS parameter estimates for the regression specification shown by Equation 1. The error bars show a 95 percent confidence interval for each parameter estimate. The intercept term indicates the probability that a taxpayer with the baseline set of characteristics claimed a charitable tax deduction in the pre-reform period: the baseline set of characteristics is a male taxpayer aged 46-65, in 50-75th income percentile, single, residing outside Copenhagen, and not self-employed.

Figure 7: Number of Charitable Donations: Ten Largest Charities



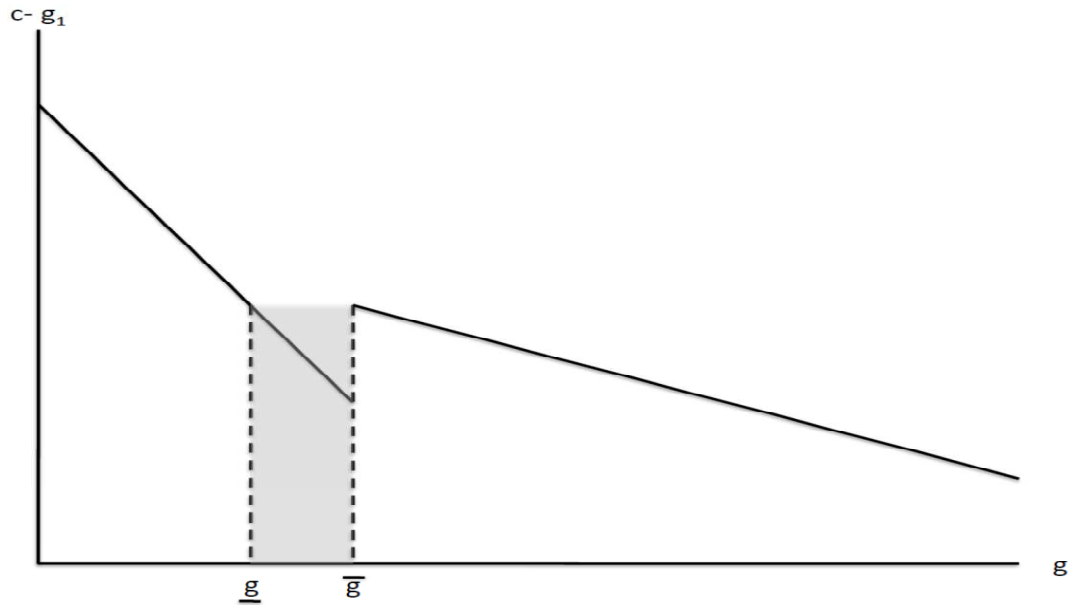
Notes: The Tax Return Data line indicates the total number of information reports received by SKAT from the 10 largest charities (aggregated by charity for each taxpayer), where charity size is measured by the total number of information reports received by SKAT over the period 2008-2011 (information reporting and pre-population for regular and long-term charitable gifts was introduced in 2008). The Charity Data line indicates the number of contributing members reported by those 10 charities. The dip in 2004 is due to a sharp drop in the number of donors reported by one large charity. Because there was no accompanying drop in the value of donations reported, we suspect this to be a reporting error.

Figure 8: Value of Charitable Donations: Ten Largest Charities



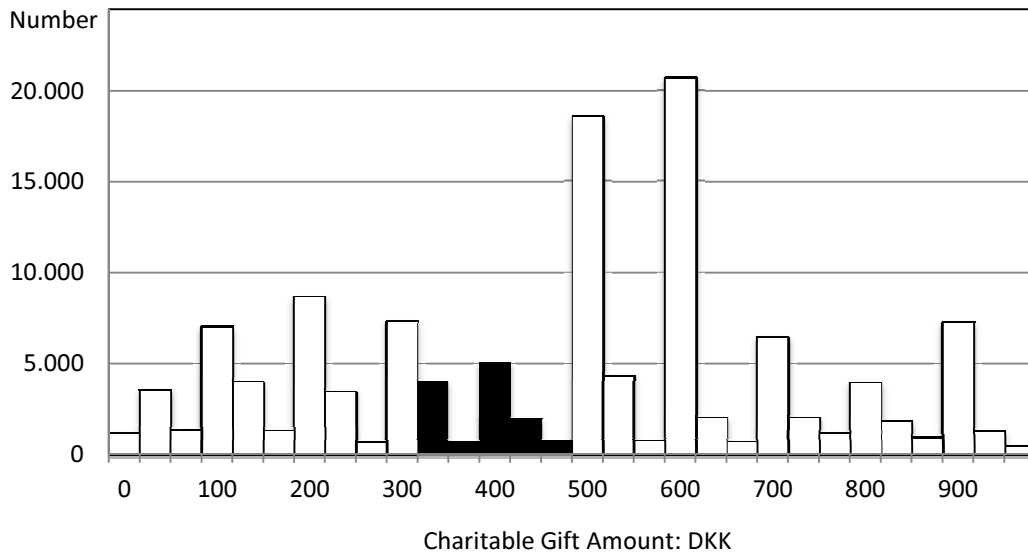
Notes: The Tax Return Data line indicates the total value of charitable donations contained in information reports received by SKAT from the 10 largest charities, where charity size is measured by the total number of information reports received by SKAT over the period 2008-2011 (information reporting and pre-population for regular and long-term charitable gifts was introduced in 2008). The Charity Data line indicates the total value of donations collected by those 10 charities.

Figure 9: Notched Budget Set



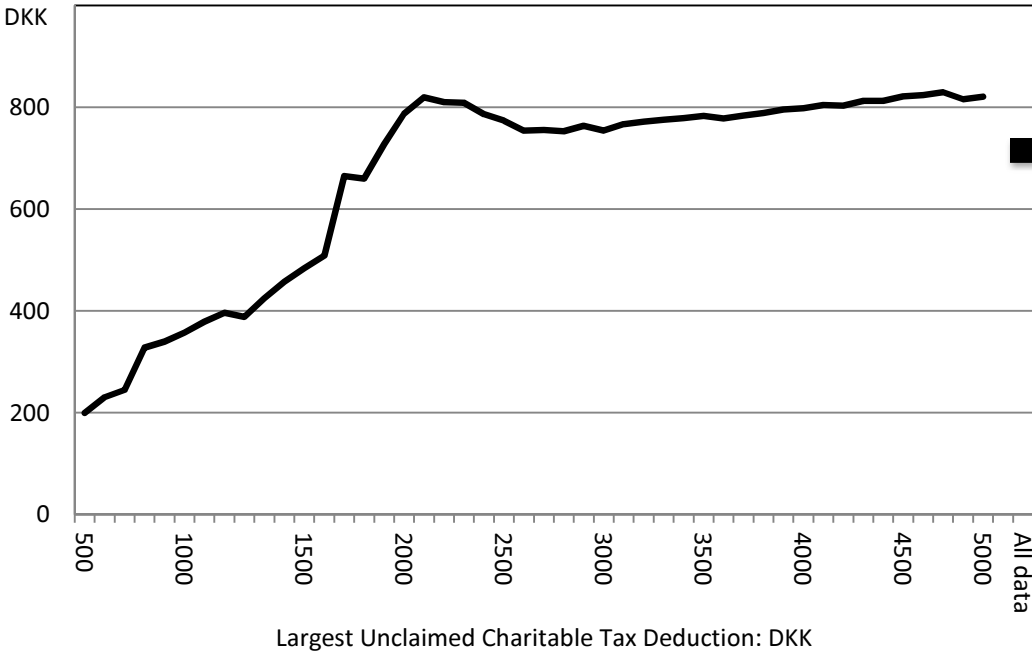
Notes: This figure shows the budget set for regular gifts, for a taxpayer with total annual gifts of DKK500 or more to a particular charity. All subsequent gifts to other charities qualify for tax deductibility provided they are of DKK500 or more per year. Any gift in the shaded region $g \in ((\underline{g}, \bar{g}^{\wedge}))$ is a strictly dominated choice for a taxpayer because a gift of \bar{g}^{\wedge} results in a higher level of charitable contributions and either the same or a higher level of consumption of all other goods. At the one-third subsidy rate, $\bar{g}^{\wedge}=500$ and $\underline{g}=333$. The y-axis measures consumption on all non-charitable items, less the largest charitable donation in excess of the DKK500 threshold (g_1).

Figure 10: Distribution of Charitable Gifts in 2011: Dominated Choices



Notes: For the group of taxpayers with a maximum regular gift greater than or equal to DKK500, this figure shows the number of other regular gifts made in 2011 (on the y-axis) by gift amount (on the x-axis). Gift amounts are in bins of DKK33.3, with tick mark labels corresponding to the lower limit of each bin. The solid bars show the number of strictly dominated charitable gift choices made in 2011. A taxpayer makes a strictly dominated choice if they make total annual gifts to at least one charity of DKK500 or more, and any further total annual gifts to other charities of more than DKK333 but less than DKK500. Raising any gift strictly inside the range DKK333-500 to DKK500 affords a higher level of charitable contributions at either no or less cost to the taxpayer. A few taxpayers made more than one strictly dominated choice, each of which is shown in the figure. The distribution is similar for the years 2008-2010 in which data are available.

Figure 11: Average Value of Unclaimed Deductions



Notes: The black line shows the average value of the change in charitable deductions claimed between 2007 and 2008 for claims having a value no more than the upper limit shown on the x-axis. That is, the mean value (m) of net new contributions between 2007 and 2008 conditional on claimed gifts (g) being no more than x is $(m | g < x) = [(V(2008) | g < x) - (V(2007) | g < x)] / (N(2007) | g < x)$, where $(V(t) | g < x)$ is the total value of tax deductions less than x in value claimed in year t , and $(N(t) | g < x)$ is the number of tax deductions with a value no more than x claimed in year t . The solid dot sets x to its maximum observed value: $x=x(\max)$.

Table 7: Regression Results for Equation (1)

Dependent Variable: Claimed a Tax Deduction			
	Coefficient	Std. Error	t-Statistic
Intercept	0.02764	0.00027068	102.11
Female	0.01331	0.00016898	78.77
Married	0.01041	0.00018638	55.86
Copenhagen	0.01260	0.00024514	51.39
Self-Employed	0.02300	0.00028487	80.74
Time	-0.00398	0.00016266	-24.45
Age: <25	-0.01014	0.00029713	-34.14
Age: 26-45	-0.01120	0.00020158	-55.55
Age: >65	0.01092	0.00027426	39.81
Income: 0-25th Percentile	-0.02050	0.00026347	-77.82
Income: 25-50th Percentile	-0.01263	0.00023914	-52.83
Income: 75-90th Percentile	0.01367	0.00026402	51.78
Income: 90-95th Percentile	0.02658	0.00039014	68.13
Income: 95-99th Percentile	0.03699	0.00042990	86.05
Income: Top Percentile	0.04671	0.00079829	58.51
Post	0.00293	0.00037333	7.86
Post x Female	0.02514	0.00020635	121.84
Post x Married	-0.00744	0.00022603	-32.93
Post x Copenhagen	0.03868	0.00029907	129.35
Post x Self-Employed	0.00328	0.00034702	9.46
Post x Time	0.00961	0.00017064	56.30
Post x Age: <25	-0.00019246	0.00036645	-0.53
Post x Age: 26-45	0.00015791	0.00024668	0.64
Post x Age: >65	0.00474	0.00032730	14.48
Post x Income: 0-25th Percentile	-0.01666	0.00032806	-50.78
Post x Income: 25-50th Percentile	-0.00906	0.00029509	-30.71
Post x Income: 75-90th Percentile	0.00868	0.00032131	27.03
Post x Income: 90-95th Percentile	0.01531	0.00045837	33.39
Post x Income: 95-99th Percentile	0.02029	0.00050629	40.07
Post x Income: Top Percentile	0.02868	0.00092872	30.88

Notes: This table reports OLS regression output for Equation (1). The data consists of the universe of taxpayers (4.37 million) observed over the years 2006-2011. Time is a linear time trend, and the R-squared statistic for the regression is 0.0265. The omitted category represents a male taxpayer aged 46-65, in 50-75th income percentile, single, residing outside Copenhagen, and not self-employed. Robust standard errors have been used.

Pay now or pay later: Danish Evidence on Owed Taxes and the Impact of Small Penalties

PEER EBBESEN SKOV*

THE ROCKWOOL FOUNDATION RESEARCH UNIT AND UNIVERSITY OF
COPENHAGEN

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Abstract

This paper studies the effectiveness of a policy designed to influence the timing decision for payments of owed taxes. Owed taxes arise when the sum of the foregoing tax year's preliminary tax payments falls short of the total tax liability. In 2009 the Danish tax authority (SKAT) introduced a small interest penalty amounting to a daily price of approximately DKK0.5 (US\$0.1) for the median amount of owed taxes. Using administrative tax data I show that the penalty introduction led to a 50-day advancement in payment timing. The evidence further indicates liquidity access as an important factor behind the taxpayer response.

Keywords: Owed taxes, small penalties, marginal interest rates.

*Skov: Sølvgade 10, 2tv. DK-1307 Copenhagen. ps@rff.dk .Thanks to Claus Thustrup Kreiner, Søren Leth-Petersen, Eskil Heinesen, Rasmus Landersø, Morten Ravn Appelsø and Søren Pedersen, and seminar participants at Copenhagen University, The Danish tax authorities (SKAT) and the Rockwool Foundation Research Unit for helpful comments, conversations and suggestions, and the Danish tax authorities for generously sharing their data. This research was supported by the Rockwool Foundation Research Unit.

I. Introduction

This paper studies the effectiveness of a policy designed to influence the timing decision for payments of owed taxes. Owed taxes arise when the sum of the foregoing tax year's preliminary tax payments falls short of the total tax liability. Although the payment timing is left to the taxpayers' discretion, the tax authorities often attempt to guide the taxpayers' decision by setting up incentives to encourage a faster payment. In fact, it is standard among western tax administrations to invoke interest penalties on owed taxes paid after some deadline.¹ The effectiveness of such policy instruments is important because the aggregate size of owed taxes can be substantial. In the case of Denmark owed taxes in 2009 amounted to about 3% of total personal tax payments for all taxpayers and close to 10% for taxpayers with a balance due.

The Danish tax year follows the calendar year. In the beginning of March (after the tax year) all taxpayers receives their pre-populated income assessment. Prior to the tax year 2009 the pre-populated income assessment informed the taxpayers that owed taxes paid before July 1st would avoid any interest penalties. The clear payment incentive seemingly had a high take up rate as 70% of all payments occurred within the last 10 days prior to July 1st. For tax year 2009, Denmark's tax authority (SKAT) introduced an interest rate penalty of 4.6% p.a. accruing from the end of the last day of the 2009 tax year, i.e., from January 1st 2010. The 2009 pre-populated income assessment informed the taxpayers that owed taxes accrued interests and showed the balance specific costs of postponing the payment. The 2009 distribution of owed taxes was roughly similar to the foregoing tax years as it included roughly a third of all Danish taxpayers and that the median amount due was close to DKK2,800. For the median taxpayer the daily interest penalty of not paying amounted to DKK0.35. Hence postponing the payment to July 1st would cost the median taxpayer DKK64. For 90% of the taxpayers with owed taxes the interest penalties resulting from postponing the payment to July 1st was less than 2.25% of their average monthly disposable income. That is, both in relative and absolute terms the 2009 introduced interest penalties on owed taxes were minor indeed. Despite the negligible size of the penalties the introduction coincided with a substantial advancement of payments. For tax

¹ For instance US taxpayers are required to file a tax return and remit any outstanding taxes to the IRS every year before April 15th. Taxpayers with a balance due who do not meet the payment deadline face a failure-to-pay penalty of ½ - 1 % with a monthly accrual on their unpaid taxes. In Sweden, a country very similar to Denmark (also in terms of overall tax burden), the tax system operates a two tier-system where owed taxes in excess of 30.000 SEK is allowed an interest free credit of 2 months before the balance accumulates interests whereas lower amounts is allowed 4 months.

year 2009 only 15% of all the payments occurred within the last 10 days prior to July 1st. Computing the average number of days from the end of the tax year (January 1st) to the payment date and comparing this distance for tax year 2008 (no interest penalty) to tax year 2009 (interest rate penalty) shows the average ‘payment distance’ was 50 days shorter in 2009. Of particular interest for tax administrations, my findings suggest that even small penalties on owed taxes can result in a substantial advancement of the payment timing.

Existing literature on the timing decision is very limited. To my knowledge the only available study examining the timing decision is Slemrod et al. (1998), who shows that a significant share of American taxpayers filed their 1988 return at the latest possible date. A deadline response so pronounced Slemrod et al. (1998) coins it the April 15 syndrome. The study shows that the amount of foregone interest, caused by the late filing, aggregated across all taxpayers with a refund due is substantial. Slemrod et al. (1998) outlines a possible theoretical model to explain the somewhat puzzling filling times. The current study targets the taxpayer decision of when to pay owed taxes and how that decision is influenced by interest penalties as opposed to the filling decision itself. For American taxpayers the filing decision and payment timing will often coincide but certainly need not as taxpayers can file according to deadline but choose not to remit owed taxes at the same time. In terms of both research design and data the current study adds to the study by Slemrod et al. (1998) in a number of ways. First, I make use of exogenous variation to the cost of payment timing from a policy reform that introduced a small interest rate penalty on owed taxes. I investigate the effect of the policy reform using a dataset constructed from the administrative tax registers. The data includes information on among other things filling status, payment timing, and internet log files from personal tax e-accounts for all Danish taxpayers. Second, to better understand the mechanisms behind the behavioral response I use a palette of different measures on taxpayer’s liquidity and show empirically how they covariate with payment timing.

Basic economic theory would suggest that the payment decision is governed by the taxpayers’ alternative interest rates. That is, taxpayers facing interest rates in excess of the penalty rate wouldn’t respond to the penalty on owed taxes whereas taxpayers with lower alternative interest rates would advance their payments.² In line with the literature on the importance of liquidity

²In general interest payments are tax deductible in Denmark, however, penalties on owed taxes are not. Therefore even taxpayers with interest rates in excess of the penalty rate of 4.6% p.a. might optimally choose to advance their owed tax payments.

constraints for consumption smoothing see e.g. Zeldes (1989), Johnson et al. (2006) and Leth-Petersen (2010) I calculate a first measure of liquidity as liquid assets relative to disposable income. I show that taxpayers who are potentially liquidity constrained respond less to the introduction of the 2009 interest penalty. Additionally, I impute each taxpayer's marginal interest rate from a novel dataset holding information on all individual deposit, and loan accounts, and account specific interest payments made throughout the previous year. For the tax year 2009 I plot the distance in days from January 1st to the payment day against the imputed marginal interest rates and find that an increase in the marginal interest rate from 5 to 10% leads to a postponed payment of 8-10 days. These findings suggest that the change in payment timing is in fact driven by economic incentives rather than a pure time effect.

In a study of the driving causes behind tax refunds and owed taxes Jones (2012) presents overwhelming evidence that taxpayers are dragging their feet in relation to adjusting to exogenous changes in their tax prepayments and tax liability. Jones (2012) attributes the low taxpayer response to inertia. I provide two sets of results on taxpayer inertia. First, based on taxpayers with owed taxes in both tax years 2008 and 2009 I find that there is only weak persistence in the payment timing between 2008 and 2009.³ Second and more closely related to the approach in Jones (2012) I compare the number of new preliminary income assessment in the wake of the announcement of the penalty introduction to the following tax year. My results align with Jones (2012) and clearly suggest that the Danish taxpayers didn't respond to the interest penalty introduction by increasing their preliminary tax payments.

Finally, my findings allow for a more general interpretation in light of the growing literature on the importance of frictions for taxpayer responses to tax incentives, see for example Chetty et al. (2009) and Chetty (2012). For close to 2/3rds of the Danish taxpayers the pre-populated income assessment distributed in March includes all the necessary information and is therefore also the final tax return and so the only required action left for taxpayers with a balance due is to file the payment. I speculate that the automatically generated tax returns and the printing of the taxpayer specific interest cost on the pre-populated income assessment constitutes a close to frictionless environment and that this was important for the effect of the albeit meager payment incentive structure. I provide some evidence for my conjecture by

³ Payment timing persistence is certainly present in the data when I construct similar plots based on data from 2006, 2007 and 2008 i.e. prior to the penalty introduction.

using the fact that while the pre-populated income assessment are not distributed before March the introduced penalty interest accruing from the end of the last day of the 2009 tax year, i.e., from January 1st 2010. In a plot of the payment dates across tax years (figure 6) I show that almost all of the reduction in payment time comes from changing the payment date from the end of June (prior to 2009) to mid-March (after 2009).

The remainder of paper is organized as follows. In section 2, I briefly outline the Danish tax system and the timing of events in the Danish tax year to clarify the rules governing the income assessment and the origins of owed taxes. The section is concluded with a detailed description of the taxpayers' repayment options. In section 3, I present the data and offer some descriptive statistics. In Section 4, I present the empirical results. Section 5 concludes.

II. Background: The Danish tax system, owed taxes, and the penalty introduction

Owed taxes arise when the sum of the foregoing tax year's preliminary tax payments falls short of the total tax liability. In what follows I will briefly outline the calculations and timing behind the total tax liability and preliminary tax payments in the Danish tax system and discuss a few examples of how and why they can diverge and result in owed taxes. The section ends with a presentation of the payment options for owed taxes and the 2010 tax reform that included the introduction of interest penalties on owed taxes. I restrict my attention to taxpayers subject to the standard filling deadline (SFD) because rules and tax deadlines vary significantly across filling status. Taxpayers subject to the SFD are primarily standard wage earners and account for roughly 80% of all the Danish taxpayers, see appendix Table A1.

For Danish wage earners the annual tax liability is the result of a 3-step calculation. First, a labor market contribution is imposed on labor income. Second, national taxes are levied on the, so-called, A-income tax base defined as labor income minus labor market contribution plus any positive net capital income. Third, municipal taxes, a health contribution, and church taxes are levied on taxable income which is defined as labor income minus labor market contribution plus net capital income minus deductions. Deductions primarily consists of interest payments, some pension plan contributions, a transport allowance for taxpayers travelling over 12km to work, union membership fees or unemployment insurance funds and child support payments. The labor

market contribution is a flat rate, 8% in 2008. The national taxes make up a progressive three-bracket system with tax rates equal to 5.5%, 11.5%, and 26.5% in 2008. The municipal tax rate varies across municipalities, in 2008 the average municipal rate was 24.8% and there was a 4.5 percentage points spread between the 10th highest and 10th lowest municipal tax rate. The church tax and the health contributions are both flat rates and were 0.73% and 8% respectively, in 2008. Finally, the system includes a tax ceiling that caps the sum of the bottom-bracket tax, middle-bracket tax, top-bracket tax, health contribution and municipal tax at a given rate, 59% in 2008. The total tax liability is found as the sum of the taxes paid in the 3-step calculation above minus the tax-value of a personal allowance for each tax rate. For 2008 the personal allowance was DKK41,000, see Kleven et al. (2011) and Kleven and Schultz (2013) for a more detailed presentation of the Danish tax system.

II.A The Danish tax year

For any given tax (calendar) year t two dates on the taxpayer's calendar stand out. First, in the beginning of November ($t - 1$) the taxpayer receive his preliminary income assessment. The preliminary income assessment includes the taxpayer's tax free deduction and withholding rate for the following tax year. The information on the preliminary income assessment is automatically distributed to taxpayers' employer(s) for withholding purposes. The information is used such that for any given monthly wage payment the tax free deduction and the withholding rate in turn determines how much tax is withheld and thereby the taxpayer's disposable wage income. The prediction of the taxpayer's income in year t is his realized income in year ($t - 2$) adjusted for income growth. The withholding rate is found as the average of the tax rates outlined above weighted by the predicted sizes of the relevant income bases. The tax free deduction is found as the difference between predicted A-income and predicted total tax liability as a fraction of the withholding rate times a 100. Second, in the beginning of March ($t + 1$) the taxpayer receive a pre-populated version of his tax assessment notice on the preceding tax year. The pre-populated tax assessment notice is based on all available third-party reporting, e.g. information from employers and banks etc., and it specifies the taxpayer's total tax liability and the amount paid via withholding. Taxpayers have until May 1st to amend their pre-populated return to include any income and deductions that is not third-party reported. Every correction to the pre-populated return will generate a new return all of which specify the taxpayers total tax liability and taxes paid. When paid taxes exceed the total tax liability a check for the difference is issued to the

taxpayer. When paid taxes are less than the total tax liability the taxpayer is liable to pay the difference. Illustration 1 below outlines a Danish tax year (t) and highlights the relevant deadlines.

Box 1: Illustration of a Danish tax year (t) and the timing of important events

Year t-1		Tax year t		Year t+1	
Month	Event	Month	Event	Month	Event
		<i>January</i>	During the tax year the taxpayers pay preliminary taxes according to their preliminary income assessment.	<i>January</i>	Tax year t have ended but the taxpayers can still make additional tax payments anytime before July 1st.
				<i>March</i>	The taxpayers receive their pre-populated tax assessment notice including information on any outstanding taxes.
				<i>May</i>	The taxpayers have to file corrections to their pre-populated tax assessment notice before May 1st
<i>November</i>	The taxpayers receive their preliminary income assessment.			<i>July</i>	The taxpayers can no longer file tax payments for tax year t. SKAT automatically collects any owed taxes.
		<i>December</i>	The tax year ends.		

Owed taxes are the result of a discrepancy between preliminary tax payments and total tax liability and can originate from many different sources. Examples typically include significant changes to either the taxpayers' income or deductions between tax year $t - 2$ and t . Recall that the preliminary income assessment is a function of the income in year $t - 2$. This discrepancy will result in the taxpayer paying either too little or too much taxes via automatic withholding. As one example, consider a taxpayer with a variable-rate mortgage. If his interest rate increases between year $t - 2$ and t then the taxpayer's interest rate payments increases which will lower his taxable income because his interest payments and thereby deductions increases. Similarly, changes in labor income due to retirement, unemployment spells, or promotions can affect the tax liability as well. As an attempt to include all relevant changes in the preliminary income assessment SKAT encourages the taxpayers to revise their preliminary income assessment form to match current conditions.

II.B Payment timing and the 2009 penalty introduction

As previously mentioned the Danish tax year follows the calendar year and so by definition owed taxes doesn't exist prior to the end of the tax year, December 31st. Additionally the taxpayers automatically receive their pre-populated tax assessment notice in the beginning of March ($t + 1$) and so it is plausible that most taxpayers avoid the hassle of calculating their return and simply wait for SKAT to inform them. As indicated in the illustration above the taxpayers can file payments on tax year t 's owed taxes until July 1st in $t + 1$. In case the taxpayer still have outstanding taxes on July 1st SKAT will automatically deduct the amount up to a threshold (DKK18,300 in 2008) into the preliminary income assessment for tax year $t + 2$ and owed taxes in excess of the threshold is charged in 3 installments of equal size in the following months of September, October and, November, tax year ($t + 1$).

The exogenous variation in this study comes from the introduction of interest penalties on owed taxes paid between January 1st ($t + 1$) and July 1st ($t + 1$). The interest penalties were introduced as a part of the Danish 2010 tax reform where the most prominent feature of the tax reform was a significant reduction in marginal tax rates for high income taxpayers, see Kreiner et al. (2013). The reform was passed in the Danish parliament on May 28th 2009 and took effect from January 1st 2010 which meant that the interest penalties applied to any owed taxes for tax year 2009 whereas the rest of the reform matter only for tax year 2010 onwards.

The box below outlines the payment rules governing the period from January 1st to July 1st for tax year 2008 and 2009, pre and post the interest penalty introduction.

Box 2: Illustration of a payment rules, penalties and important deadlines

Payment timing	Tax year 2008 (Pre penalty introduction) - Penalty rate -	Tax year 2009 (Post penalty introduction) - Penalty rate -
December 31th (year t)	0%	0%
Between January 1st and March 17th (year t + 1)	0% on payments up to DKK40,000 2% on amounts in excess of DKK40,000.	Penalty = 4,6 % * ((Payment date - January 1st) / 365 days). <u>For example:</u> payment on March 11th 2010 4,6 % * (70 days / 365 days) = 0,88%.
Between March 17th and July 1st (year t + 1)	0% but payments capped at DKK40,000.	As above.
After July 1st (year t + 1)	7 % - Owed taxes (including the penalty) below a threshold, 17.700 DKK, is deducted against the following tax year's (t+2) tax free allowance. Any owed amount in excess of the threshold is charged in 3 installments of equal size in the following months of September, October and, November, tax year (t+1).	6.6 % - Owed taxes (including the penalty) below a threshold, DKK18,300, is deducted against the following tax year's (t+2) tax free allowance. Any owed amount in excess of the threshold is charged in 3 installments of equal size in the following months of September, October and, November, tax year (t+1).

The 2009 penalty introduction meant that from January 1st 2010 (thereby covering tax year 2009) the interest free credit of DKK40.000 from January 1st to July 1st was abolished. Instead owed taxes were penalized by an interest penalty:

$$(1) \quad \text{Penalty} = \delta * \left(0.046 * \frac{\#days(\text{payment date} - \text{january 1st})}{365} \right)$$

where δ is the balance due. In addition, to simplify the rules, the previous penalty rate of 2% for owed taxes of above DKK40,000 repaid before March 15th and the payment cap between March 17th and July 1st was removed.

Figure 1 illustrates the payment scheme facing the Danish taxpayers with owed taxes across the penalty introduction. Time is plotted on the x-axis and publication of the pre-populated tax assessment is highlighted by the first vertical dotted line at March. The second vertical dotted line shows the May filling deadline for changes to the pre-populated return. The two plotted lines show the total amount of owed taxes by elapsed days from January 1st (end of

the tax year), for a taxpayer who underpaid his tax liability with DKK2,800, for the pre and post reform tax years, 2008 and 2009.⁴

The interest penalty introduction changed the payment incentive facing the taxpayers in the period from January to July. In the January – July window payments are characterized by the taxpayer initiating the payment process. He either logs on to his e-account at SKAT and pays over the internet or makes a bank transfer. The 2008 zero gradient on the line segment from January 1st to July 1st reflects the (pre-reform) policy rule that owed taxes weren't penalized. For the taxpayer with owed taxes of DKK2,800 that meant he would have to pay 2,800 DKK no matter if he paid in January, or in March when received his preliminary income assessment or waited until the very last week of June. In other words, in the pre-reform payment scheme SKAT offered half a year interest free credit on the payment of owed taxes. For tax year 2009 SKAT introduced an interest rate penalty of 4.6% p.a. accruing from the end of the last day of the 2009 tax year, i.e., from January 1st 2010. The positive gradient in the 2009 line segment reflects the adopted policy as shown in equation 1.

For a taxpayer with owed taxes of DKK2,800 the price of postponing payment from January 1st to July 1st was DKK64 making the daily price, the gradient on the January-July line segment, 0.35 DKK. In addition to the introduction of the interest penalty SKAT simplified the rules governing large payments. Prior to the reform payments of more than DKK40,000 had to be done before March 15th and the amount above DKK40,000 was penalized by a 2% interest penalty. In the period between March 15th and July 1st the taxpayers could pay up to DKK40,000 interest free. From tax year 2009 the special rules governing payments of more than DKK40,000 was abolished all together.

The payment process following July 1st is characterized by SKAT initiating the events. Both pre and post the penalty introduction remaining owed taxes were penalized, by 7% (2008) or 6.6% (2009), which is graphically evident as a price notch on July 1st. The payment process after July 1st includes at most two parts and is invoked automatically. First the amount of owed taxes (including the penalty) below a threshold, DKK18,500 in 2008, is deducted against the following tax year's ($t + 2$) tax free allowance. Second, any owed amount in excess of the threshold is charged in 3 installments of equal size in the following months of September, October and, November, tax year ($t + 1$).

⁴ DKK2,800 is the median of owed taxes for both tax years 2008 and 2009, see appendix Table A1.

Given the penalty scheme the payment timing decision can be solved analytically for each taxpayer and will depend on the amount of owed taxes and the alternative interest rate. However, for now I'll constrain myself to two more casual observations. First, both post and prior to the penalty introduction the penalty scheme includes a notch on July 1st which suggests that a substantial share of the payments fall in the final week of June. Second, the introduction of the interest penalty the taxpayers were given an incentive to bring forward their payment of owed taxes. However, at least for the median taxpayer, as illustrated in figure 1, the incentive was somewhat diminutive.

III. Data: Individual level information on owed taxes, payment timing, and liquidity

This study is based on data from the Danish tax authorities (SKAT) and covers all Danish taxpayers from 2005 to 2009. Despite the fact that all the information is related to the annual tax return, SKAT stores the data in four different registers due to the size and varying data structure. The first register includes the results of the tax return calculations, i.e., the amount each taxpayer has either under or overpaid relative to his total tax liability, and the time and date the income assessment was available to the taxpayer via his personal e-account. Each taxpayer can have multiple records because of corrections to a tax return, e.g., the taxpayer provides new information on item deductions or SKAT receives new third party information. Furthermore, using internet log files from the personal e-accounts the register also shows the time and date for when each return was first viewed by the taxpayer. The personal e-accounts are available to all taxpayers but the taxpayers are not required to use them. Therefore, the register also includes the date the tax return was printed and packed for air mail. The second register provides information on the payments made by the taxpayers to SKAT. For each taxpayer the second register holds information on the amount paid and the timing of the payment. For the taxpayers who underpaid their taxes, register one and two, in combination, shows what each taxpayer owes, when they learned the results of tax authorities tax return calculation, and when they paid. The third register provides information on the preliminary income assessment.⁵ The taxpayer's preliminary income assessment include the monthly allowance and average tax rate which in turn determines how much the taxpayer pays in tax of each wage payment. Because it is possible for the

⁵ The information on the preliminary tax statements is currently only available after 2009.

taxpayer to file adjustments to his preliminary income assessment throughout the year the register can hold multiple records for each taxpayer. The fourth register provides annual information on all individual deposit and loan accounts and account specific interest payments made throughout the foregoing year. This information allows me to approximate the interest rate for each of the taxpayer's accounts and in turn impute each taxpayer's marginal interest rate. Finally using the personal identification number (CPR) all of the tax data has been augmented with demographic and socio-economic variables from Statistics Denmark.

Figure 2 provides an overview of the size of owed taxes over the five tax years. The calculations are based on the pre-populated tax assessment and include all taxpayers subject to the SFD, roughly 80% of all taxpayers.⁶ Panel A shows the sum of owed taxes. In the pre-reform period from 2005 to 2008 owed taxes increased from roughly DKK6.5 bn. to almost DKK10 bn. The 2010 reform coincided with a drop in owed taxes of about DKK1 bn. The number of taxpayers with owed taxes has been in the neighborhood of 1.3mil throughout the observation period, corresponding to one third of the SFD taxpayers. Panel B includes only the taxpayers with owed taxes and reports the average amount due and owed taxes as a share of the total tax payment. In combination Panel A and B provide evidence that owed taxes is a significant component of the tax system with DKK10 bn. being 3% pct of 2008s total tax revenue from personal taxation and for the taxpayers with a balance due, owed taxes made up approximately 10% of their total annual tax payments.

Figure 3 shows the distribution of owed taxes separated out on the four tax years 2006-2009, the corresponding percentiles can be read in appendix Table A1. Most of the observations are relatively small amounts with 60% of the distribution owing less than DKK5.000. For the last 3 years of the observation window the median is stable at DKK2.800 whereas the average displays an increasing trend from DKK5.434 in 2005 to DKK7.317 in 2008 and then it drops to DKK6.718 in 2009. Comparing data the owed tax distribution in 2008 and 2009 shows a lowering of owed taxes particular above the 90th percentile which drops from DKK17.019 in 2008 to DKK14.986 in 2009.

Using the payment register I construct two distance measures that will serve as my main outcome variables. The first measure computes the distance in days between January 1st and the payment date. The second distance measure

⁶ Appendix Table A1 shows number of taxpayers by filing deadline and total amount of owed taxes across the tax years.

computes the difference in days between the time the taxpayer received the income assessment and the payment was made. For each taxpayer payment I link the corresponding income assessment that is closest in time. If there is no income assessment prior to the payment I use the date for the closest income assessment following the payment, allowing this distance to be negative. For each income assessment I compute the day the taxpayer received the information either by logging on to his e-account or if no such internet log record exist I use the standard mail shipping date. The two distance measures will allow me to compute the change in average ‘payment distance’ across the years from 2006 – 2009 and assess whether the introduction of the penalty coincided with a change in the payment timing. The distributional statistics for each of the two calculated distance measures can be found in appendix Table A2.

Finally, I construct two measures of liquidity which allow me to link the within year distribution of my constructed payment distances to indicators on credit market constraints. The first measure computes the level of liquid assets relative to disposable income, similar to the measure used in, e.g., Zeldes (1989), Johnson et al. (2006) and Leth-Petersen (2010). The second measure is imputed marginal interest rates and is constructed based on the deposit and loan register. First I compute account specific interest rates as

$$(2) \quad r_i = \frac{R_i^t}{1/2[D_i^{t-1} + D_i^t]}$$

where R_i^t is interest payments from account i during year t . D_i^{t-1} is the value of the account by the end of tax year $t-1$ and D_i^t is the value of the account by the end of tax year t . For individuals with loan accounts I choose the highest account-specific interest rate, and for individuals holding only deposit accounts I chose the lowest account-specific interest rate as the individual’s marginal interest rate. Figures of the distribution of the two liquidity measures can be found in appendix Figure A1 and a more thorough introduction to the construction of the marginal interest rates and discussion of possible pitfalls can be found in Kreiner et al. (2012).

The compiled database on owed taxes allows me to calculate the change in payment timing across the policy introduction of the interest rate penalty. However, in order to interpret any such annual difference in payment timing as the causal effect of the new policy I need to assume that in the absence of the policy introduction the payment timing distribution had remain unchanged. The validity of this time invariance assumption can to some degree be

assessed by comparing the payment timing distributions prior to the reform, e.g., tax year 2007 and 2008.⁷ Based on panels A-C in figures 4 and 6 I consider this assumption reasonable.

IV. The effect on payment timing from the introduction of small penalties

IV.A Payment timing across years

If taxpayers responded to the introduction of the interest penalty on owed taxes then the accumulated payment distribution as a function of time should reveal that a larger fraction of owed taxes was paid sooner for tax year 2009 than for the previous tax years. As a natural first test, then, Figure 4 shows the accumulated payment distribution for tax years 2006-2009. The panels include all owed tax payments from day 0 (the tax year specific publication date for the pre-populated tax assessment) to the payment deadline July 1st indicated by the vertical red line. Panels A, B and C reveal a consistent payment pattern from 2006 to 2008 with over 50 % of the payments falling in the final week of June. Panel D shows a clear change in the payment timing coinciding with the 2010 reform with only 15 % of the payments falling in the final week of June. Similarly, for tax years 2006-2008 it took 109 days to reach 50% of all payments whereas for tax year 2009 it only took 46 days. The panels also reveal that the total amount paid (in DKK) across the tax years is fairly stable ranging from a low of DKK3.2 bn. in 2006 to a high of DKK3.5 bn. in 2008 suggesting that the external margin of whether or not to make a so-called voluntary payment is not affected only the timing of the payment is pushed forward as a consequence of the rule change. Note that this change in payment timing and lack of change in amounts paid aligns with the fact that the interest rate penalty on any owed taxes after July 1st was roughly unchanged by the 2010 reform (7% in 2008 and 6.6% in 2009). Overall figure 4 clearly suggests a reform effect on the payment timing.

Figure 5 offers a different graphical illustration of the same underlying behavioral response to the 2010 reform where the bars in the 4 Panels A-D show percentage payments by week for the four tax year. Each panel shows a plot of tax year specific payments and average weekly payments from week 51 (displayed as week minus 2), that is voluntary payments made at the end of the tax year, to week 28 which is the end of the voluntary payment period, July 1st.

⁷ The assumption is similar to assumption 4 in Jones (2012).

The pre-reform plots of Panel A-C all show a clear spike in the number of payments in the final week prior to the July 1st payment deadline whereas Panel D, tax year 2009, display much more evenly distributed payments. Figure 5 adds to figure 4 by showing the number of payments instead of amounts paid thereby filling the picture by showing that the 2010 penalty introduction affected both the total amount paid and the number of payments. The four panels also include a local polynomial smooth plot of the average amount paid per week. The shape of the polynomial smooth function is characterized by three different periods. First, large average payments in the final two weeks of the tax year, week 51 and 52 (displayed as week minus 1 and minus 2). Recall that prior to tax year 2009 payments of more than DKK40,000 had to be filed before March 15th and the amount above DKK40,000 was penalized by a 2% interest penalty. Hence taxpayers with large owed taxes who wanted to avoid the 2% interest penalty made their payment at the end of the tax year. The DKK40,000 threshold also explains the average payments in the second period from week 2 to 10 which is fairly close to the DKK40,000. Panel D suggests that the introduction of the 2010 interest penalty and the abolishment of the DKK40,000 threshold seem to have effectively pushed payments into period one thereby increasing the number of payments in week 51 and week 52 and at the same time lowering the average amount paid. The third period, from week 10 to week 28 includes comparatively lower average payments. It is noteworthy that for the pre-reform years the average payments from week 10 to week 22 are very low, which show that the taxpayers who paid well in advance of the July 1st deadline, thus not taking advantage of the interest free period only did so with small amounts. This dip in the average payment from week 10 to 22 is not present for tax year 2009.

The four panels in each of figure 6 and figure 7 show histograms for the two calculated payment distance measures across the four tax years. The vertical red line in figure 6 highlights the tax year specific announcement date of the pre-populated tax assessment. Apart from the finer grid on the x-axis figure 6 tells much the same story as figure 5 with a large part of the pre-reform payments occurring within even the final days of June. The vertical red line at elapsed day 0 in figure 7 is specific for each taxpayer and highlights the time the taxpayer received his pre-populated tax assessment either by air mail or via his e-access. The four panels in figure 7 allow a comparison of the payment propensities shortly after the taxpayer was informed. This instant payment propensity is noticeably increased for tax year 2009 with close to 25% of all

the payments occurring within a few days after the taxpayers learned about his outstanding taxes as opposed to less than 5% of the payments for the pre-reform years.

Table 1 holds two sets of parameter estimates from OLS regressions of the two payment distance measure on tax years. In both regressions tax year 2005 is set as base group such that the constant show the average numbers days between January 1st (column 1) and the payment date, or between the information time (columns 2) and the payment date in 2005. The parameter estimates on the tax years 2006-2009 then show the change in payment timing compared to 2005. Column 1 shows that the payment distance measure based on January 1st only changed very little between 2005 and 2008, the taxpayers paid their owed taxes three days faster in 2007 than in 2005 whereas the parameter estimate on tax year 2009 reveals that on average the taxpayers paid their owed taxes 52 days faster post reform compared to 2005. The dependent variable in column 2 is the payment distance measure based on the taxpayer specific information date. The post reform reduction in days based on this second distance measure is 38 days but from an average 2005 payment time of 61 days this corresponds to more than a 60% reduction in days as opposed to the 33% reduction observed in column 1.

The documented behavioral response to the introduction of the interest penalty lends itself nicely to an interpretation including the notion of frictions. The introduction of the 2009 interest penalty meant that owed taxes accrued interest from January 1st, i.e., from before the taxpayer received his prepopulated tax assessment. The taxpayer could of course go through the hassle and calculate his return and remit any owed taxes by January 1st and thereby avoid any interest penalties all together. Figures 4-6 of the payment timing clearly shows that for the majority of the taxpayers that didn't happen. Instead most of the taxpayers waited for the result of their pre-populated assessment to transfer the money. This point is clear from the regression results in table 1 which shows that the reduction in days is much larger in percentage terms when the distance measured is anchored on the day the taxpayer received the information (column 2) rather than the end of the tax year (column 1), i.e., the day the discrepancy between the preliminary tax payments and the total tax liability started collecting interests. In addition figure 5 revealed that, the two weeks just prior to New Year 2010 did include an increased number of taxpayers transferring significant amounts suggesting that frictions were overcome for taxpayers who expected large amounts of

owed taxes. Note that these voluntary tax payments just prior to New Year occurred both pre and post reform but that the number of payments increased after the reform this could suggest that introduction of the interest penalty lead a larger share of the taxpayers to overcome the frictions of calculating their own return. This is supported by the fact that the post reform histogram (see figure 2) of owed taxes is rather stable across the 5 year observation window with the most notable change is the drop in the top 10 percentiles for tax year 2009, see appendix Table A1.

IV.B The size of the penalties paid

Figure 1 and the discussion in section 2 suggested that for most taxpayers with owed taxes the interest rate penalty was minor. Recall that the price of postponing the payment by one day for the taxpayer with owed taxes of DKK2,800 was DKK0.35 thus postponing the payment to July 1st cost the taxpayer DKK64. Despite the small incentives provided by the introduction of the interest penalty the results presented above shows that the taxpayers reacted strongly to the changed, however small, incentives. The two panels in figure 8 offers some information on the size of the realized interest penalties that is, the interest penalty the taxpayers eventually paid.

Panel A shows the distribution of the absolute value of the paid interest penalties and Panel B shows the paid interest penalty as a fraction of one month disposable income. For 99% of the taxpayers the penalty was less than DKK1,000 which amounted to less than 1/6th of 1 percent of the taxpayers' disposable monthly income.

IV.C Payment timing and liquidity

The analysis above showed that the introduction of the interest penalty significantly advanced the payment of owed taxes. Specifically the distance in days from the end of the tax year to the payment date was reduced by more than 50 days on average. The following subsection attempts to dissect this average timing response along two different liquidity margins. The idea behind the introduction of the interest rate penalty was that the taxpayers would take the daily added penalty on owed taxes into account and in order to avoid/reduced their penalty payment they would file their owed tax payments earlier. Due to the interest rate structure of the penalty scheme it seems natural to query if the timing response is somehow correlated with taxpayer liquidity,

such that taxpayers with more lenient access to credit responded more heavily to the adoption of the new policy.

Figure 9 holds four local polynomial smooth plots of the payment distance as a function of a liquidity measure defined as liquid assets relative to disposable income. A low liquidity rate suggests the taxpayer is likely to have only very limited access to credit and correspondingly as the liquidity measure increases so does the likelihood of the taxpayer having a more lenient access to credit. For the pre-reform years the relationship between the payment distance and the liquidity measure is remarkably stable around 160-165 days. Note that the y-axis for tax year 2009, Panel D, is reduced by 35 days showing that the timing response occurs throughout the liquidity distribution. However, the 2009 timing x liquidity relationship display a negative slope showing that in line with my expectations; taxpayers with more lenient access to credit cut their credit period with SKAT by more days. The negative timing x liquidity slope is present for the liquidity range between 0 and 40 with a corresponding drop in the payment distance from 122 to 110 days, suggesting that an increased liquidity rate of 2%-points increased the response to the introduction of the interest penalty by 1 day.

Figure 10 use the imputed marginal interest rates as a measure of access to credit and show the relationship between payment timing and marginal interest rates. The available data only allows the marginal interest rates to be imputed from 2007 onwards. The relationship for the two pre-reform tax years tells a similar story to figure 10 with a fairly stable, though now slightly decreasing, timing x liquidity relationship. Note that Panel C holding the post reform tax year 2009 again has a reduced y-axis. Hence, the payment timing change also takes place throughout the taxpayer distribution of marginal interest rates and as figure 9 the timing response is more pronounced for taxpayers less likely to be credit constrained. The timing x marginal interest rate slope suggests that an increased marginal interest rate of 2% lead to a 1 day slower payment.

Finally, Table 2 includes the estimations from a set of regressions of the payment distance on the two liquidity measures and a rich set of taxpayer socio-economic characteristics. The post reform point estimates on both liquidity measures have the expected sign and are significant even when then regression includes a broad range of socio-economic variables. The point estimates of the pre-reform variables are all positive and statistically significant but they are all an order of magnitude smaller than their post reform counterparts.

The inclusion of the socio-economic variables leaves the point estimates on the liquidity measures largely unaffected. However, they do contribute to the understanding of the effect of policy reform in their own right. At least two interesting observations arise by comparing pre (e.g. column 6) and post reform (e.g. column 8) estimates. First, comparing pre and post reform point estimates on the dummy variables for origin: Danish (baseline), immigrant and descendent, shows that prior to 2009 Danes more fully exploited the interest free credit whereas post 2009 they filed their payments 8-9 days earlier than the two immigrant groups. Second, a similar story is observed for educational groups where taxpayers with long run tertiary educations (university degrees) were significantly slower (6 days) in paying prior to the reform and then significantly faster (7 days) after the reform. Overall the pre and post reform point estimates on the socio-economic variables show that the response to the introduction of the interest penalty includes social gradients as well as the expected response along the liquidity margin.

IV.D Payment inertia

In a recent study of the cause behind tax refunds and owed taxes Jones (2012) provide compelling evidence that in the wake of new policies changing either tax liability or tax prepayments while leaving the other unchanged, taxpayers only sluggishly adapt to the new policy regime. This high degree of inertia among taxpayers naturally leads to mismatches between tax liability and tax prepayments resulting in either increasing tax refunds or owed taxes. In what follows I examine two different types of inertia among taxpayers. First, I investigate whether taxpayers with at least two annual consecutive payments tend to file their payment in the same month across tax years. Second and more closely related to Jones (2012) I look at the number of new preliminary income assessment in the wake of the announcement of the penalty introduction. Recall that taxpayers can, and are encouraged by SKAT to, file changes to their preliminary income assessment in order to account for new information and better align their tax prepayments to expected tax liability.

In order to examine one type of payment persistence I exploit the panel aspect of the payment data and select taxpayers making payments in both of two subsequent tax years. This approach also provides one additional margin along which to slice the timing response to the penalty introduction. In Figure 11 the vertical axis in Panel A depicts payment months for tax year 2006 and the horizontal axis depicts payment months for tax year 2007. Together the two axes outline a 7 x 7 grid detailing the payment transition from tax year 2006 to

tax year 2007 where each cell corresponds to a particular payment sequence. Hence the matrix diagonal corresponds to the share of payments falling in the same month for both tax years. To facilitate the interpretation the figures includes a color scheme such that the darker shaded cells includes more payments than the lighter shaded ones. The number reported in the cell is the percentage of total payments.

The four transition matrices hold at least three observations related to persistence in behavior. First, the vast bulk, more than 2/3rds, of the payments prior to tax year 2009 (Panels A-C) are found in the 2 x 2 June/July rectangle.⁸ This persistent payment pattern is consistent with the unchanged timing incentive and shows that the taxpayers making annual subsequent payments had a business as usual approach towards their payment timing. Second, following the 2010 penalty introduction (Panel D) most payments, close to 1/2, are located in the 2 x 2 rectangle located on June/July x March/April. Thus, for the vast majority of taxpayers the changed incentive structure proved strong enough to break the persistent payment pattern observed prior to the reform. Third, two of the diagonal cells stand out relative to their immediate surroundings cells the first one being December x December and the second one April x April. Although they are both small as a percentage of all payments they highlight persistence in behavior. Note that the December x December cell can likely be explained by the incentive created by the penalty on owed taxes in excess of DKK40,000 prior to 2009. One possible explanation for the April x April is that some taxpayers have a ‘get it of the way’ approach, otherwise also referred to as a notion of dread, see Berns et al. (2006).

The interest rate penalty on owed taxes was part of a larger reform introduced by the former government on March 1st 2009. The reform was passed in the Danish parliament on May 28th and signed into law with effect from January 1st 2010. The announcement time left the taxpayers with more than six months to adjust their preliminary income assessment. That is, taxpayer who expected to have a balance due and wanted to avoid paying the interest penalty could adjust their preliminary income assessment so as to increase their preliminary tax payments and thereby reduce or eliminate any owed taxes. The two panels in figure 12 outline the changes to the preliminary income assessments for tax year 2009 and tax year 2010. The bars display the number of new preliminary income assessments by month and the plotted red line

⁸ As previously July includes payments made prior to July 5th.

outlines the average change in the personal allowance. Recall from section 2 that relevant information for the preliminary tax payments is the taxpayer's tax free deduction and withholding rate. Because of the nature of the calculation of the withholding rate it is largely unaffected unless the taxpayer files extreme changes to income. Instead most changes, e.g. increased interest rate payments, will affect (increase) the tax free deduction which in turn then alters (increase) the preliminary tax payments. The vertical red line just left of June 2009 in Panel A highlights the signing of the 2010 tax reform including the interest penalty on owed taxes.

For both tax years the number of new preliminary income assessments is decreasing over the course of the year and a month by month comparison by the two years doesn't suggest any obvious response around the reform time. Moreover, the average change in the personal allowance is increasing meaning that on average the taxpayers who did file changes to their preliminary income assessments increased their tax free deduction and thus if anything also increased any owed taxes. The findings that the adoption of the penalty interest rate on owed taxes were met with only limited responses in terms of new preliminary income assessment align nicely with the results from Jones (2012).

V. Conclusion

An increasing number of Public Finance studies document the importance of taxpayer frictions in understanding why apparent economic incentives don't always guide taxpayer behavior according to more straight forward economic predictions. My results add to this literature by showing that even very small incentives can be highly potent when the environment is close to frictionless. First, the Danish 2009 introduction of an interest penalty on owed taxes coincided with a 50 day advancement of payments corresponding to a 35% reduction of the payment time. Second, most of the reduction in payment time was brought about by taxpayers changing their payment date from the end of June to mid-March. Third, taxpayers didn't respond to the adoption of the interest penalty policy by increasing tax year withholdings. Together these findings adhere to the basic economic principle that individuals respond to incentives, but my results also underscore the importance for policy makers to consider the specific environment in which they create such incentives. The June to March (as opposed to January) payment change is easily explained by the March arrival of the automatically generated and distributed pre-populated income assessment making it easy for the Danish taxpayer to change their

payment date. Meanwhile the pre-printed balance specific cost of postponing the payment lowered any requirement to taxpayer policy awareness and understanding. The importance of these frictions is highlighted by the fact the taxpayers didn't respond to the Government passing the law by increasing their tax year withholdings, a process that would require individual understanding of the new law and knowledge of a possible balance due. Furthermore I show the response to the introduction of interest penalty is correlated with taxpayer specific measures of liquidity, i.e., taxpayers more likely to be liquidity constrained respond less to the new policy. These findings serve in part to validate that the response is in fact based on economic incentives and is not an artifact following, for example, from a news effect. Additionally the liquidity gradient highlights the fact that the cost of the policy borne by the taxpayers is likely higher for individuals with only very tight access to credit.

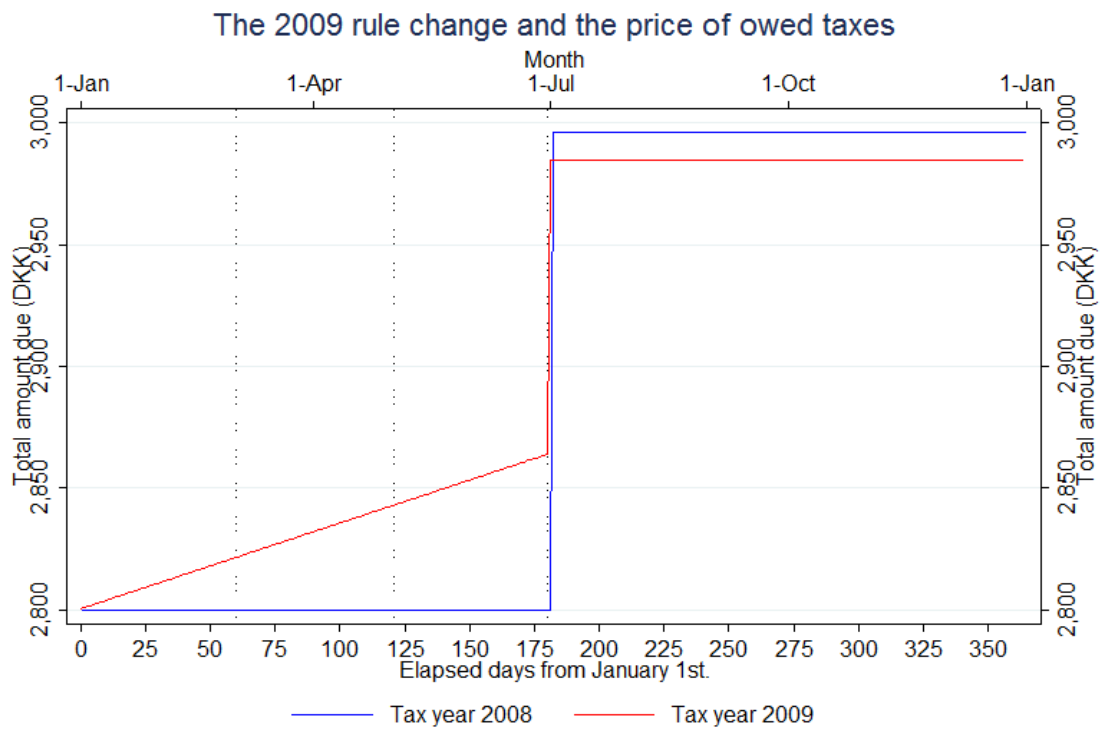
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Figure 1: Illustration of incentives



The figure shows the development in the total amount due for a taxpayer with owed taxes of 2,800 DKK (the median for tax year 2009) as function of time, before and after the introduction of the interest penalty in 2009

Figure 2: Owed taxes over time

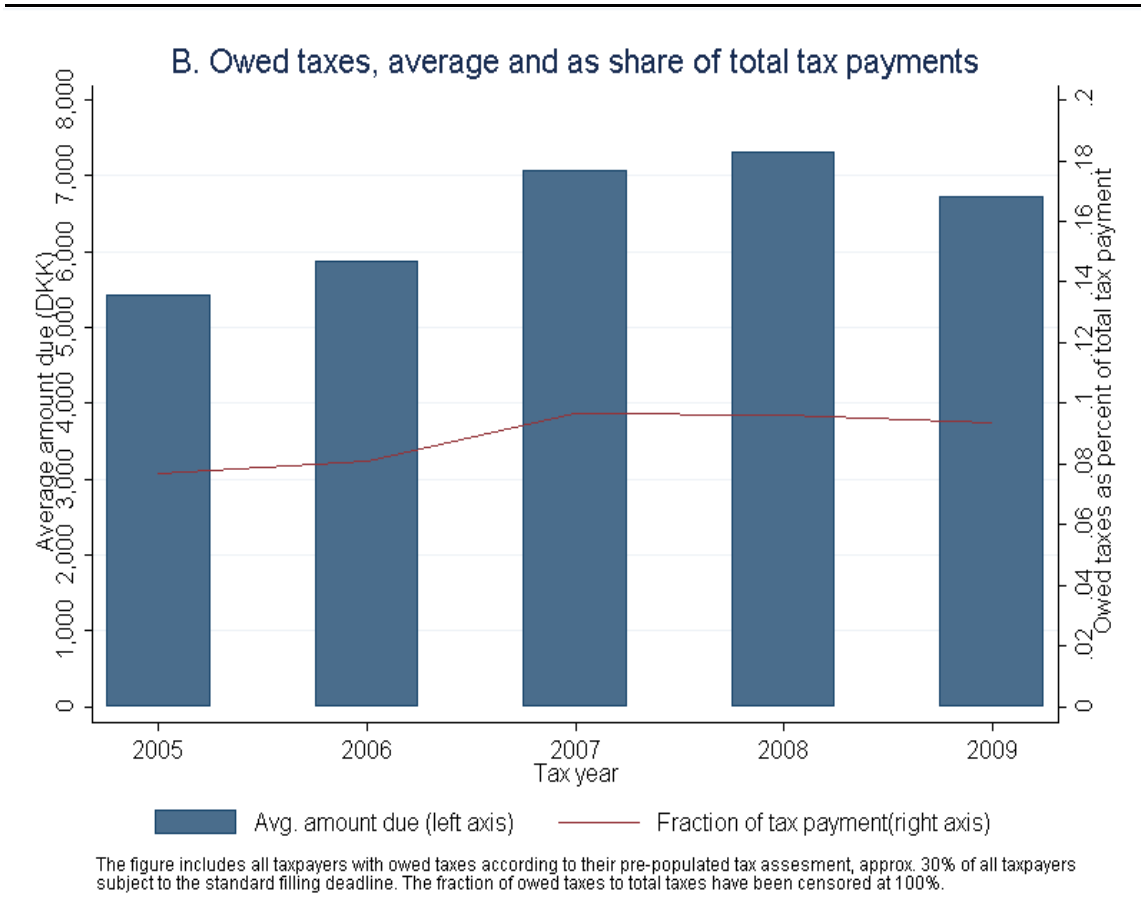
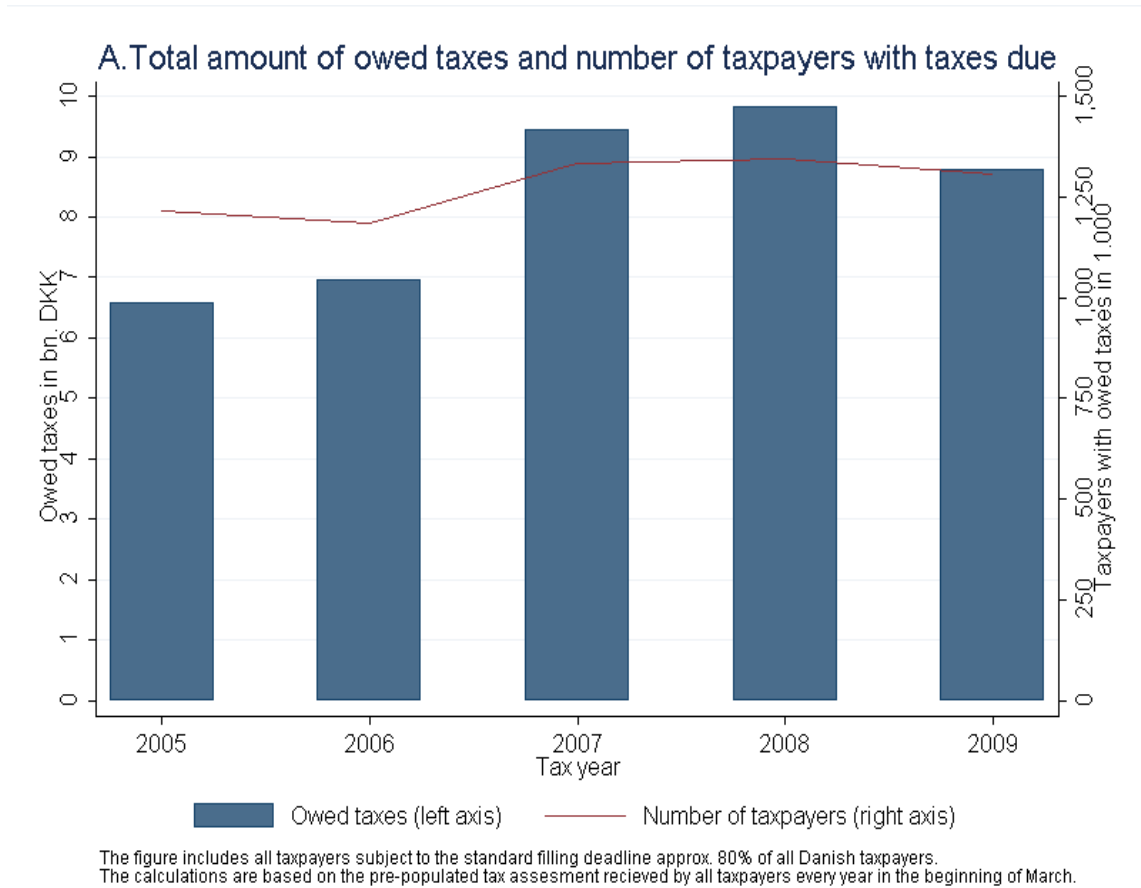


Figure 3: Distribution of owed taxes by tax year

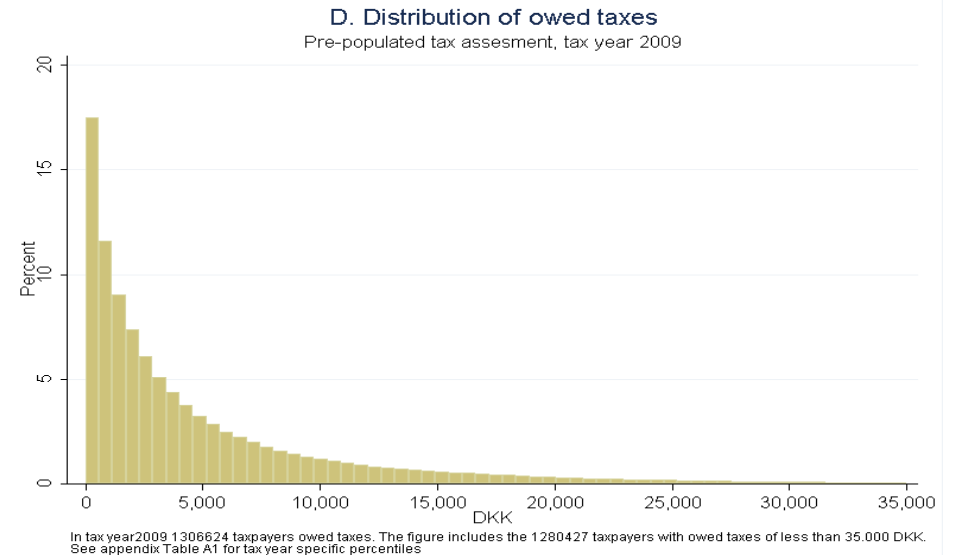
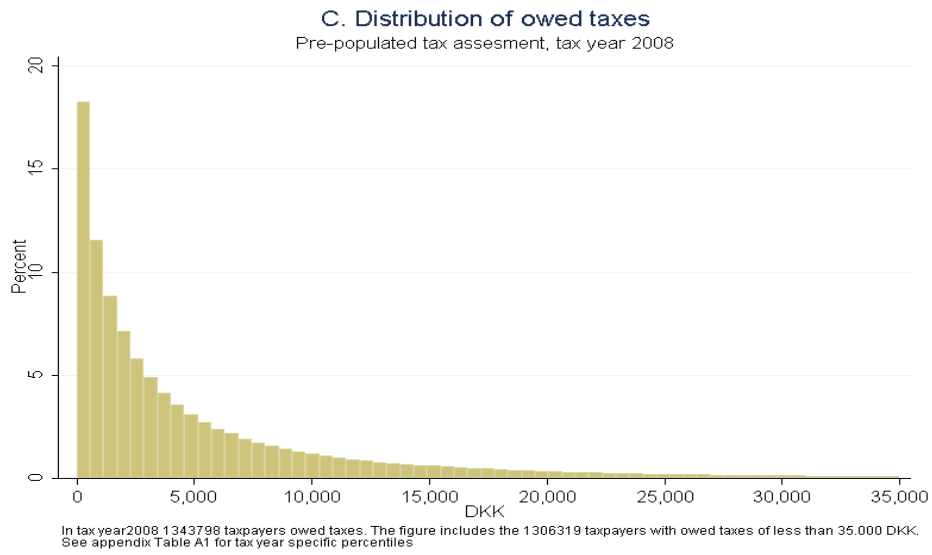
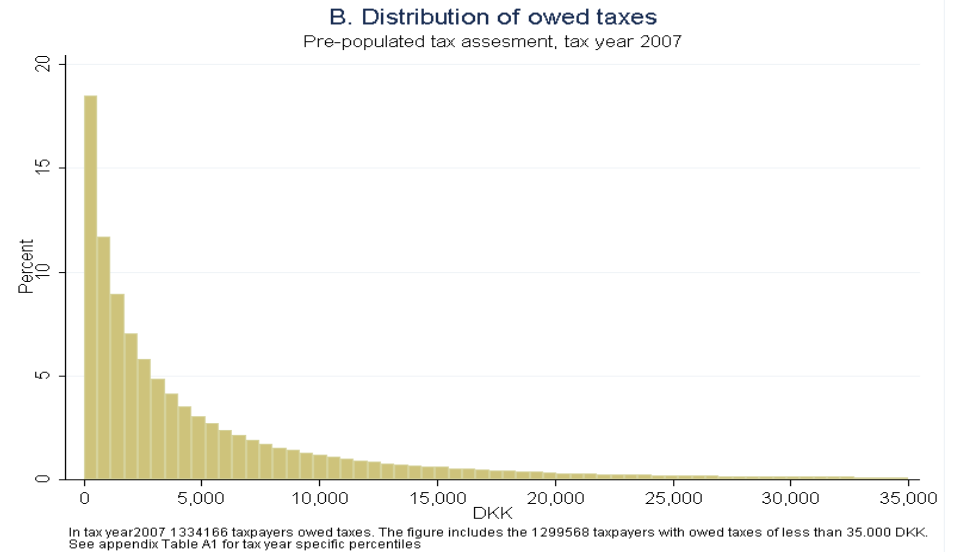
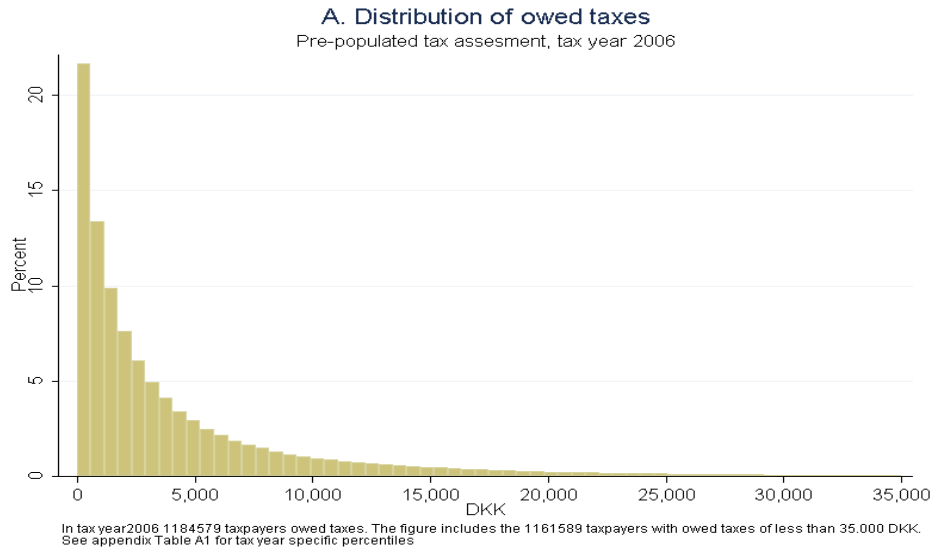
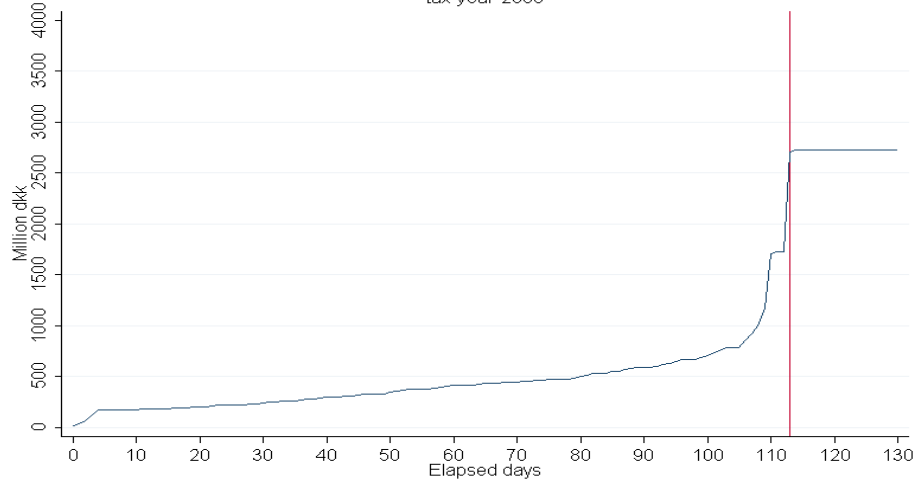


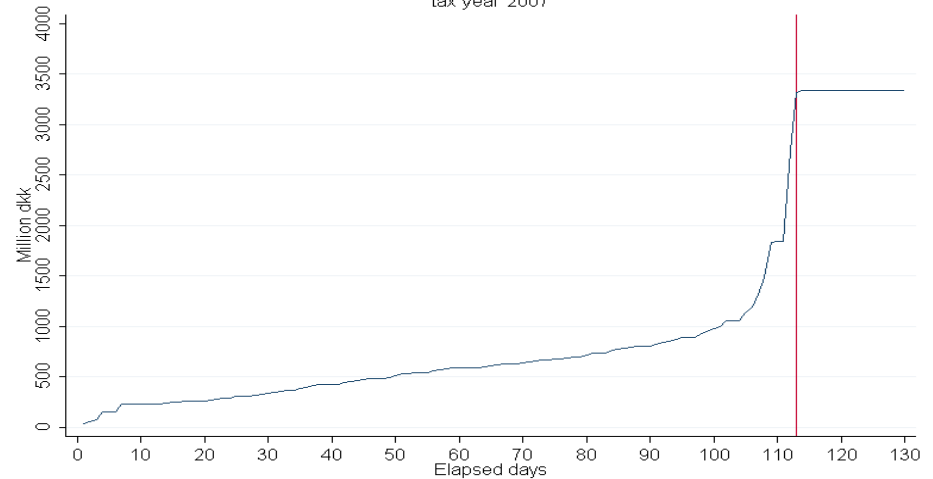
Figure 4: Accumulated owed tax payments by tax year

A. Accumulated payments from March to July
tax year 2006



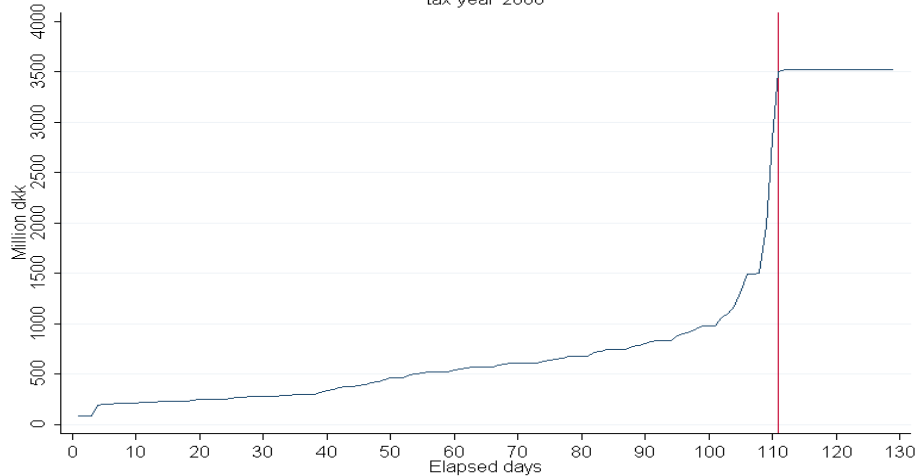
The figure shows the accumulated payments from the arrival of the pre-populated tax assessment on March 10th (day 0) to end of the voluntary payment period, 1st July (day 113)

B. Accumulated payments from March to July
tax year 2007



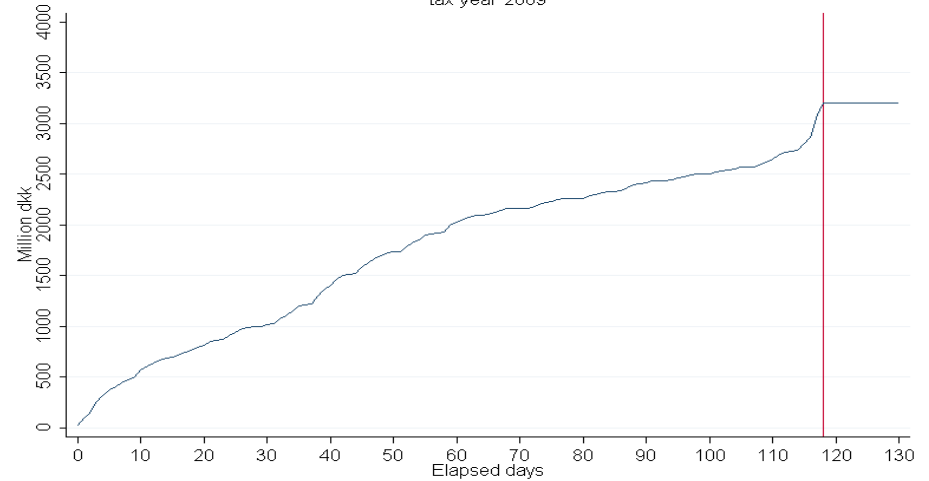
The figure shows the accumulated payments from the arrival of the pre-populated tax assessment on March 10th (day 0) to end of the voluntary payment period, 1st July (day 113)

C. Accumulated payments from March to July
tax year 2008



The figure shows the accumulated payments from the arrival of the pre-populated tax assessment on March 12th (day 0) to end of the voluntary payment period, 1st July (day 111)

D. Accumulated payments from March to July
tax year 2009



The figure shows the development of owed taxes from the arrival of the pre-populated tax assessment on March 5th (day 0) to end of the voluntary payment period, 1st July (day 118)

Figure 5: Weekly payments by tax year

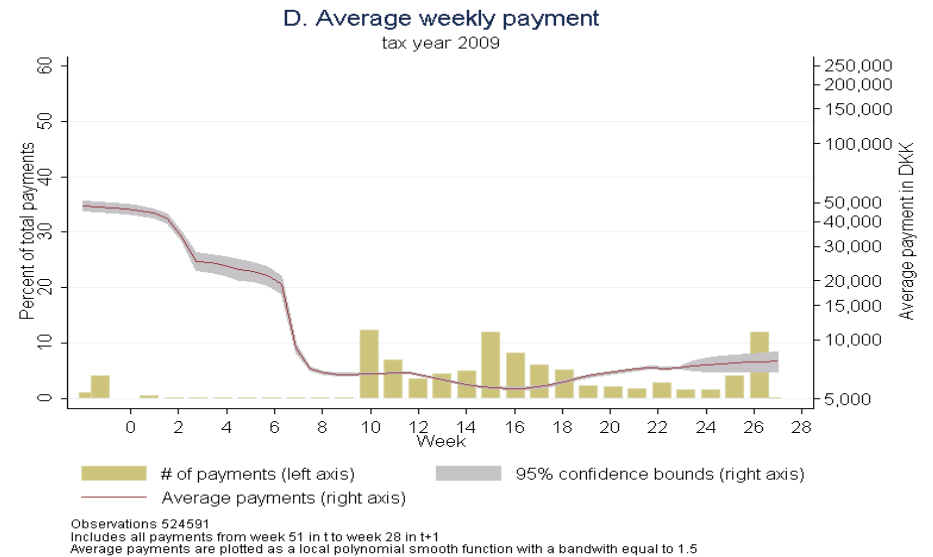
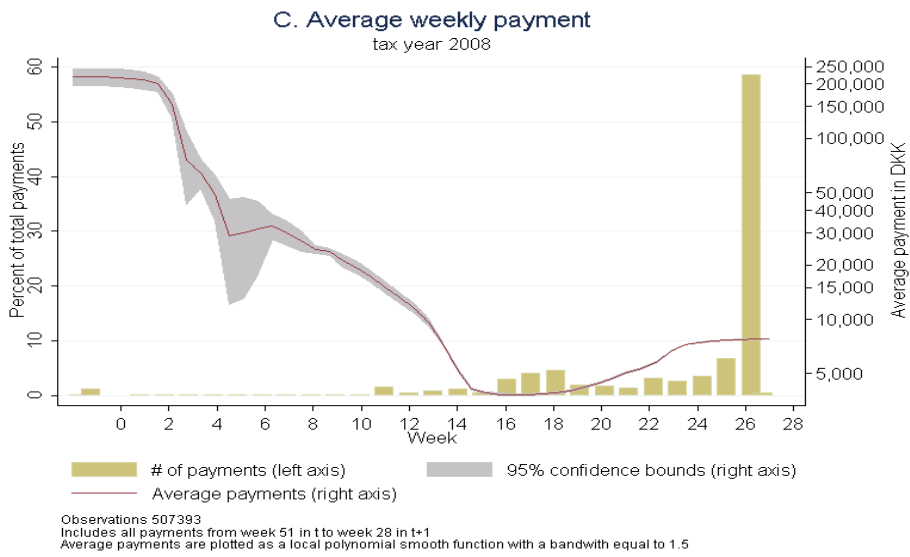
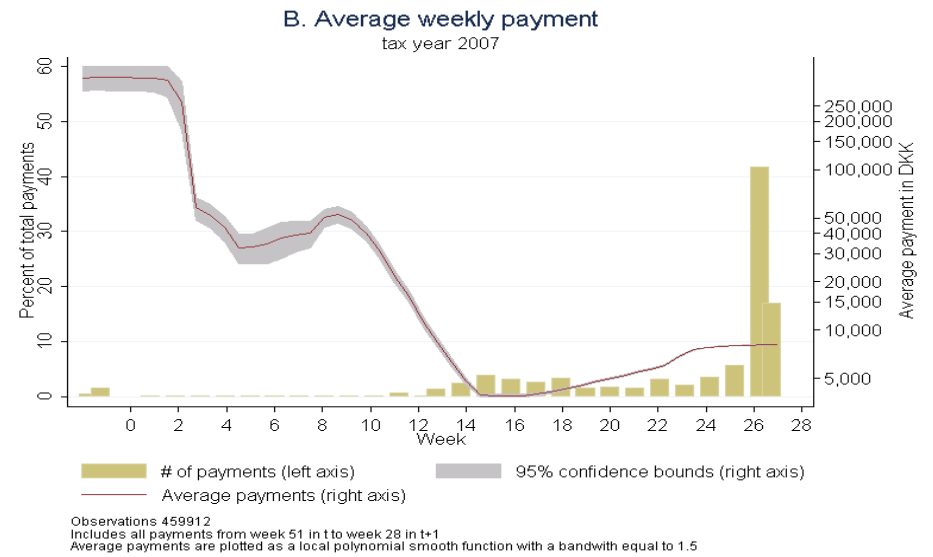
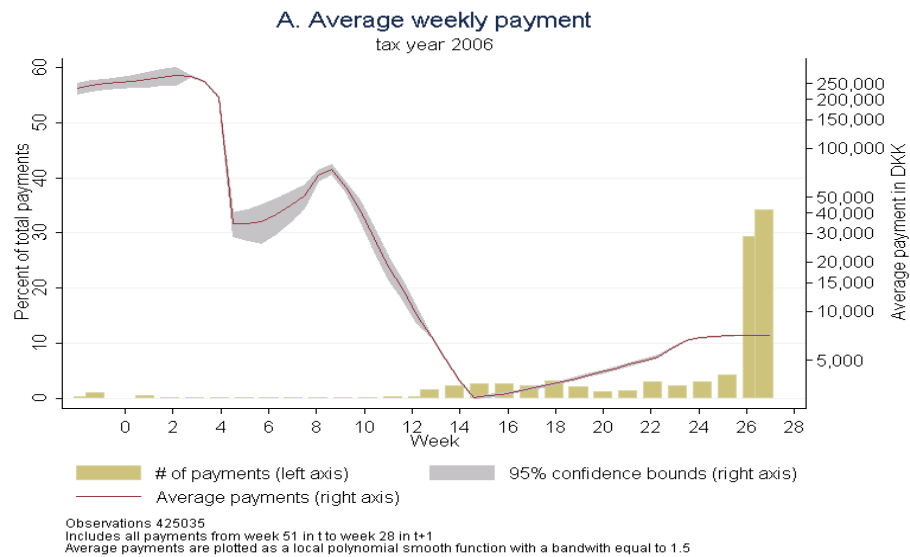


Figure 6: Payment timing [I]

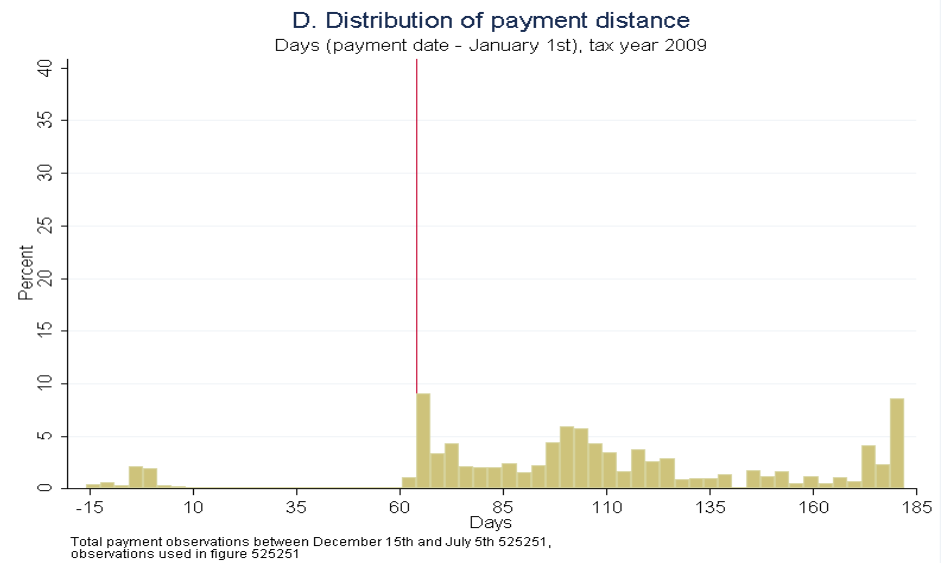
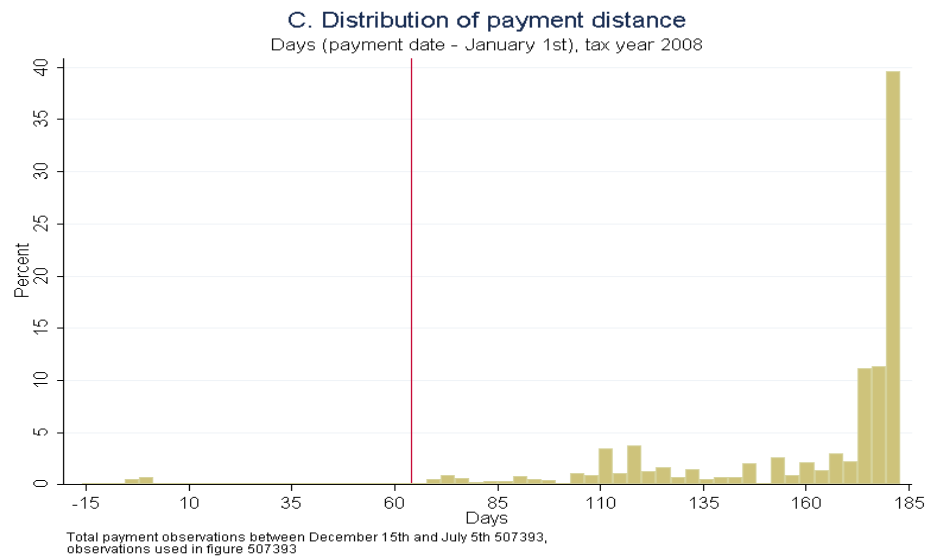
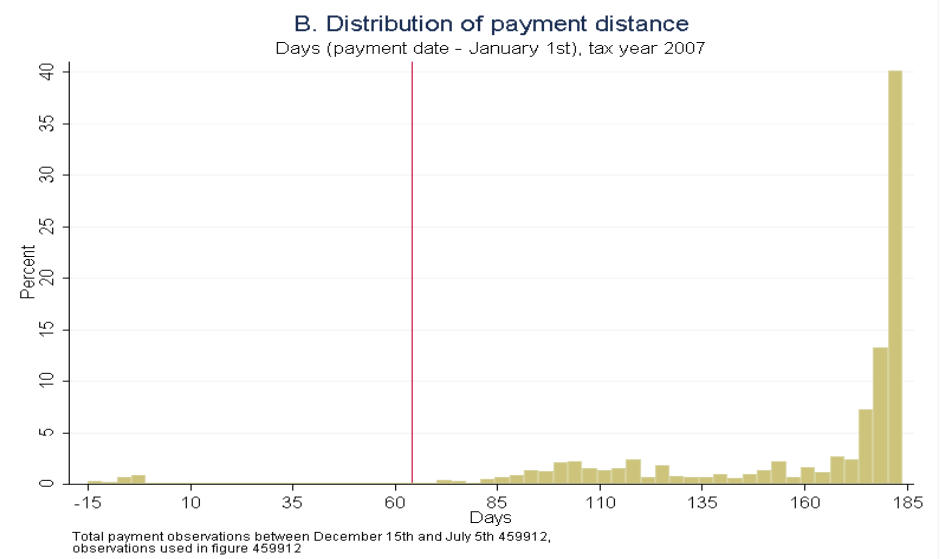
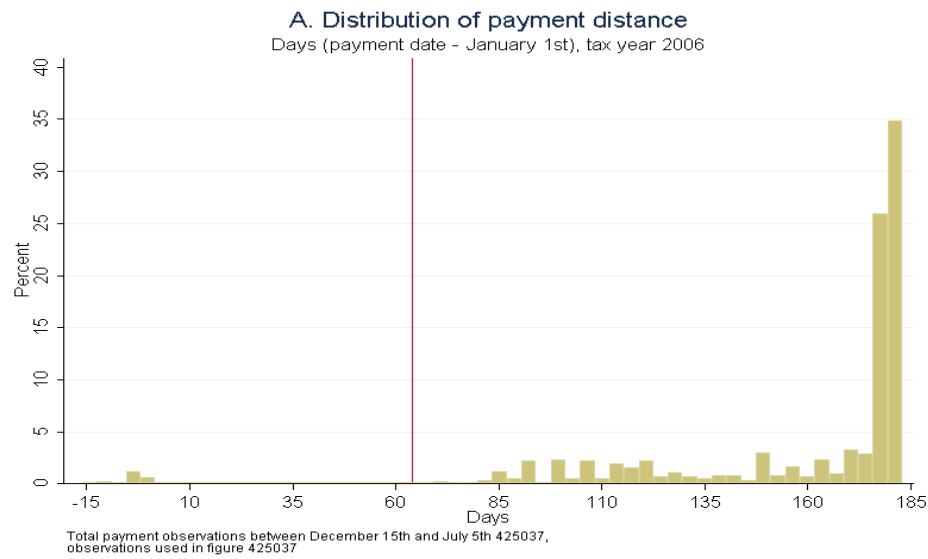


Figure 7: Payment timing [II]

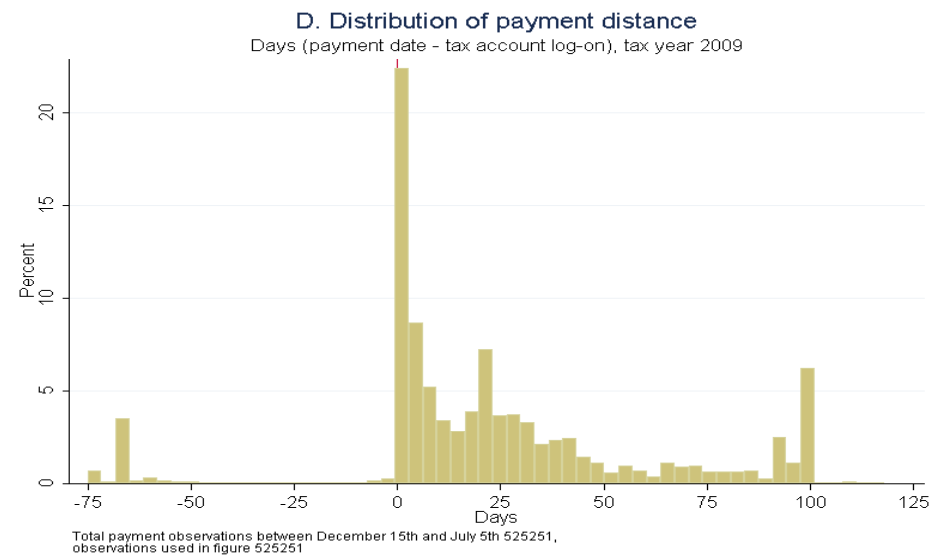
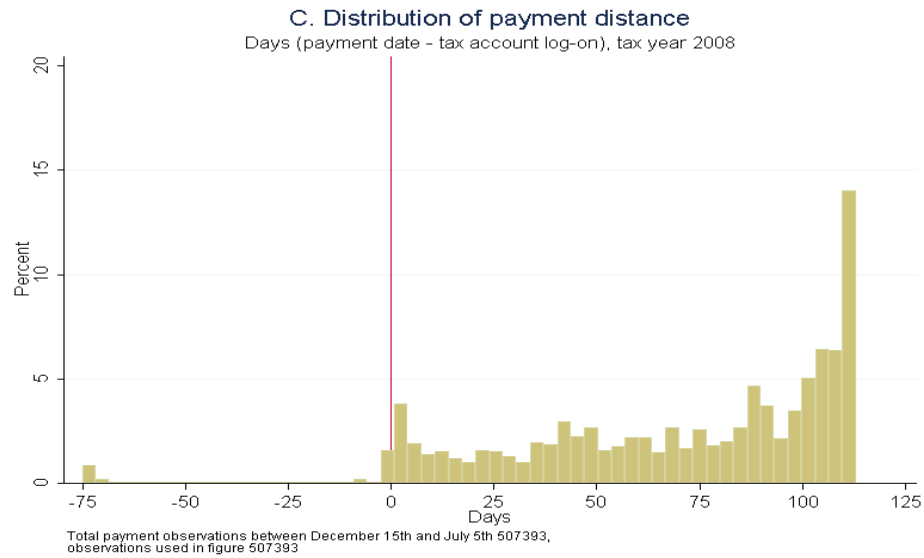
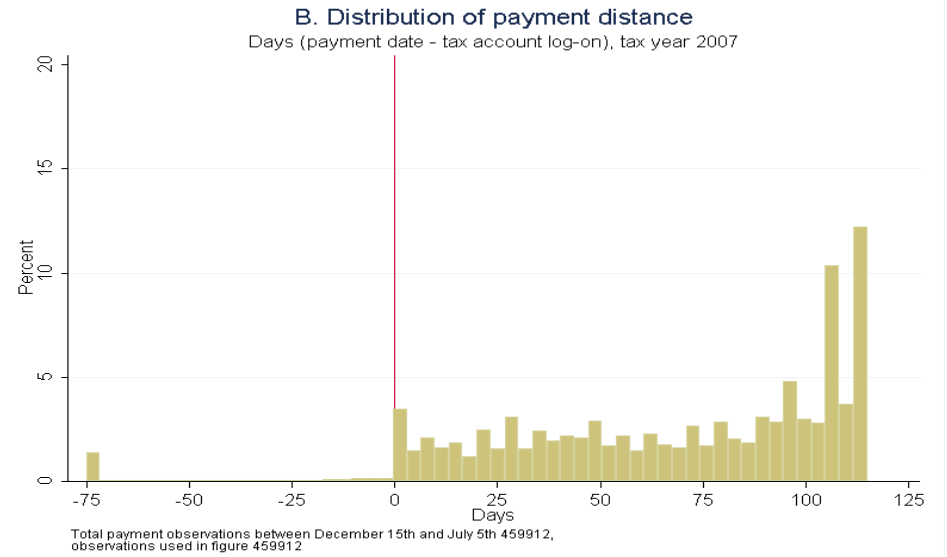
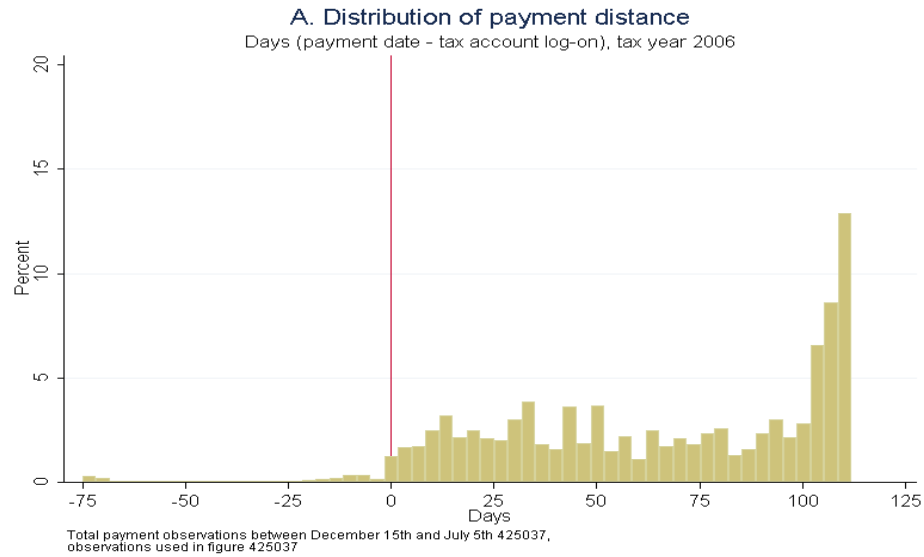
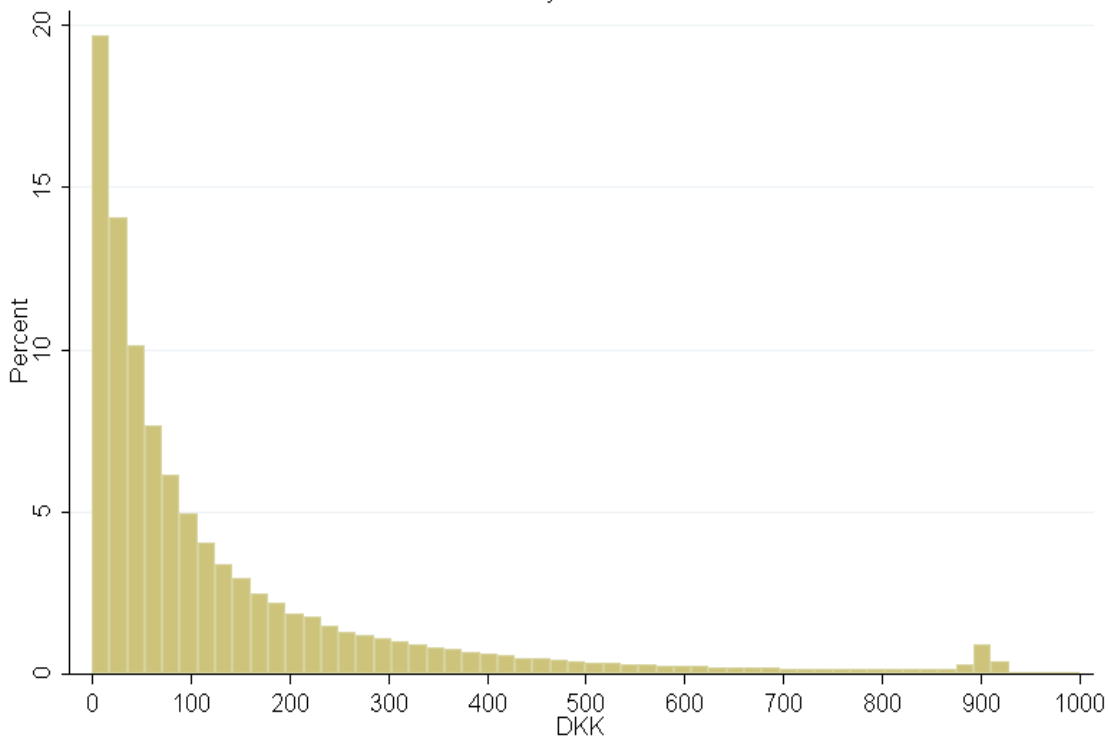


Figure 8: The size of the interest penalty

A. Distribution of interest payments

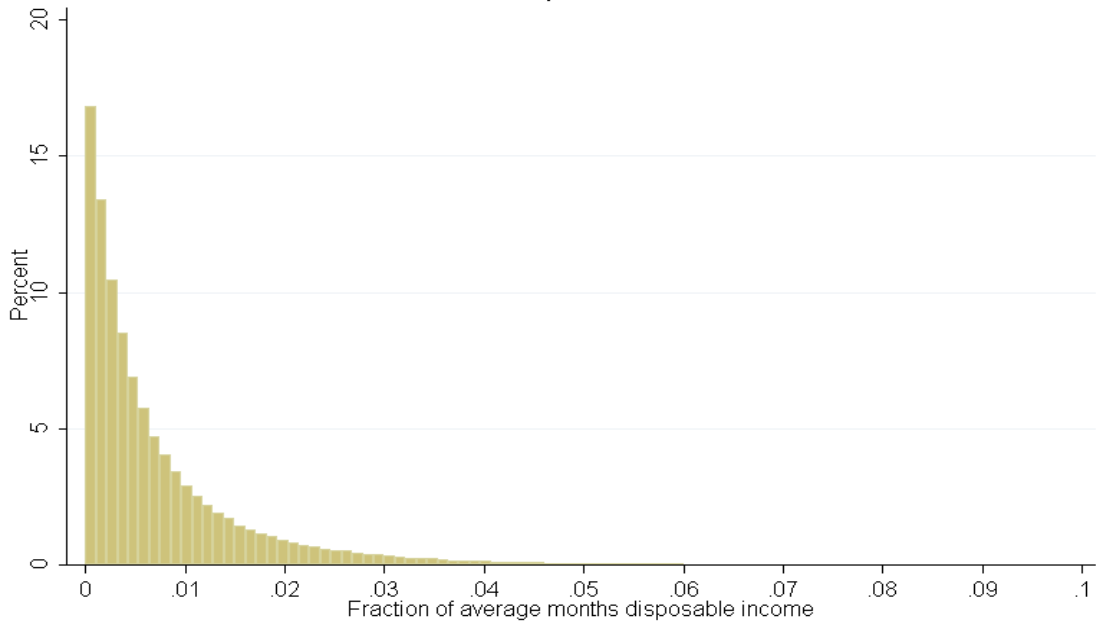
tax year 2009



total interest rate payment observations 499166
The figure includes the 498004 observations where the interest rate payment was less than 1.000 DKK

B. Distribution of interest payments relative to one months disposable income

tax year 2009



total interest rate payment observations 498237
The figure includes the 496232 observations where the interest rate payment was less than 1.000 DKK

Figure 9: Payment timing as a function of liquidity

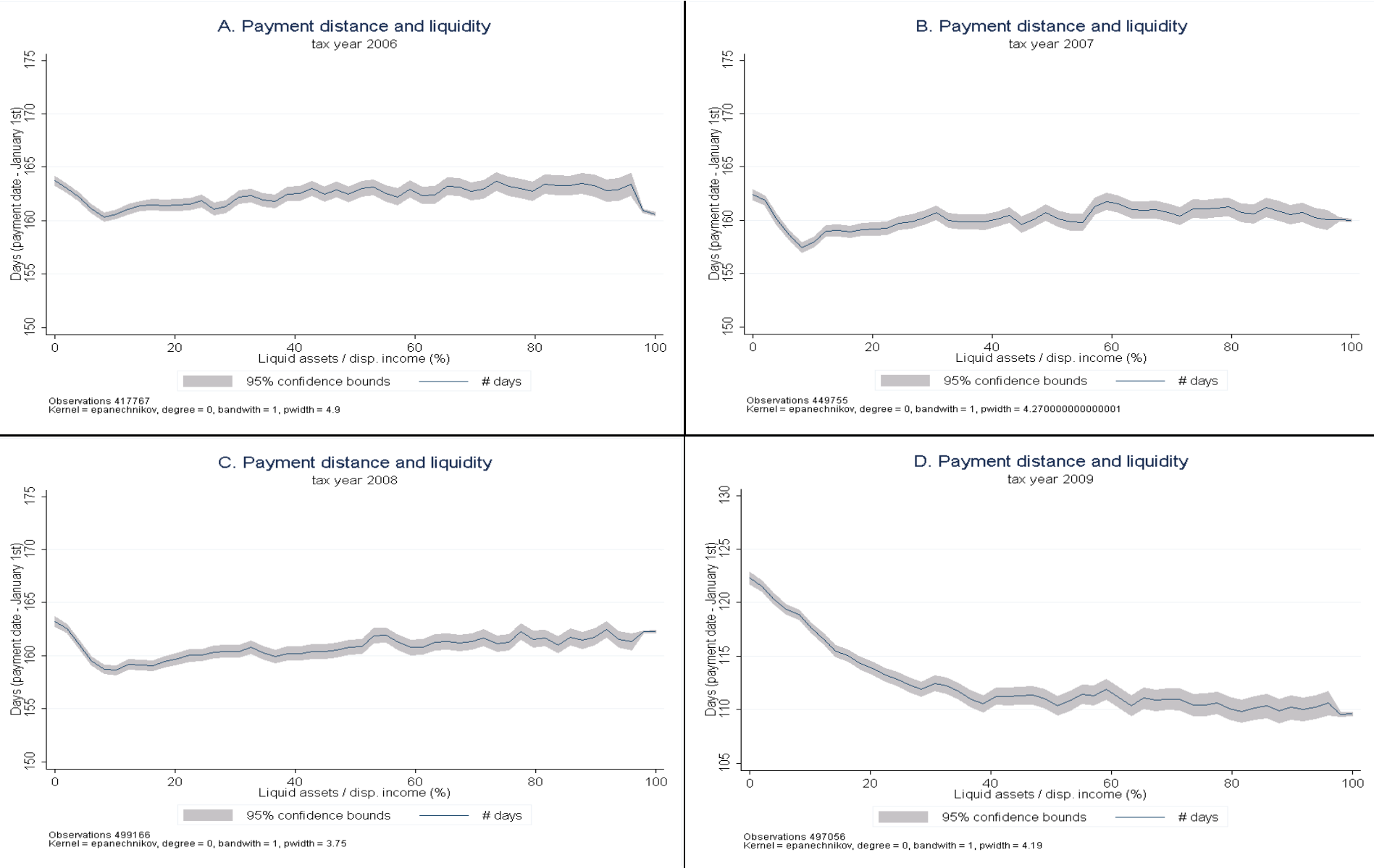


Figure 10: Payment timing as a function of marginal interest rates

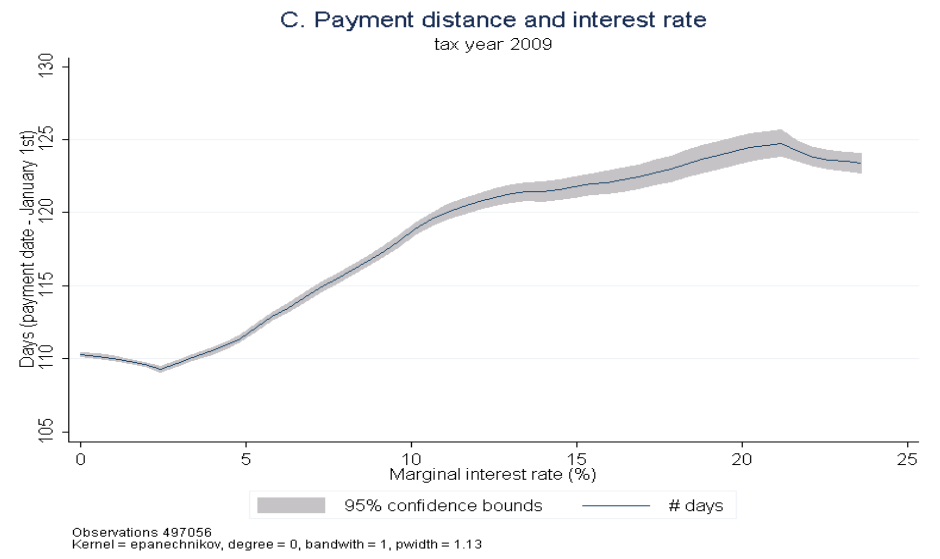
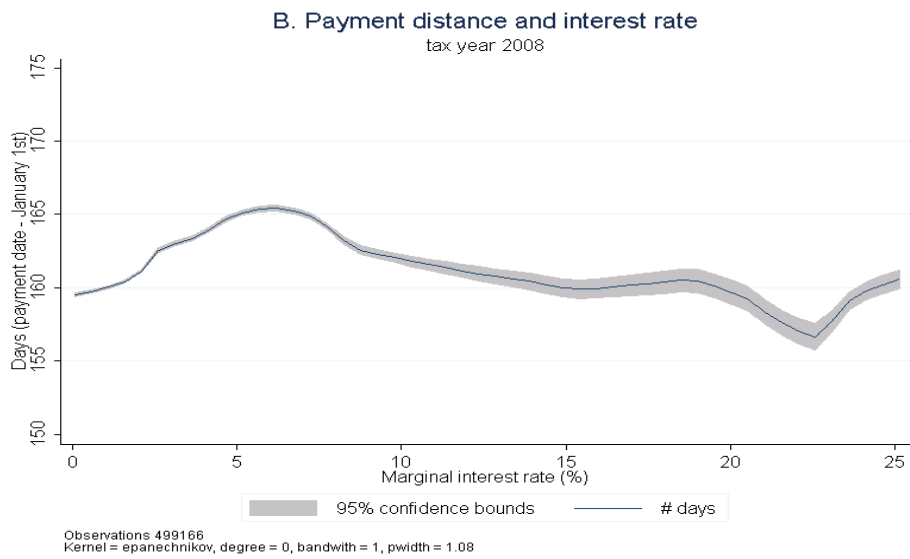
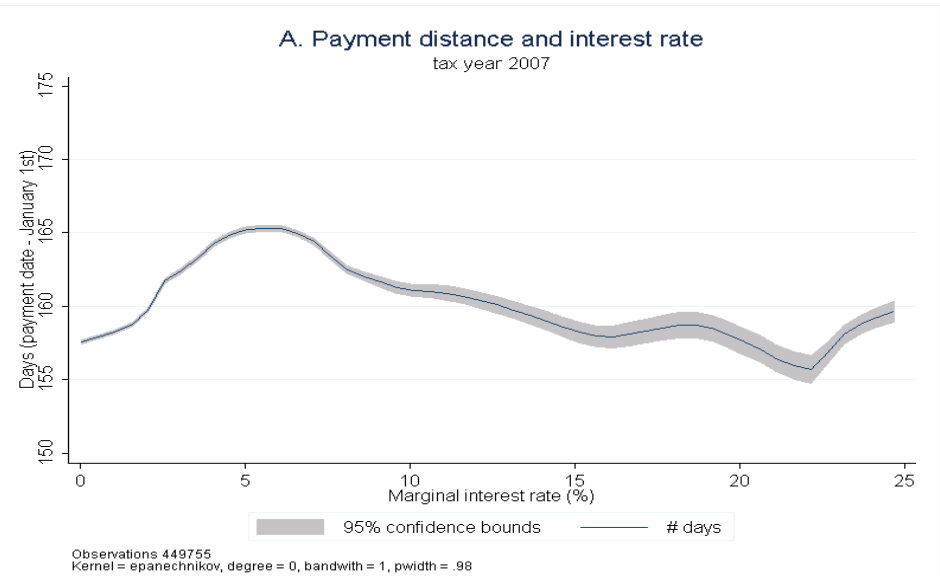


Figure 11: Payment transition for taxpayers with consecutive payments

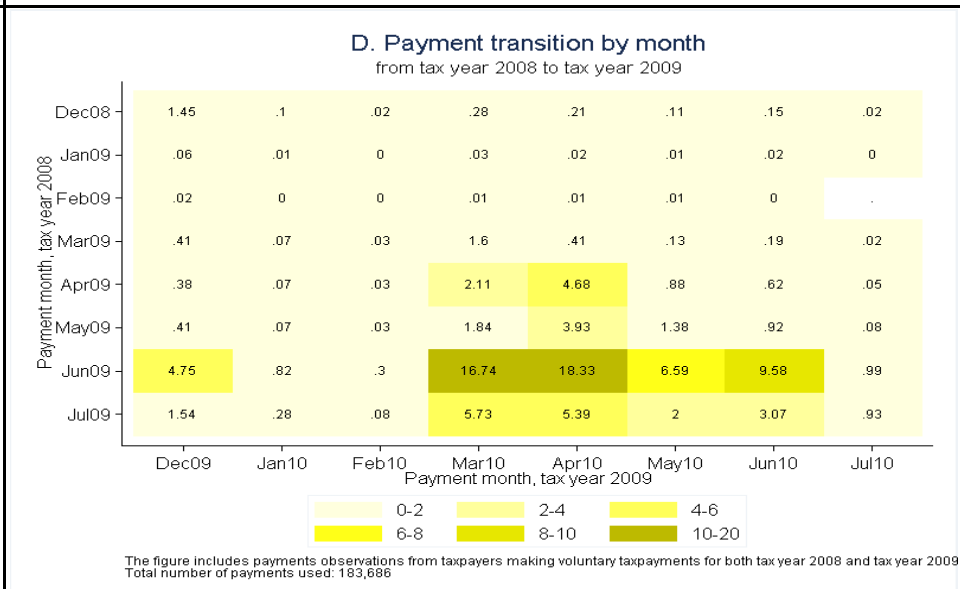
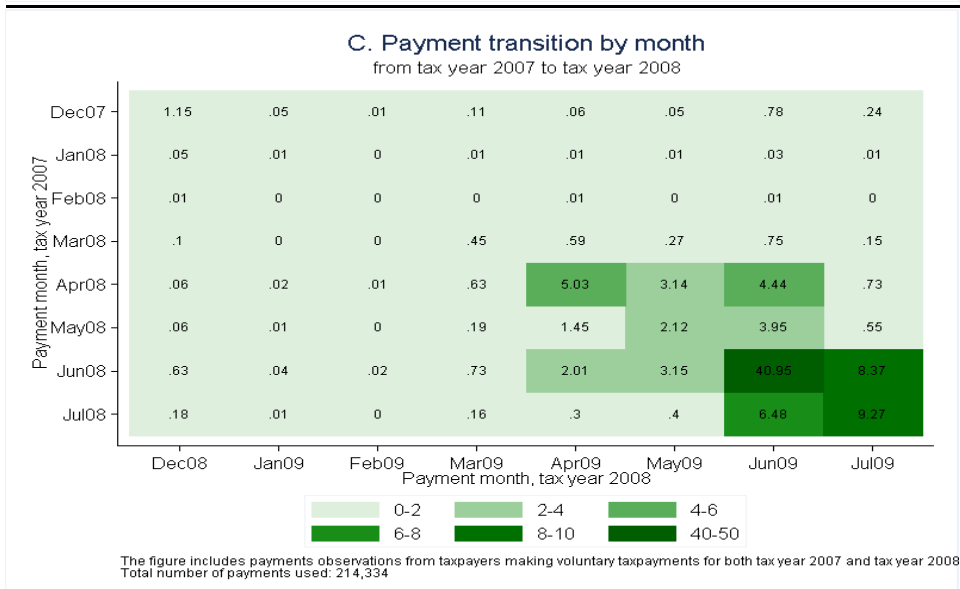
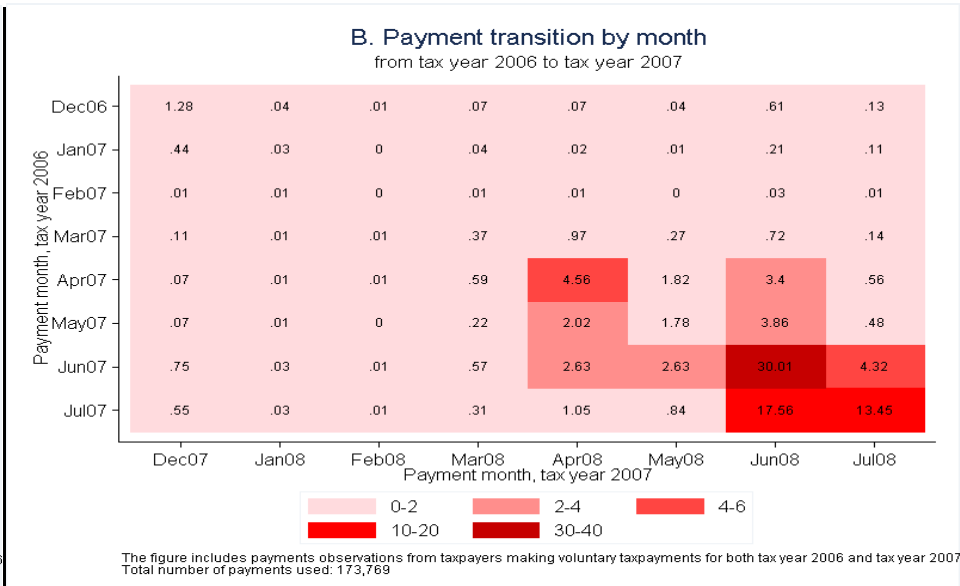
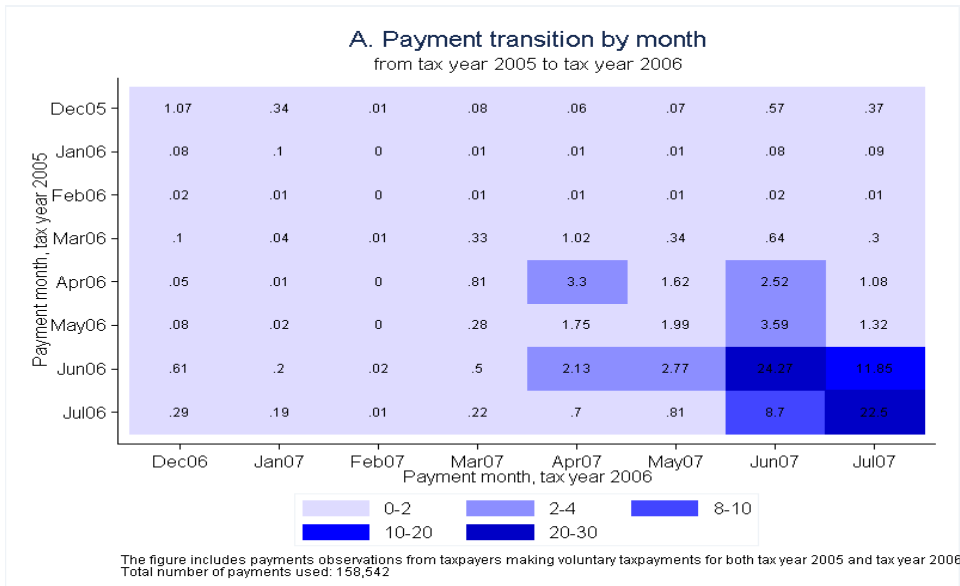


Figure 12: Changes to the preliminary income assessment

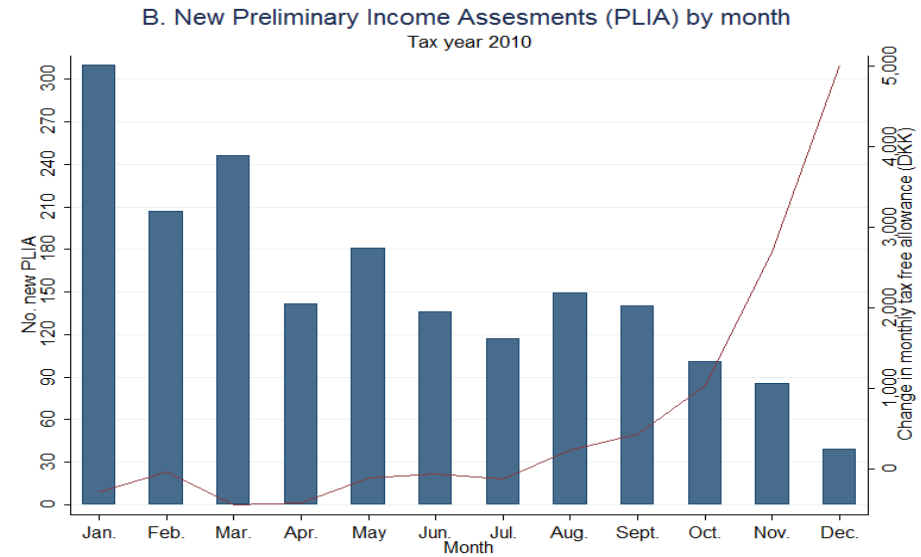
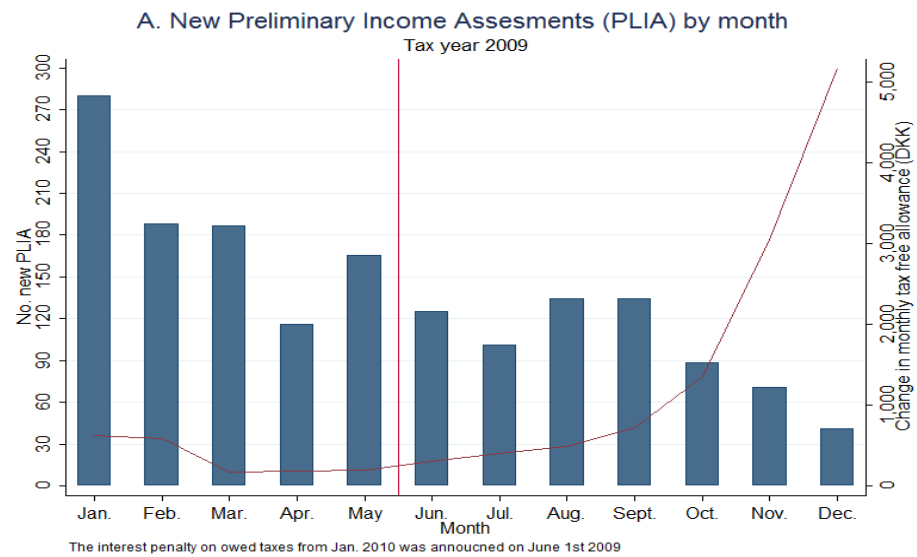


Table 1: OLS estimation of payment distance on tax year

	M1	M2
	distance (Payment date - January 1st)	distance (Log on date - January 1st)
	b/se	b/se
Baseline (2005)	0 (.)	0 (.)
Tax year 2006	-1 ^{***} (0.1)	0 (0.1)
Tax year 2007	-3 ^{***} (0.1)	5 ^{***} (0.1)
Tax year 2008	-1 ^{***} (0.1)	8 ^{***} (0.1)
Tax year 2009	-53 ^{***} (0.1)	-38 ^{***} (0.1)
Constant	159 ^{***} (0.1)	61 ^{***} (0.1)
Observations	2.325.967	2.325.963

The dependent variable in model 1 (M1) is computed as payment date - January 1st for each tax year

The dependent variable in model 2 (M2) is computed as payment date - tax account log-on for each tax year

Regression 1 and 2 includes all payments from December 15th to July 5th,

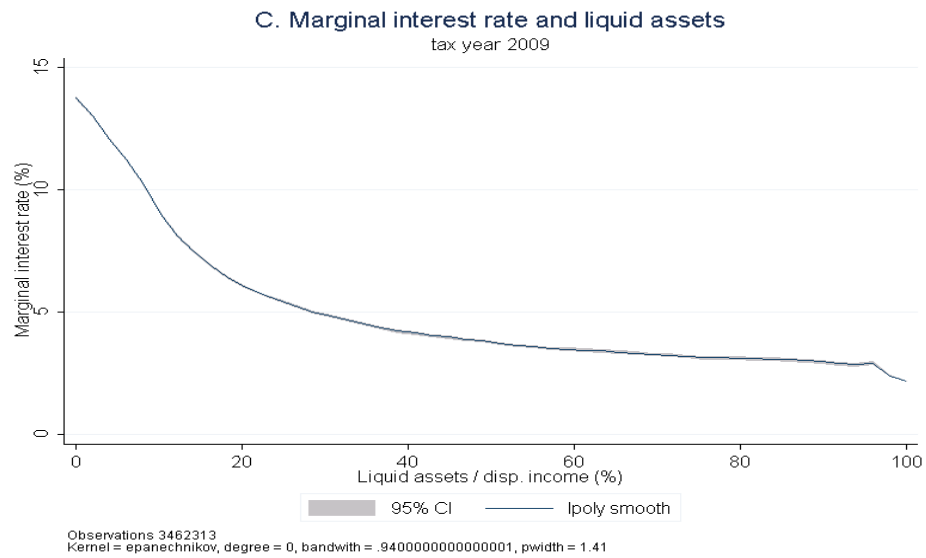
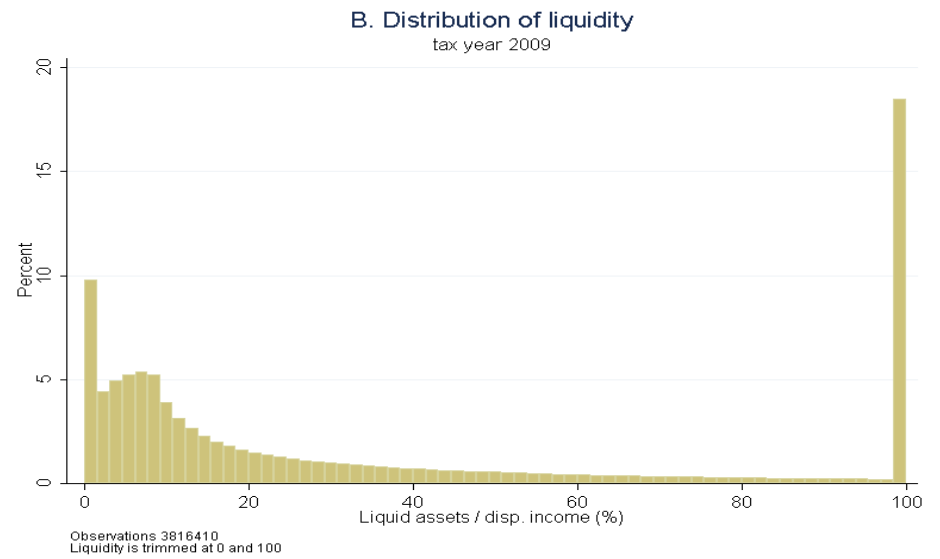
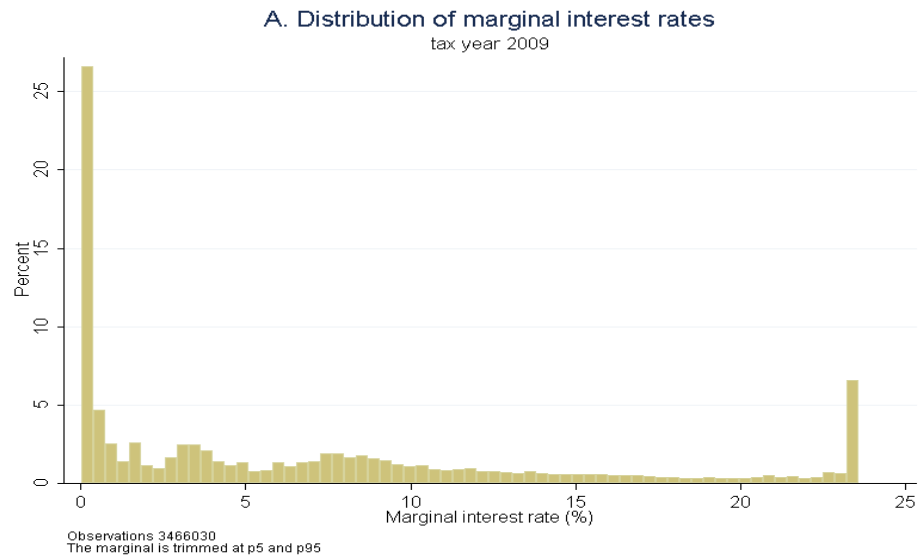
Robust standard errors are reported in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: OLS estimations of payment distance and liquidity

	2005	2006	2007		2008		2009	
	dist_jan b/se	dist_jan b/se	dist_jan b/se	dist_jan b/se	dist_jan b/se	dist_jan b/se	dist_jan b/se	dist_jan b/se
Liquidity	0.021*** (0.00)	0.013*** (0.00)	0.033*** (0.00)		0.035*** (0.00)		-0.106*** (0.00)	
Marginal interest rate				0.047*** (0.01)		0.022* (0.01)		0.774*** (0.01)
Age	0.113*** (0.01)	0.058*** (0.01)	0.082*** (0.00)	0.117*** (0.00)	0.050*** (0.00)	0.081*** (0.00)	0.084*** (0.01)	0.039*** (0.01)
Female	0.696*** (0.10)	0.545*** (0.10)	-0.250** (0.09)	-0.210* (0.09)	-0.113 (0.10)	-0.157 (0.10)	2.018*** (0.12)	2.166*** (0.12)
<i>Danish</i>	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Immigrant	-8.345*** (0.27)	-7.183*** (0.26)	-7.063*** (0.23)	-7.171*** (0.24)	-8.201*** (0.26)	-8.292*** (0.27)	8.345*** (0.26)	9.216*** (0.28)
Descendent	-6.979*** (0.96)	-7.332*** (0.86)	-7.541*** (0.78)	-7.157*** (0.80)	-7.763*** (0.84)	-7.642*** (0.88)	7.483*** (0.83)	7.977*** (0.89)
<i>Copenhagen</i>	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Zealand	2.308*** (0.17)	0.452** (0.16)	3.001*** (0.14)	3.019*** (0.15)	1.699*** (0.16)	1.646*** (0.16)	0.929*** (0.18)	1.093*** (0.19)
Southern Denmark	4.322*** (0.15)	0.928*** (0.15)	3.871*** (0.12)	3.854*** (0.13)	3.257*** (0.13)	3.144*** (0.14)	2.083*** (0.16)	1.957*** (0.17)
Central Denmark	6.554*** (0.14)	3.062*** (0.14)	5.517*** (0.12)	5.433*** (0.12)	5.145*** (0.13)	5.012*** (0.14)	3.786*** (0.16)	3.770*** (0.16)
Nothern Denmark	6.323*** (0.17)	3.422*** (0.17)	5.142*** (0.15)	5.109*** (0.15)	4.355*** (0.16)	4.212*** (0.17)	4.482*** (0.20)	4.425*** (0.21)
<i>Single</i>	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Married	7.740*** (0.16)	8.089*** (0.16)	7.612*** (0.13)	6.933*** (0.14)	9.202*** (0.15)	8.550*** (0.15)	-3.032*** (0.17)	-2.573*** (0.17)
Divorced	1.703*** (0.24)	2.250*** (0.24)	3.022*** (0.20)	2.415*** (0.20)	3.160*** (0.22)	2.478*** (0.23)	-0.873*** (0.25)	-0.876*** (0.26)
Widower	2.915*** (0.28)	2.694*** (0.27)	2.798*** (0.20)	2.309*** (0.20)	3.379*** (0.23)	2.960*** (0.24)	-0.250 (0.26)	-0.067 (0.27)
<i>Elementary (9th grade)</i>	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
High School	2.460*** (0.26)	1.861*** (0.25)	-0.991*** (0.23)	-0.784*** (0.23)	0.740** (0.25)	0.929*** (0.26)	-4.527*** (0.26)	-4.265*** (0.27)
Vocational	4.125*** (0.13)	3.712*** (0.13)	2.738*** (0.10)	2.722*** (0.11)	3.752*** (0.12)	3.802*** (0.13)	-3.393*** (0.14)	-3.652*** (0.15)
Short run tertiary	6.074*** (0.24)	5.402*** (0.24)	3.496*** (0.21)	3.494*** (0.21)	5.575*** (0.22)	5.807*** (0.23)	-5.855*** (0.28)	-5.955*** (0.29)
Medium run tertiary	5.324*** (0.16)	4.581*** (0.16)	2.291*** (0.14)	2.209*** (0.14)	4.561*** (0.15)	4.628*** (0.16)	-6.200*** (0.18)	-6.043*** (0.19)
Long run tertiary	7.352*** (0.20)	5.811*** (0.20)	4.083*** (0.18)	4.100*** (0.18)	6.144*** (0.19)	6.208*** (0.20)	-7.553*** (0.24)	-7.319*** (0.24)
<i>Employed</i>	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Unemployed	-2.978*** (0.40)	-2.517*** (0.49)	-0.681 (0.64)	-0.399 (0.66)	-1.322* (0.59)	-1.321* (0.62)	3.177*** (0.48)	2.832*** (0.50)
Out of labor force	-7.820*** (0.14)	-6.768*** (0.14)	-5.175*** (0.11)	-4.793*** (0.11)	-7.374*** (0.13)	-6.956*** (0.13)	0.614*** (0.15)	0.342* (0.15)
Constant	146.367*** (0.27)	150.973*** (0.26)	147.905*** (0.23)	148.215*** (0.25)	147.545*** (0.26)	148.330*** (0.27)	115.714*** (0.27)	108.402*** (0.29)
Observations	377.927	390.572	475.513	453.208	426.534	401.522	479.494	452.685

Figure A1: Imputed marginal interest rates and liquidity



Appendix Table A1

	2005		2006		2007		2008		2009	
	N	records	N	records	N	records	N	records	N	records
Taxpayers	4.402.394	6.262.057	4.441.477	6.503.096	4.494.685	7.990.774	4.530.139	7.956.036	4.441.054	7.603.611
Change in deadline	48	120	45	114	13	43	18	66	789	2.156
Deadline missing	1.238	1.884	1.071	1.721	1.153	1.790	1.024	1.598	304	479
Extended deadline (d1)	57.226	88.580	57.524	89.561	56.516	100.927	55.704	93.727	55.101	116.952
Standard deadline	3.748.931	5.326.645	3.783.517	5.492.425	3.807.272	6.868.871	3.840.103	6.738.120	3.829.393	6.564.177
Extended deadline (d2)	594.951	844.828	599.320	919.275	629.731	1.019.143	633.290	1.122.525	555.467	919.847
<i>Distribution of owed taxes on pre-populated tax assesment for SFD taxpayers</i>										
Total owed taxes	1.213.512	DKK 6.593.663.876	1.184.579	DKK 6.957.234.432	1.334.166	DKK 9.441.452.104	1.343.798	DKK 10.131.519.494	1.306.624	DKK 11.913.900.335
Average		DKK 5.434		DKK 5.873		DKK 7.077		DKK 7.539		DKK 9.118
Minimum		DKK 1		DKK 1		DKK 1		DKK 1		DKK 1
Maximum*		DKK 4.589.084		DKK 20.549.808		DKK 82.355.616		DKK 330.327.296		DKK 1.529.997.312
Percentile 1th		DKK 12		DKK 13		DKK 14		DKK 12		DKK 12
Percentile 5th		DKK 99		DKK 94		DKK 111		DKK 110		DKK 120
Percentile 10th		DKK 231		DKK 221		DKK 267		DKK 269		DKK 288
Percentile 25th		DKK 747		DKK 732		DKK 908		DKK 929		DKK 954
Percentile 50th		DKK 2.182		DKK 2.201		DKK 2.805		DKK 2.861		DKK 2.812
Percentile 75th		DKK 5.562		DKK 5.795		DKK 7.553		DKK 7.682		DKK 7.128
Percentile 90th		DKK 12.253		DKK 13.111		DKK 16.590		DKK 17.019		DKK 14.986
Percentile 95th		DKK 18.999		DKK 20.406		DKK 25.843		DKK 26.325		DKK 22.273
Percentile 99th		DKK 46.409		DKK 50.252		DKK 55.227		DKK 55.456		DKK 48.060
Average (trimmed)*		DKK 5.434		DKK 5.873		DKK 7.077		DKK 7.317		DKK 6.718
Total owed taxes (by March)	848.034	DKK 3.600.147.210	820.254	DKK 3.688.338.128	1.267.515	DKK 8.736.162.071	1.285.732	DKK 9.553.180.688	1.256.383	DKK 11.498.815.871

Note: The table shows tax year specific number of taxpayers, number of observations and distributional statistics on owed taxes for standard filing deadline (SFD) taxpayers.

Appendix Table A2

Tax year	# of payments	Σ payment (DKK)	Min	Max	Mean	Percentile 1th	Percentile 5th	Percentile 10th	Percentile 25th	Percentile 50th	Percentile 75th	Percentile 90th	Percentile 95th	Percentile 99th
Payment timing: distance in days from January 1st to payment														
2005	400.961	2.837.831.016	1	183	162	78	93	108	151	180	183	183	183	183
2006	417.767	3.213.140.365	1	183	162	73	92	107	151	179	182	182	182	182
2007	449.755	3.408.812.732	1	184	160	76	97	105	147	178	181	182	182	182
2008	499.166	3.572.084.072	1	183	161	74	103	113	152	179	180	181	181	181
2009	497.056	3.398.668.229	1	182	113	20	64	66	81	105	141	178	180	181
Payment timing: distance in days from e-account log on/air mail to payment														
2005	400.961	2.837.831.016	-665	112	64	-37	3	11	32	69	102	112	112	112
2006	417.767	3.213.140.365	-933	112	64	-34	4	12	33	69	103	111	111	111
2007	449.755	3.408.812.732	-747	115	69	-7	4	13	37	78	105	112	113	113
2008	499.166	3.572.084.072	-933	113	71	0	3	11	43	82	104	110	111	111
2009	497.056	3.398.668.229	-247	118	27	-47	0	0	2	18	42	92	99	101

Note: The table shows tax year specific number and sum of owed taxes payments filed during the 'voluntary' payment period December 15th to July 5th, cf section 2. Additionally the table includes distributional statistics on two constructed measures of payment timing.