Unwilling, unable or unaware? The role of different behavioral factors in responding to tax incentives

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Abstract

This paper studies how different behavioral factors affect individual responses to different tax incentives. This is important because different reasons for responding and not responding might have different policy implications and welfare conclusions. Our analysis compares the empirical significance of the inability to respond to tax incentives and unawareness of tax rules. Using population-wide Finnish panel data, we estimate behavioral responses to local changes within the tax and transfer system among similar or even the same individuals. We especially focus on higher education students, who are eligible for a study subsidy . The study subsidy rules create notches in the income tax schedule. We find that Finnish taxpayers in general do not respond at all to small incentives induced by kink points, but students do respond to larger incentives induced by notches. At the same time a large fraction of students do not respond to the notches making them worse off in absolute terms. This is evidence of optimization frictions, which according to subsequent results are partly due to not being aware of the system and partly due to not being able to respond to local tax incentives.

Keywords: income taxation, income transfers, behavioral responses, frictions
JEL Classification Codes: H21, H24, H30

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1 Introduction

Existing studies find varying responses to similar income tax incentives (see Saez *et al.* 2012 and Meghir and Phillips 2010 for surveys). While divergent responses are traditionally explained by heterogeneous preferences, recent literature adds optimization frictions to explain differences in observed behavior. Optimization frictions potentially prevent taxpayers from fully responding to tax incentives according to their underlying preferences (Chetty 2012, Kleven and Waseem 2013). One example of these frictions are job search costs (Chetty *et al.* 2011), which reduce the willingness to switch jobs when tax incentives change. Other examples in previous literature are insufficient knowledge about tax rules, inattention and salience of tax regulations (Chetty *et al.* 2013, Chetty and Saez 2013, Chetty *et al.* 2009). Although different institutional settings could feature different optimization frictions, the literature has not thus far systematically addressed their role in explaining heterogeneous responses to tax incentives.

Understanding the role of different optimization frictions has important policy implications. Different frictions might imply different patterns of responding to similar tax incentives (Reck 2014, Chetty *et al.* 2009 and 2007). For example, when observed behavioral responses are attenuated by the inability to respond immediately because of rigid labor demand, we would expect individuals to adjust their behavior in the future, and this adjustment might cause notable welfare losses. In contrast, when responses are attenuated by unawareness of tax regulations or inattention, it is not clear whether individuals would be more aware or attentive over longer time (and change their behavior accordingly). Therefore, if individuals do not ever even know or understand that there is a change in tax incentives, it is not clear that welfare losses occur either. The extent of the welfare loss matters, among other policy relevant issues, for the design of optimal tax schedules.

In this paper we study to what extent and in which manner taxpayers respond to different tax incentives. We use local variation in tax incentives created by different tax and transfer schemes. First, we study discontinuous jumps in marginal income tax rates (kinks). Under standard labor-leisure preferences, if individuals bunch at these kink points, it can be seen as clear evidence that marginal tax rates affect the behavior of taxpayers (Saez 2010). However, if taxpayers do not bunch, it remains an open question whether tax incentives are inherently not large enough to induce responses, optimization frictions eliminate the observed response, or the underlying structural model is not correctly specified.

Second, we utilize stronger variation in tax incentives created by a means-tested income transfer, the study subsidy. In Finland, all university students can apply for a substantial study subsidy (approx. 500 euros/month). However, earning income above an income limit results in losing a part of this subsidy, which creates a jump in the average tax rate, called a notch (see Slemrod 2010).

Similarly, bunching at a notch in the tax schedule provides clear evidence that individuals respond to tax incentives. However, there are two key differences between responses to notches and kinks. First, notches create much stronger variation in incentives than kinks. Thus comparing responses to kinks with responses to notches allows us to outline the role of the strength of the tax incentive in explaining taxpayer responses. Second, according to standard economic theory, taxpayers should never locate themselves just above the notch where they *lose* disposable income compared to the notch point. Utilizing this so-called dominated region and the shape of income distribution around the notch allow us to characterize the role of optimization frictions. There is no such dominated region of behavior associated with kink points.

We use register-based panel data on all Finnish taxpayers from 1999-2011. The data include detailed tax and transfer variables from official registers. These data allow us to accurately analyze bunching behavior associated with different kinks and notches.

One particular advantage is that we can compare how similar or even the same taxpayers react to different tax incentives, holding other institutional features constant. Also, the large and extensive data set allows us to conduct the bunching analysis for different subgroups, such as wage earners, self-employed individuals and students with different characteristics.

Our findings support the view that frictions play an important role in explaining taxpayer responses to tax incentives. First, we do not find any bunching at kink points. This result holds for any tax rate kink and for any subgroup. This implies that either the structural elasticity is small or optimization frictions play an important role, or both.

Interestingly, we find no bunching at kink points for the self-employed (sole proprietors and partners of partnership firms). However, we find that the self-employed individuals bunch actively at round numbers (e.g. multiples of 10,000 euros) of personal gross earned income. Thus they are at least somewhat able to alter their reported income, but despite of this they choose not to report income that is close to tax rate kink points. In general, the ability to affect reported income suggests that inability to respond does not prevent the self-employed from bunching more prominently at the marginal tax rate kink points.

Second, we find that income notches related to the study subsidy system create significant bunching behavior among students. This indicates that given strong enough incentives, taxpayers do react to local variation in the tax schedule. However, although the bunching behavior is evident, the local changes in tax incentives are so large that the implied observed earnings elasticities are in general small (<0.1).

As for other groups, we do not find any bunching at the marginal tax rate kink points for students. However, bunching at the notch reveals that at least some students are able to respond to tax incentives, and thus no bunching at kink points is not completely driven by the inability to respond to any local tax incentive.

Furthermore, despite the distinctive bunching behavior, we find that many students are located in the dominated region just above the notch. This is compelling evidence in favor of notable optimization frictions (Kleven and Waseem 2013). To characterize the source of the friction, we turn to institutional features associated with the study subsidy and the labor market students are in. We hypothesize that most of the friction is due to the inability to respond. Compared to the self-employed, it is difficult for students to choose or report any income they want. Instead, they have a limited number of different wage and hours contracts to choose from, and it could be costly to search for new job or to stop working abruptly at a certain point of time during the year when the income limit is reached.

We hypothesize that unawareness of study subsidy rules is not the main friction. Notches created by the study subsidy system are fairly simple and transparent. First, students need to apply for the subsidy, which makes it an active choice. Second, when they get the acceptance decision, the income limits are stated in the notification letter. Third, Social Insurance Institution remits back the subsidy if students earn income above the limit. In comparison, taxpayers might not be aware of marginal tax rates, or correctly understand what changes in marginal tax rates indicate. The fact that we do not find any bunching at kink points for students or even for the self-employed supports this view.

In order to further support the view that inability to respond is the source of frictions for students as opposed to unawareness of the rules, we study how changes in the location of the notch point affect the behavior of students The income limits were not changed even in nominal terms for several years. However, in 2008, the income limits were adjusted upwards by 30%. We find that students start bunching at the new thresholds immediately, indicating that they are aware of the rules.

In addition to optimization frictions, this study contributes to the literature on observed responses to kinks and notches. This study is the first to analyze bunching at marginal tax rate kink points in Finland. Many previous studies find no or only little bunching at the kink points of the marginal tax rate schedule for wage earners, but significant and sharp bunching for the self-employed (Saez 2010, Bastani and Selin 2014 and Chetty *et al.* 2011). One intriguing finding in this study compared to the earlier literature is that we find only negligible if any bunching at marginal tax rate kink points for the self-employed.

Kleven and Waseem (2013) show that wage earners bunch actively at income tax notches in Pakistan. We add to this study by estimating responses to income notches in a developed country where the tax system is strongly enforced, and thus the responses are more related to labor supply decisions as opposed to reporting behavior. Other existing evidence on responses to notches comes from a range of different institutions, for example, the medicaid notch in the US (Yelowitz 1995), eligibility for in-work benefits in the UK (Blundell and Hoynes 2004 and Blundell and Shepard 2012), social security and financial incentives in retirement rules (Gruber and Wise 1999 and Manoli and Weber 2011), and car taxes affecting the fuel economy of cars (Sallee and Slemrod 2012).

This paper proceeds by presenting the relevant institutions in Section 2. In Section 3 we present the conceptual background on responding to kinks and notches, and discuss the role of different behavioral frictions. We then present the empirical methodology and data in Section 4. Section 5 presents the results. Section 6 discusses the implications and concludes the study.

2 Institutions

2.1 Income taxation and marginal tax rate kink points

We study the marginal tax rate (MTR) kink points created by the central government income tax schedule.[1] Small amounts of earned income are not taxed by the central government. The first kink appears at a point where the central government tax rate first applies. After the central government tax rate is first applied, it increases in a stepwise manner. This results in 4-6 kink points in the MTR schedule, depending on the year in question.

Different kink points are associated with MTR increases between 4-11 percentage points. At the first income threshold, there is a clear increase in the overall MTR. In 1999-2011, increase in the MTR associated with the first income threshold has varied between 6-14 in percentage points, which relates to a 22-53% decrease in the overall net-of-tax rate (1-MTR) on average (excluding employer social security payments). In addition to the first kink point, the last kink involves the most salient and distinctive increase in the MTR. The last kink point is associated with a 6-9 percentage points increase in the MTR, and 9-16% decrease in the overall net-of-tax rate.

As an example, Figure 1 presents the marginal income tax rate schedule for the year 2007. The Figure illustrates the discontinuous changes in the income tax rate at different levels of taxable income. Taxable income is the base for central government taxation, and it is roughly defined as gross earned income minus deductions.

[1] The Finnish income tax system comprises of three components: progressive central government income taxes, proportional municipal taxes and mandatory social security contributions. The average municipal income tax rate is 18.3, and the average social security contribution rate is 5.1 (in 1999-2011). In general, municipal income taxation and social security contributions do not induce kink points since they are proportional. The main exception is the municipal earned income tax allowance which will be briefly discussed in Section 5. Since 1993, Finland has applied the dual income tax system. In dual income taxation, earned income (wages, fringe benefits, pensions etc.) is taxed at a progressive tax schedule, and capital income (interest income, dividends from listed corporations etc.) is taxed at a flat tax rate. In this study we focus on the details of the earned income tax schedule. However, the dual income tax system affects the tax rules of self-employed individuals which we discuss at the end of this section.

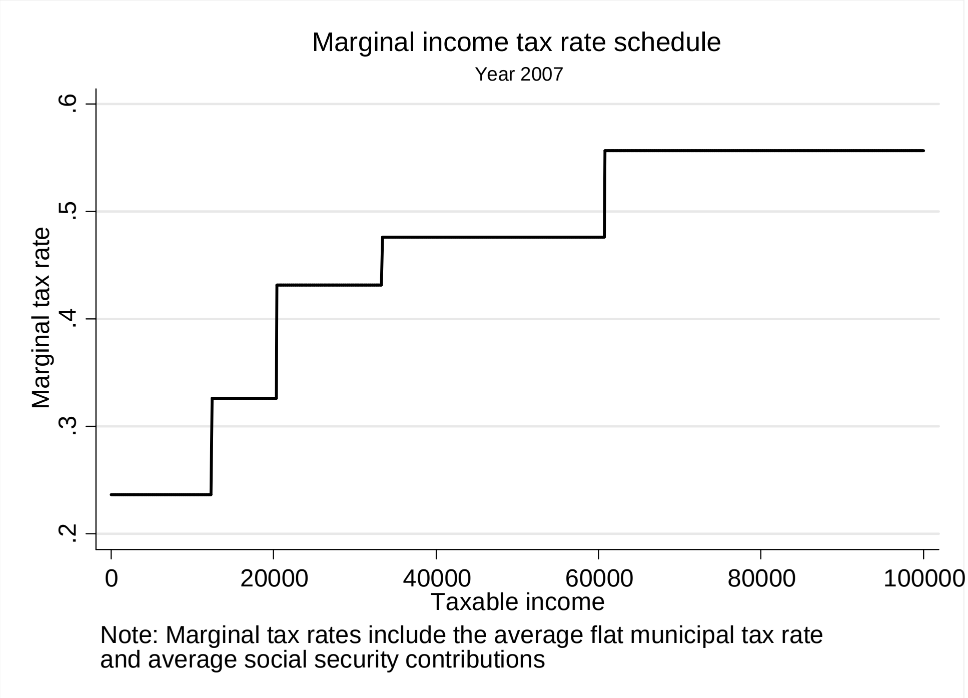

Figure 1: Marginal income tax rate schedule (year 2007)

In order to take into account the general increase in wages and other prices over time, the nominal income thresholds have moved upwards in time. However, increases in the income thresholds are not tied to any price or wage index, and are announced by the government on annual basis. Table 1 in the Appendix presents the nominal MTR schedules of central government income taxation in 1999-2011. Figure 15 in the Appendix presents the overall nominal average marginal income tax rates in 1999, 2007 and 2011 (including average municipal tax rates and social security contributions).

In addition to wage earners, we study the behavior of self-employed individuals. In this study self-employed individuals include sole proprietors and partners of partnership firms (all non-corporate entrepreneurs in Finland). The annual reported income of these individuals is based on the reported profits (earnings-costs) of their firms. In the Finnish dual income tax system with separate tax rate schedules for earned and capital income, these profits are mechanically divided into capital income and earned income components.

Profits are divided into capital income and earned income according to the net assets of the firm (assets-liabilities from the year before). The amount corresponding to 20% of net assets is considered as flat-taxed capital income, and any profits exceeding this amount are progressively taxed as earned income.[2] In the case of zero or negative net assets, the profits are taxed completely as earned income.

As an example, consider a self-employed individual who solely owns the firm, and has

[2]The flat capital income tax rate was 28% in 1999, and 29% in 2000-2004. In 2005-2011, the rate was again reduced to 28%.

net assets of 100,000 and profits of 30,000 euros. In this case, 20,000€ of the profits are flat-taxed, and the remaining 10,000€ are taxed with a progressive tax rate schedule, illustrated in Figure 1. Without any net assets, the whole 30,000€ is taxed as earned income.

Intuitively, all self-employed individuals face similar *local* incentives within the earned income MTR schedule as regular wage earners. Even though profits are partly flat-taxed, the kink points of the earned income tax schedule provide similar marginal changes in incentives. Furthermore, as the maximum amount of flat-taxed capital income is predetermined based on net assets from the year before, there is no possibility for static income-shifting between tax bases among sole proprietors and partners of partnership firms in Finland.

2.2 Study subsidy

In Finland, all students enrolled in a university or polytechnic can apply for a monthly-based study subsidy.[3] The maximum amount of the subsidy is 461€ per month in the academic year 2006/2007.[4] Students can apply for the subsidy for a limited number of months per degree (max. 55 months).

Study subsidy is typically applied when a student is accepted to study for a university or college degree. The default number of study subsidy months per a study year is 9 (fall + spring semester), which most of the students also receive. The study subsidy eligibility depends on academic progress[5], and it is limited if the yearly gross earned income of the student is too large.

Students can earn a certain amount of gross income (earned income + capital income) per calendar year without an effect on the study subsidy. With the typical 9 months of the subsidy per calendar year, the annual gross income limit is 9,260€ (in 2006/2007). Students can alter the number of subsidy months from the default 9 months by making an application beforehand, or by returning already granted subsidies by the end of march in the next calendar year. More study subsidy months decreases the income limit, and less study subsidy months increases it.[6]

[3]The study subsidy is intended to enhance equal opportunities to acquire higher education, and to provide income support for students who often have low disposable income. In Finland, university education is publicly provided, and consequently there are no tuition fees. A large proportion of individuals receive higher education in Finland (ca. 40% of individuals aged 25-34 have a degree), and the study subsidy program is widely used among students.

[4]The full study subsidy includes a study grant and housing benefit. The standard study grant is 259€/month (in 2006/2007). The housing benefit depends on rent payments and other housing details. Maximum housing benefit is 202€/month (in 2006/2007). In addition to the study subsidy, students can apply for repayable student loans which are secured by the central government.

[5]The academic progress criteria requires that a student completes a certain number of credit points per academic year in order to be eligible for the subsidy.

[6]The formula for the annual gross income limit is the following: 505€ per study subsidy month plus

The gross income limit in the study subsidy program creates a notable notch in the tax system. If the income limit is exceeded, the study subsidy of one month is reclaimed by the Social Insurance Institution. Additional month of the subsidy is reclaimed for an additional 1,010€ of gross income over the threshold.

Students face large local incentives not to exceed the income limit. Since earning just a little over the limit results in losing one study subsidy month, this results in an implied marginal tax rate of over 100% just above the notch. Thus the study subsidy notch induces a strictly dominated region above the notch where students can earn more disposable income by decreasing their gross income level.

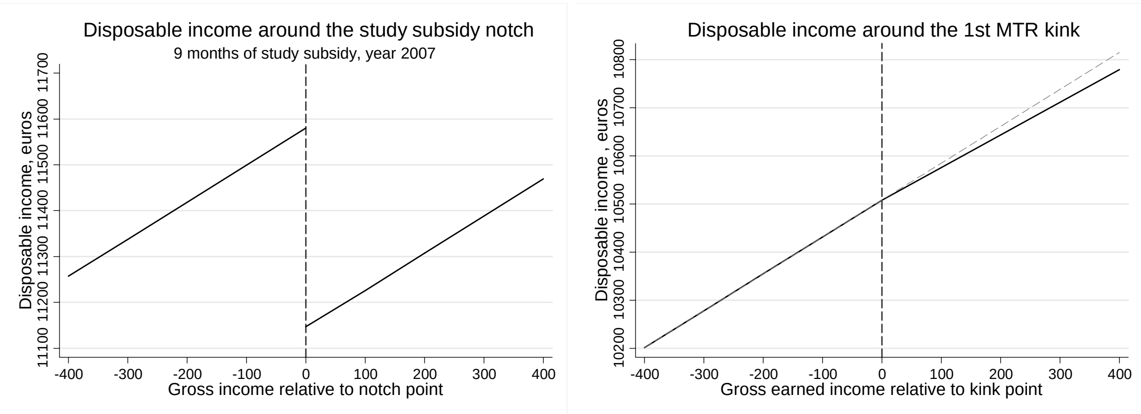

Figure 2: Disposable income around the study subsidy notch (left-hand side) and the first MTR kink point (right-hand side), year 2007

The left-hand side of Figure 2 illustrates the effect of the study subsidy notch on disposable income with the standard case of 9 study subsidy months (in 2007). In the figure, the vertical axis denotes disposable income including the subsidy, and the horizontal axis denotes gross income relative to the notch point (9,260€). The Figure shows that once the gross income limit is exceeded, reclaiming of the study subsidy causes a dip in disposable income. At the margin, earning 100 euros above the threshold results in a loss of 360 euros in disposable income.

The right-hand side of Figure 2 illustrates the effect of the first marginal income tax rate kink point on disposable income. Earning income after the kink point results in less disposable income than before the kink. For example, 100 euros of gross income above the kink results in 9 euros less disposable income than below the kink.

Figure 2 highlights that the difference between the study subsidy notch and the MTR kink points is notable. Even though kink points also change the incentives at the margin, the effect of the study subsidy notch is significantly larger.

The study subsidy program was reformed in 2008. The main outcome of the reform was that the income limits were increased by approximately 30%. The default income

a fixed amount of 170€, and 1,515€ per month without the study subsidy (in 2006/2007).

limit for 9 study subsidy months increased from 9,260€ to 12,070€[7] In addition, the monthly study subsidy was increased from 461€ to 500€ per month. In general, other details of the system were not changed, including the academic criteria and the loss of the subsidy of one month if the income limit is exceeded.[8] Finally, Table 2 in the Appendix shows the income limits for different number of study subsidy months, and the relative loss incurring when the income limit is exceeded both before and after the reform.

3 Conceptual framework

3.1 Behavioral responses to kinks and notches

We analyze taxpayer responses to kinks and notches in the tax schedule with a static model that follows closely Saez (2010) and Kleven and Waseem (2013). In short, the model shows that if behavioral responses are notable, we should find individuals bunching in the income distribution at the kink and notch points. We first analyze behavioral responses without frictions and then discuss how different frictions alter the baseline bunching formula.

We assume that individuals have a quasi-linear utility (no income effects). Individuals have homogenous tastes and labor supply elasticities but different abilities, which gives rise to the shape of the income distribution. The iso-elastic utility function is of the form

$$u(c,z) \quad = \quad c - \frac{1}{1+1/e}\frac{z}{n}^{1+1/e}$$

where c is consumption, z is gross earnings, e is the earnings elasticity and n is ability.

Individuals maximize utility with respect to a budget constraint $c = z(1-t) + R$, where R denotes virtual income. We focus on linear income tax rates t to simplify the problem. Maximizing utility with respect to the constraint gives the following earnings supply function

$$z = n(1-t)^e$$

We assume that there is a continuous distribution of abilities, giving rise to density function $f(n)$ and distribution function $F(n)$. For a baseline tax system which is linear and has no kink points, there is an earnings distribution associated with a density and distribution function, $H_0(z) = F(z/(1-t)^e)$ and $h_0(z) = H_0'(z) = f(z/(1-t)^e)/(1-t)^e$.

Next, we look at how kinks and notches transform the underlying distributions with no kinks or notches. For kink points, consider a small increase in the marginal tax rate,

[7] After 2008, the gross income limits are 660€ (before 505€) per study subsidy month plus a fixed amount of 220€ (170€), and 1,970€ (1,515€) per month when no study subsidies are collected.

[8] After 2008, additional month of the subsidy is reclaimed for an additional 1,310€ of gross income over the threshold, compared to 1,010€ before 2008.

dt, at a point $z = k$. At k income is taxed with a tax rate t_1, and above the kink point the tax rate is $t_2 = t_1 + dt$. Individuals who were previously located at the kink do not need to change their behavior, but individuals above the kink face a higher tax rate than before. dz denotes the behavioral changes in gross earnings as a response to the increased tax rate. In terms of the earnings elasticity e, the behavioral responses can be written as

$$\frac{dz}{k} = e\frac{dt}{1 - t_1}$$

Figure 3 illustrates the bunching effect in the absence of frictions. The vertical axis denotes the net-of-tax income, and horizontal axis denotes pre-tax income. The straight blue lines illustrate the tax rates, and curvy red lines the indifference curves. As a result of the behavioral response to the introduced kink point k, individuals located within the income interval $(k, k + dz)$ now bunch at k. In the Figure, individual of type H is the highest pre-tax income individual to move to the kink point. Individuals further up in the income distribution $z > k + dz$ do not move to the kink point, and individuals originally located below or at the kink point (Type L) do not change their behavior either. Thus we can express the extent of bunching behavior as $B(dz) = \int_k^{k+dz} h_0(z)dz$.

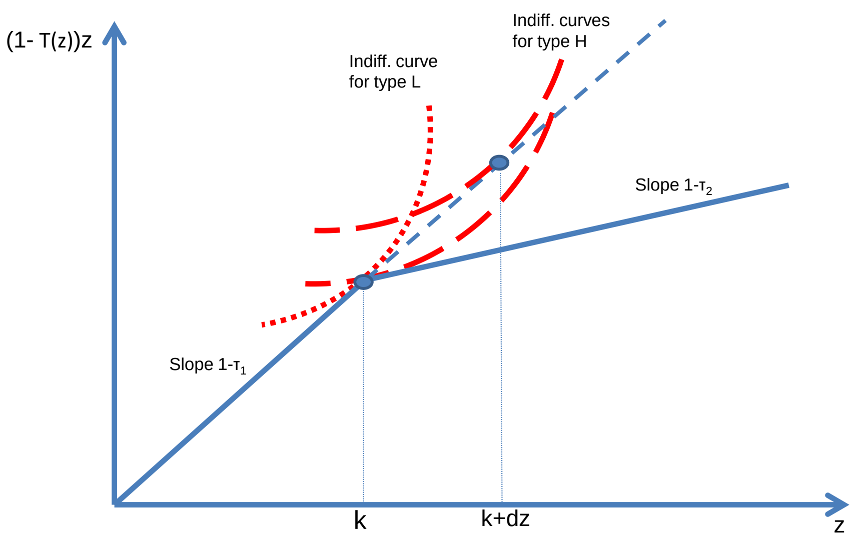

Figure 3: Bunching at a kink point

Notches can be analyzed in a similar fashion. The tax schedule above the notch point at $z = j$ is characterized as $t + \Delta t$. For $z <= j$, the income tax rate is t. When $z > j$, income is taxed with a tax rate t plus an additional tax of Δt. In the case of income transfers with income limits, Δt can be thought of as the forfeit transfer when the income limit is exceeded.

Notches create a so-called dominated region just above the notch point where individuals can increase net-of-tax income by moving to the notch point and earning *less* pre-tax income. Under normal preferences and absent any frictions, no individuals should locate themselves within the dominated region.

Figure 4 illustrates the bunching effect related to notches. Individuals located within $(j, j+\Delta z)$ will bunch at the notch point, and type H individual is the last to move to the notch. Thus type H individual represents the marginal buncher with the highest pre-tax income before the implementation of the notch. The bunching behavior is denoted as $B(\Delta z) = \int_j^{j+\Delta z} h_0(z)dz$.

In the figure, the dominated region is denoted as $(j, j+\Delta z^D]$. Throughout the paper, we define the dominated region such that the upper limit of the region is a point where the net-of-tax income equals the net-of-tax income at the notch. By definition, all points between the notch and the upper limit of the dominated region produce less net-of-tax income compared to the notch point.

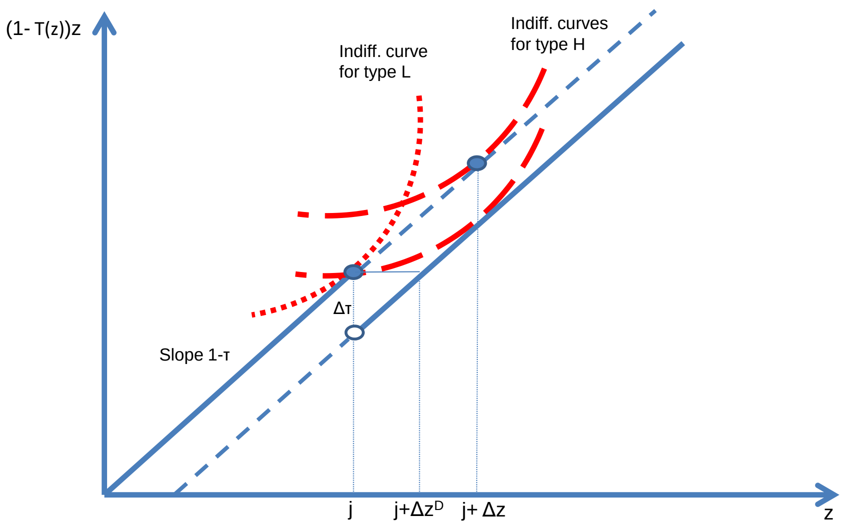

Figure 4: Bunching at a notch point

3.2 Earnings elasticities based on observed bunching

Following Saez (2010), using the expression for excess bunching $B(dz)$ along with the taxable income elasticity formula by Feldstein (1999), we can express the local average elasticity of taxable income (ETI) at the kink point in proportion to the number of individuals bunching at the kink point

$$e(k) \simeq \frac{B(dz)}{k \times h_0(k) \times log(\frac{1-\tau_1}{1-\tau_2})} \tag{1}$$

In equation (1), k is the kink point, $h_0(k)$ denotes the counterfactual density in the absence of the kink point, and $(1-\tau_1)$ and $(1-\tau_2)$ denote the net-of-tax rates below and above the kink point, respectively.

Intuitively, larger $B(dz)$ indicates larger behavioral responses and larger local elasticity, and vice versa. Also, with given $B(dz)$ and $h_0(k)$, smaller difference of the tax rates τ_1 and τ_2 indicates larger local elasticity. As underlined in Feldstein (1999), this elasticity measure is directly proportional to the excess burden of the income tax. Thus, in the absence of frictions, we can measure the excess burden with $e(k)$.

As the behavioral response to a notch is related to changes in average tax rates rather than marginal tax rates, deriving the implied elasticity using excess bunching at notches is less straightforward. However, the earnings elasticity at a notch can be approximated in terms of the excess mass at the notch point and the implied change in marginal tax rate above the notch.

We approximate the earnings elasticity at the study subsidy notch using a similar approach as Kleven and Waseem (2013). We derive an upper-bound reduced-form earnings elasticity by relating the earnings response of a marginal buncher at $j + \Delta z$ to the implicit change in tax liability between the notch point j and $j + \Delta z$. The marginal buncher represents the individual with the highest income to move to the notch point, compared to a counterfactual state in the absence of the notch (see Figure 4).

Intuitively, this approach treats the notch as a hypothetical kink which creates a jump in the implied marginal tax rate. More formally, the reduced-form earnings elasticity is calculated with a quadratic formula

$$e(j) \approx (\triangle z/j)^2/(\triangle t/(1-t)) \tag{2}$$

where $(1-t)$ is the net-of-tax rate at the notch, and $\triangle t$ defines the change in the implied marginal tax rate for the marginal buncher with an earnings response of Δz.

3.3 Frictions

In the forthcoming analysis, we decompose behavioral frictions into two broadly defined components: unawareness of tax rules and regulations and the inability to respond to tax incentives. Unawareness of tax rules covers the lack of knowledge that taxpayers might have on tax regulations. This includes both the pure inattention of tax rules and the failure to understand them even when general knowledge about tax regulations is available. For example, taxpayers might not know that kink or notch points even exist, or not know the correct income base which determines their location in the income tax schedule.

Unawareness also includes any mistakes that taxpayers might make on interpreting the actual incentives. A well-known example is the confusion between marginal and average tax rates (see e.g. Chetty and Saez 2013, and Liebmann and Zeckhauser 2004). The misunderstanding of marginal changes in incentives might induce individuals not to respond to local changes in incentives.

The inability to respond covers a range of reasons why taxpayers are not able to flexibly respond to tax incentives. These include the factors constraining behavioral responses even when taxpayers are aware of local incentives. The inability to respond might stem from institutional factors as well as individual constraints. For example, due to fixed long-term contracts, wage earners might not be able to alter their working hours easily. Also, it might be costly to search for a new job that provides more suitable working hours and wage rates in terms of tax incentives (see e.g. Chetty *et al.* 2011). Intuitively, when inability frictions are present, large local changes in incentives should produce more observed bunching than small changes, since it is on average more profitable to overcome the inability friction when payoffs from changing behavior are larger (Chetty 2012).

In general, compared to underlying structural responses in the frictionless benchmark (Figures 3 and 4), frictions attenuate the observed behavioral responses. However, different frictions potentially cause different patterns of observed behavior. If individuals are both aware of tax changes and able to respond to them, we should see sharp bunching at kinks and notches if the underlying elasticity is significant. If some or all individuals are unaware of tax rules, this would either mitigate or eliminate the sharp response. In contrast, if individuals are aware but not able to fully respond, the observed bunching response would not be sharp but more scattered around kinks and notches.

Furthermore, different frictions imply different reasons for responding and not responding to tax incentives. Consequently, different frictions hold potentially different policy implications and long-run welfare conclusions. We discuss these in more detail when we interpret and discuss the results in Section 6.

Finally, we include optimization frictions in the theoretical analysis. Since all frictions have an *a priori* similar effect on average responses in a cross-sectional context, we denote frictions by a single term a, $0 < a < 1$. The higher a is, the larger the frictions are and the less individuals respond to tax incentives. The fraction of individuals responding to tax incentives in the presence of frictions is denoted as $(1 - a)$.

After including the frictions, the two bunching formulas become $B_a(dz) = \int_k^{k+dz}(1 - a)h_0(z)dz$, and $B_a(\Delta z) = \int_j^{j+\Delta z}(1 - a)h_0(z)dz$. It is evident that bunching behavior is reduced when frictions exist. Nevertheless, the behavioral response absent frictions might still be non-negligible, giving rise to a baseline long-run structural earnings elasticity.

4 Empirical methodology and data

4.1 Bunching at kinks and notches

With both kinks and notches it is straightforward to verify visually whether there is bunching or not. The challenge is in estimating the size of the excess mass in relation to the counterfactual state of no kinks or notches. In short, the excess mass of individuals at a kink or a notch is estimated by comparing the actual density function around the discontinuity point k to a smooth counterfactual density. The counterfactual density function describes how the income distribution at the notch or kink would have looked like without a change in the tax rate. The bunching method implicitly assumes that individuals in the neighborhood of a kink or a notch are otherwise similar except that they face a different slope or shape of the budget set.

Due to imperfect control and uncertainty about the exact amount of income in each year, the usual approach is to use a "bunching window" around k to estimate the excess mass (see Saez 2010). Thus when analyzing kink points, we compare the density of taxpayers within an income interval $(k - \delta_L, k + \delta_H)$ to an estimated counterfactual density within the same income range. δ_L denotes the lower income limit on the left of the kink, and δ_H denotes the income limit above k.

We follow Chetty *et al.* (2011) to estimate excess bunching at kink points. The counterfactual density is estimated by fitting a flexible polynomial function to the observed density function, excluding the region $[\delta_L, \delta_H]$ from the regression. First, we re-center income in terms of the discontinuity point, and group individuals into small income bins of 100€. Next, we estimate a counterfactual density by regressing the following equation

$$c_j = \sum_{i=0}^{p} \beta_i (z_j)^i + \sum_{i=\delta_L}^{\delta_H} \eta_i \cdot \mathbf{1}(z_j = i) + \varepsilon_j \tag{3}$$

and by omitting the bunching window $(k - \delta_L, k + \delta_H)$ from the regression. In equation (3), c_j is the count of individuals in bin j, and z_j denotes the income level in bin j. The order of polynomial is denoted by p. Thus the fitted values for the counterfactual density are given by

$$\hat{c}_j = \sum_{i=0}^{p} \beta_i (z_j)^i \tag{4}$$

The relative difference of observed individuals and the counterfactual density within the bunching window defines excess bunching. More formally, for kink points, excess bunching is calculated as

$$\hat{b}(k) = \frac{\sum_{i=\delta_L}^{\delta_H} (c_j - \hat{c}_j)}{\sum_{i=\delta_L}^{\delta_H} \hat{c}_j / (\delta_H - \delta_L + 1)} \tag{5}$$

As in the earlier literature, parameters δ_L, δ_H and p are determined visually and based on the fit of the model. In general, our results are not very sensitive to the choice of the omitted region or the degree of the polynomial.[9]

The method for analyzing excess mass at notches is based on similar principles. The main difference with notches is that the excess mass should locate below the notch and not as a diffuse mass around both sides of it. Thus in the case of notches, the excess bunching is measured by comparing the observed distribution and the counterfactual within the interval $(k - \delta_L, k)$, where δ_L is the lower limit of the interval and k refers to notch point.

With notches it is less straightforward to define the income limit above the notch point when estimating the counterfactual density. We follow Kleven and Waseem (2013) and define the upper limit for the excluded region δ_H such that the excess mass $\hat{b}_E(k) = (\sum_{i=\delta_L}^{k} c_j - \hat{c}_j)$ equals the missing mass above the notch $\hat{b}_M(k) = (\sum_{z>k}^{\delta_H} \hat{c}_j - c_j)$. This procedure is implemented by starting from a small value of δ_H and increasing it incrementally until $\hat{b}_E(k) \approx \hat{b}_M(k)$. Intuitively, this convergence condition implies that the excess mass below the notch comes from the missing mass above the notch, and that we can define the earnings response $\triangle z$ and the marginal buncher using the estimated excess mass. This definition for δ_H also denotes the upper bound for the excluded range (Kleven and Waseem 2013).

In order to assess frictions related to responding to notches, we measure the relative proportion of individuals who locate at the dominated region just above the notch. Following Kleven and Waseem (2013), individuals at the dominated region are inherently not able to respond to the notch because of frictions, as these individuals would have more disposable income by earning (marginally) less. We define the share of individuals in the dominated region as $a = c^D / \hat{c}^D$, where c^D is the observed number of individuals in the dominated region $(k, k + D)$, and $\hat{c}^D$ is the counterfactual estimate for the individuals

[9] Chetty *et al.* (2011) adjust the counterfactual density above the kink such that it includes the excess bunch at the kink, making the area under the estimated counterfactual equal to the observed density. Due to the small observed excess bunching at kink points, this has only a trivial effect for our empirical analysis, and thus we estimate the counterfactual for kink points by simply excluding the bunching window from the regression as described above. Intuitively, our approach provides an upper bound estimate for excess bunching at kink points.

within the same region. D denotes the upper limit of the dominated region.

Similarly as in Chetty *et al.* (2011) and Kleven and Waseem (2013), the standard errors for all the estimates are calculated using a bootstrap procedure. We generate a large number of earnings distributions by randomly resampling the residuals from equation (3), and generate a large number of new estimates of $\hat{c}_j$ based on the resampled distributions to evaluate variation in the estimates of interest. The standard errors for each estimate ($\hat{b}(k)$ and $\hat{e}(k)$ for kinks, and $\hat{b}_E(k)$, $\hat{\delta}_H$, $\hat{a}$ and $\hat{e}(k)$ for notches) are defined as the standard deviation in the distribution of the estimate.

4.2 Data

We use panel data on all working-aged individuals (15-70 years) living in Finland in 1999-2011. The data set is based on the Finnish Longitudinal Employer-Employee Data (FLEED). To this data we have linked a variety of essential register-based variables, such as detailed tax register data from 1999-2011, and information on students and the study subsidy program from 1999-2010. With this data we can reliably and accurately analyze local changes in incentives among various subgroups of taxpayers. To analyze self-employed individuals, we use panel data on all main owners of Finnish businesses from 1999-2010, provided by the Finnish Tax Administration.

Table 3 in the Appendix presents the key summary statistics for all taxpayers. Table 4 shows the summary statistics for students. The average gross income excluding the study subsidy among students is 7,600 euros per year. This implies that many students have part-time or full-time jobs during their studies and breaks between semesters, which is very typical among Finnish university students. Finally, Table 5 presents the summary statistics for the self-employed individuals, including the key firm-level characteristics.

5 Results

5.1 Baseline results

This section presents the overall results on bunching at MTR kink points and the study subsidy notch. We characterize the role and significance of frictions in the following sections.

Marginal tax rate kink points First, we present taxable income distributions around different MTR kink points for all taxpayers. The figures plot the observed income distributions and counterfactual distributions relative to each MTR kink point in bins of 100€ in the range of +/- 5000€ from the kink. The figures denote the excess mass estimates (with standard errors), and the implied elasticity estimates based on observed excess bunching.

In each graph, the kink point is marked with a dashed vertical line. The excluded counterfactual region (the bunching window) is marked with solid vertical lines. In each graph, the bunching window is +/- 7 bins from the kink. The counterfactual density is estimated using a 7th-order polynomial function. Our results are not sensitive to the choice of the bunching window and the order of the polynomial.

Figure 5 presents the income distributions around different kink points of the central government income tax rate schedule for all taxpayers. The Figure illustrates bunching at the first, second, third and last kink point using pooled data for the years 1999-2011. As shown in Table 1 in the Appendix, the number of kink points have decreased from 6 to 4 in the period we study. Throughout the study, the first MTR kink point always includes the threshold where the central government income tax rate first applies. The other kink points in Figure 5 correspond to the kink points still existing after 2007.

The Figure shows that there is no bunching at the marginal tax rate kink points in Finland. The only conceivable exception might be the second kink. However, the second kink is likely to produce upward-biased excess bunching because of the locally hollow shape of the income distribution around the kink. Consequently, the elasticity estimates are zero or very close to zero at all MTR kink points.

In terms of the size of the tax rate change and the characteristics of the Finnish tax system, we should in particular find excess bunching at the first and last kink point of the tax schedule. However, there seems to be no significant responses at these kink points. The income distribution around the first kink point does not include individuals with means-tested social benefits, such as unemployment insurance payments and housing benefits. These benefits are regarded as taxable income, and they tend to cluster at certain income levels, causing a lot of noise in the low-end of the income distribution. Importantly, there is no significant bunching at the first MTR kink even if we include individuals with these taxable benefits.

The result of no bunching holds also for all other central government kink points that are not shown in Figure 5. Also, there is no significant bunching at any kink point in any separate year. Thus there is no increase in excess bunching over time, and no differences in responses to kinks of different size. In addition to central government taxation, we find no bunching at the MTR kink points associated with graduated tax credits or allowances, including the municipal earned income tax allowance.

The result of no bunching at MTR kink points in Figure 5 indicates that marginal tax rates do not induce local behavioral responses. This could be explained by both the low underlying (local) tax elasticity and various behavioral frictions. It might be that the relatively small changes in incentives induce no behavioral responses, even in the absence of frictions. However, it might be that taxpayers cannot adjust their reported income or

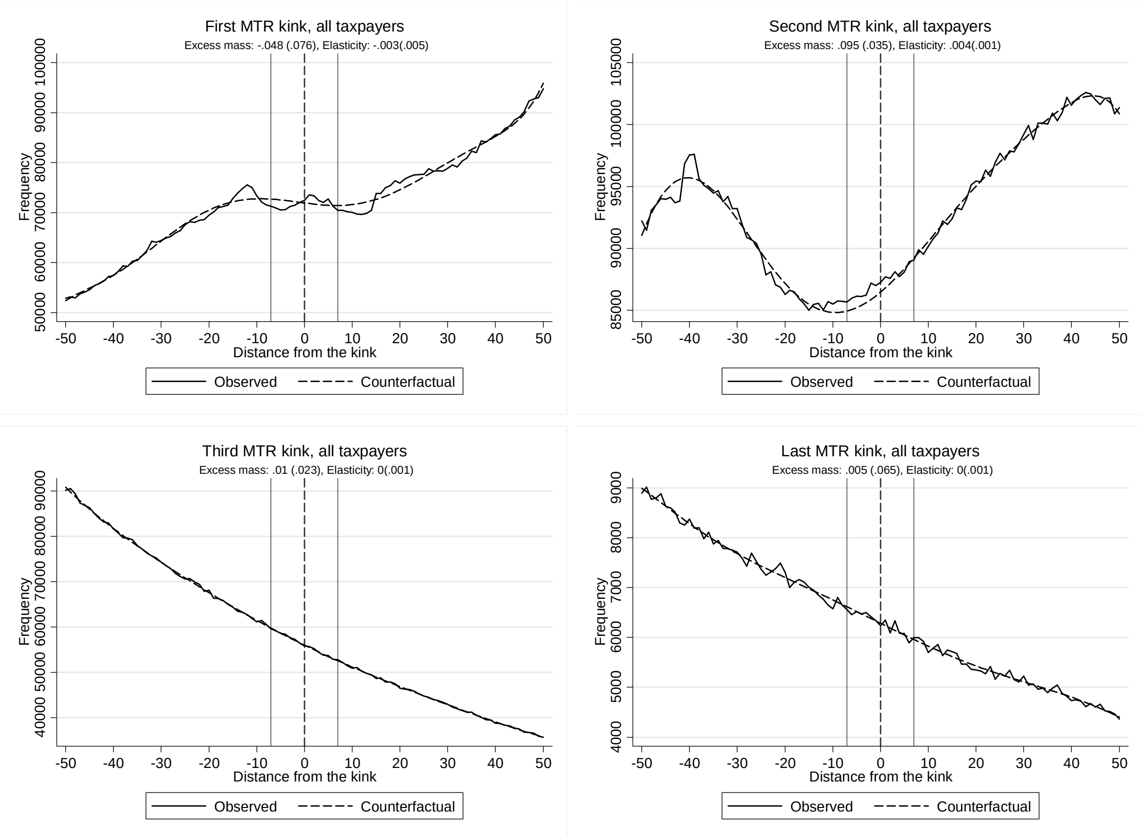

Figure 5: Income distributions around MTR kink points, 1999-2011

working hours with reasonable costs. Finally, it might be that taxpayers do not know or understand the details of the MTR schedule. We study these hypothesis by utilizing students and the self-employed individuals as example groups in the next section.

Study subsidy notch Next, we study behavioral responses around the notch points of the study subsidy system among Finnish university students. Figure 6 shows the gross income distribution around the notch point (relative to the notch in bins of 100€ in the range of +/- 5000€ from the notch). The Figure presents the distribution of all students (left-hand side) and students with the default number of 9 study subsidy months (right-hand side) in 1999-2010. In the Figure, the dashed vertical line denotes the notch point above which a student loses one month of the subsidy. The solid vertical lines denote the excluded range (see Section 4 for details on defining the upper limit of the excluded range). The dash-point vertical line above the notch shows the upper limit for the dominated region.

The figure also includes the estimates and standard errors for the excess mass at the notch, the share of individuals in the dominated region, and the upper limit of the counterfactual and Δz. In each figure the counterfactual density is estimated using a 7th-order polynomial function. Our main conclusions are not very sensitive to this choice, although the point estimates vary somewhat with different choices on the degree of polynomial.

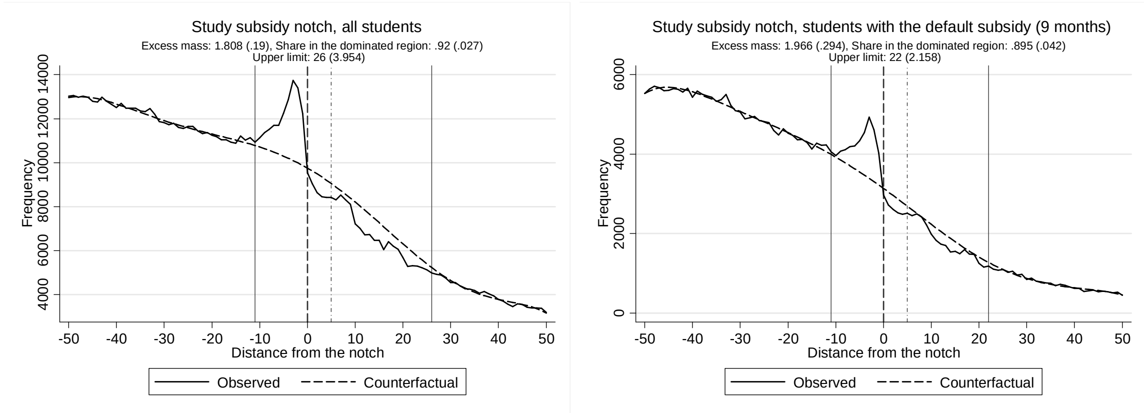

Figure 6: Bunching at the study subsidy notch, 1999-2010

Figure 6 indicates a clear and statistically significant excess mass on the left of the notch for both all students (1.8) and students with the default subsidy (2.0). This indicates that students are both aware of the notch and respond to the strong incentives created by it. However, implied earnings elasticities are rather low, 0.083 (0.019) and 0.065 (0.007) for all students and students with 9 subsidy months, respectively (standard errors in parenthesis).[10] Thus even though excess bunching is evident and notable earnings responses occur ($\triangle z$ is around 15% of disposable income at the notch), the observed elasticities are still small. This stems from the fact the changes in incentives are also very distinctive, as notches induce very high implicit marginal tax rates above the income limit.[11]

5.2 Inability to respond

Students Figure 6 implies that students are aware of the incentives and respond to the notch created by the income limit of the study subsidy program. However, the Figure also suggests that students cannot affect their working hours or reported income very precisely. First, the excess mass below the notch is rather diffuse. This indicates that it is difficult for students to control or predict annual income very precisely. Second, there

[10]Earnings elasticity for all students is calculated using the average number of study subsidy months (7). All elasticities at study subsidy notches are calculated using the SISU microsimulation model and the average number of subsidy months. We thank Markus Paasiniemi for research assistance on calculating the elasticities.

[11]In addition, implicit marginal tax rates remain relatively high (>50%) even further away above the notch, as an extra month of the subsidy is reclaimed after additional 1,010€ above the income limit (1,310€ after 2008). Thus, the effective tax schedule for students inherently includes multiple notches. However, we only observe significant bunching at the first notch, which justifies the analysis of the first notch only. The analysis of the first notch is also rationalized by the fact that students can alter the number of study subsidy months until the march of next tax year.

is an economically and statistically significant mass of students at the strictly dominated region above the notch where students can increase their net income by lowering their gross income. This indicates that in addition to the inability to respond, some students might not be aware of the notch, at least when exceeding the income limit for the first time.

To study the inability to respond, we first divide students into two groups based on the number of years they have studied: students with under three study years and students with more than (or equal to) three study years.[12] It is presumable that the ability to adjust and predict annual income enhances over time, therefore inducing the inability friction to decrease along the study years. If the inability to respond decreases over time, we would expect that students with more study years bunch more actively, and that less students are located in the dominated region. In contrast, we have no clear reason to assume that willingness to respond would be different *locally* around the notch point for students with more or less study years.

Figure 7 weakly supports the above hypothesis. There is more excess bunching for more senior students, but the difference is not statistically significant.[13] Also, the share of individuals in the dominated region is practically unaffected. This suggests that a notable fraction of students are (still) not able to respond by adjusting their working hours. In addition, it might be that students with more experience on the study subsidy program are more aware of its details, and thus would respond more prominently. We study the awareness of the study subsidy rules in more detail in the next subsection.

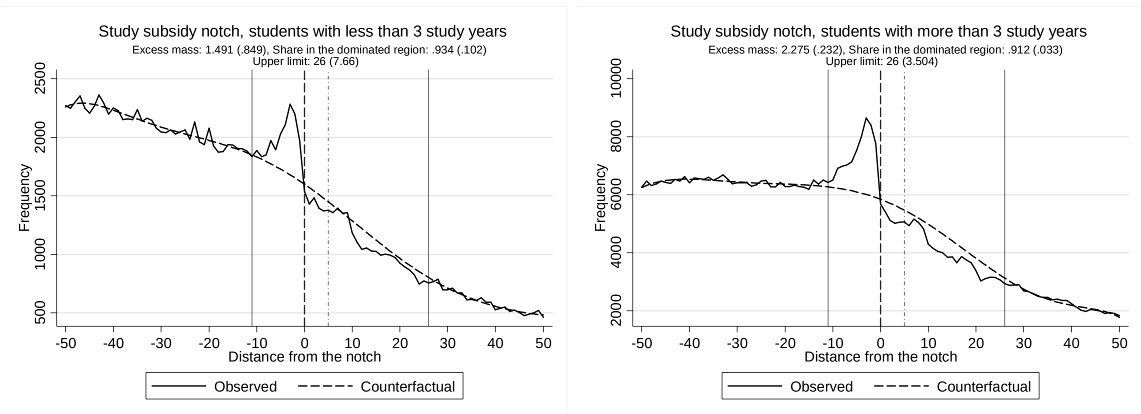

Figure 7: Bunching at the study subsidy notch: Students with more or less than 3 study years, 1999-2010

Next, we compare the responses of students around the study subsidy notch and the MTR kink points. There is a striking difference between bunching at notches and

[12] In order to eliminate the effect of dropouts and graduates, we include only students who also study in the next year.

[13] The earnings elasticities are 0.083 (0.035) and 0.083 (0.018) for students with less or more than three study years, respectively. Both elasticities are calculated using the average number of study subsidy months.

bunching at MTR kinks. Figure 8 shows income distributions around MTR kink points for current students (first kink), university graduates (last kink) and students who previously bunched at the study subsidy notch (first kink). For all of these groups we find no significant bunching at any MTR kink point in any year.

Even though students are clearly responding to large incentives induced by the notch, they do not respond to smaller incentives created by MTR kinks. For current students this cannot be explained by the inability to respond to *any* local incentives, as we observe similar or even the same individuals bunching at income notches. In other words, there is no fundamental reason to assume that students are less able to affect their labor supply around the MTR kink compared to the study subsidy notch. Nevertheless, this result does not indicate that students would not respond to MTR kinks of *any* size. Larger changes in the MTR might induce larger observed behavioral responses, as with larger kinks it becomes more profitable to adjust labor supply (see Chetty *et al.* 2011, and Chetty 2012). However, in addition to the size of the incentive, the underlying elasticity and the inability frictions, it might be that the MTR schedule is too obscure for many students.

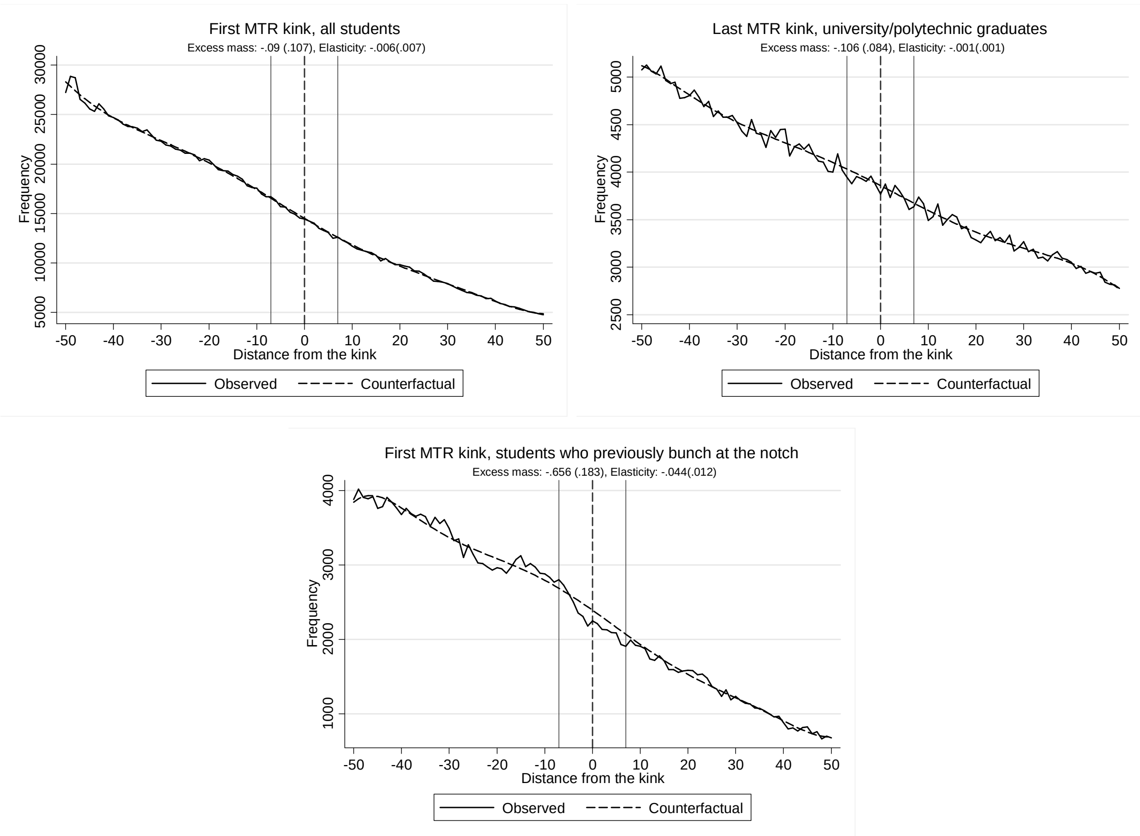

Figure 8: Bunching at MTR kink points: Current students, graduates and students who bunched at the study subsidy notch, 1999-2010

To further characterize the effect of the size of the incentive and the inability friction, we divide students into two groups by the number of study subsidy months they apply for. The default number of study subsidy months is 9, which students receive every year while studying if they do not wish to apply for additional subsidy months (up to 12), or decrease the number of subsidy months. There is a different income limit associated with each number of subsidy months which is inversely related to the number of months. In other words, less annual study subsidy gives a higher income limit. Table 2 in the Appendix shows the income limits for different number of study subsidy months and the relative loss incurring when the income limit is exceeded (both before and after the reform of 2008).

We analyze students who have 2-5 or 6-8 study subsidy months. Both of these groups have decided to opt out from the default option by making an active decision. Therefore, the difference between these groups is that the size of the tax incentive at the notch is weaker for the group that had only few months of the study subsidy, compared to the group that applied for more subsidy months. Importantly, both groups still lose disposable income if they earn marginally over the limit. In order to eliminate the possible curious effects of dropouts and graduates, we only include students who also study in the next year.

Figure 9 presents the bunching evidence at the study subsidy notch for students with different number of study subsidy months. Students with 2-5 subsidy months respond moderately, whereas for students with 6-8 months there seems to be a clear response at the notch. The observed elasticities are 0.07 (0.034) and 0.125 (0.042) for students with 2-5 and 6-8 subsidy months, respectively. However, it should be noted that the non-monotonic shape of the income distribution around the notch for students with 6-8 study subsidy months is not ideal when applying the bunching method, and there is large variation in the estimate of the counterfactual density when the degree of polynomial is varied. Therefore, the estimates need to be interpreted with caution. However, the Figure clearly illustrates the notable behavioral response to the notch.

These findings support the notion that the relative strength of tax incentives matter, which corresponds to larger responses for larger tax incentives. This result also points to the direction that inability to respond matters. When inability to respond occurs, we should find more observed bunching at larger local changes in incentives. Furthermore, we have no explicit reason to assume that the two groups differ in awareness, especially as both groups have actively deviated from the default option. However, there is a possibility that the inability to respond increases along with income for some students (i.e. along with more permanent or more highly-paid jobs and more regular working hours). This would also indicate lower bunching when the income limit is higher.

Self-employed individuals Next we study the behavior of self-employed individuals. In this study, the self-employed include sole proprietors and partners of partnership firms (all non-corporate entrepreneurs in Finland). In many previous studies, individuals with

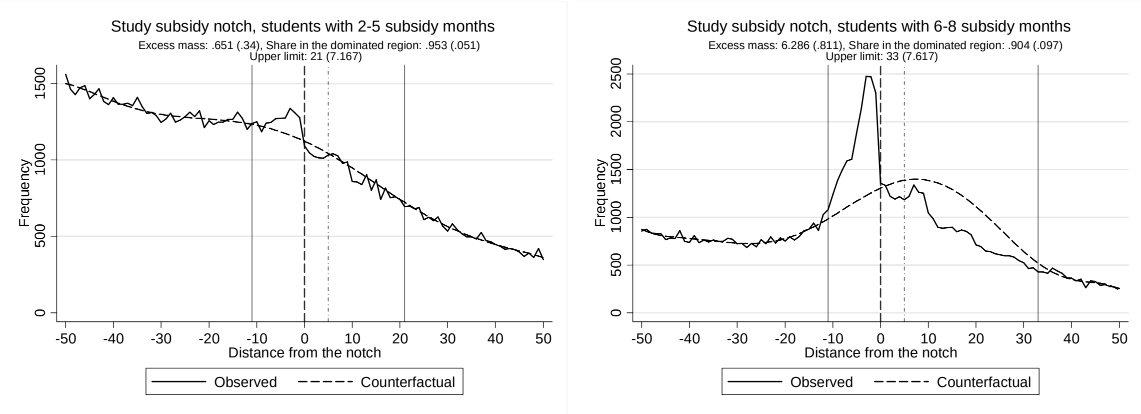

Figure 9: Bunching at the study subsidy notch: Students with different number of study subsidy months, 1999-2010

self-employment income bunch much more actively at MTR kink points than regular wage earners. Saez (2010) finds clear and significant excess bunching for the self-employed in the US, Chetty *et al.* (2011) in Denmark, and Bastani and Selin (2014) in Sweden. One explanation for this finding is that entrepreneurs can more easily affect their labor supply and effort. Also, self-employed individuals have more opportunities to adjust their reported incomes. Combining the ability to respond and the large observed changes in behavior, earlier results indicate that entrepreneurs are aware of the incentives around kink points and respond to them actively.

In contrast to earlier findings form other Nordic countries (Chetty *et al.* 2011, and Bastani and Selin 2014), we do not find sharp and distinctive excess bunching for the self-employed at the kink points of the earned income tax rate schedule. This result holds for all kink points and, for example, for self-employed individuals in different industries and counties. As an example, the two graphs in Figure 10 show the income distributions around the first and last kink point for all Finnish self-employed individuals in 1999-2010. For the first kink point, the excess bunch estimate is statistically significant. However, the relatively large overall variation in the income distribution makes the evaluation sensitive to choices regarding the bunching window and the degree of the polynomial. For example, when decreasing the order of polynomial of the counterfactual density from 7 to 5, the excess mass at the first kink decreases to 0.083 (0.08). Thus we can conclude that MTR kink points do not induce robust and significant local responses among the self-employed individuals in Finland.

In order to assess the ability to affect reported income among self-employed individuals, we study bunching at round numbers in terms of personal *gross* earned income.[14] Significant round-number bunching would indicate that at least some self-employed individuals can affect the gross income they report to tax authorities. Thus if we find evidence

[14]The connection between gross earned income and taxable earned income is that taxable earned income is calculated by deducting individual tax allowances and tax deductions from gross earned income.

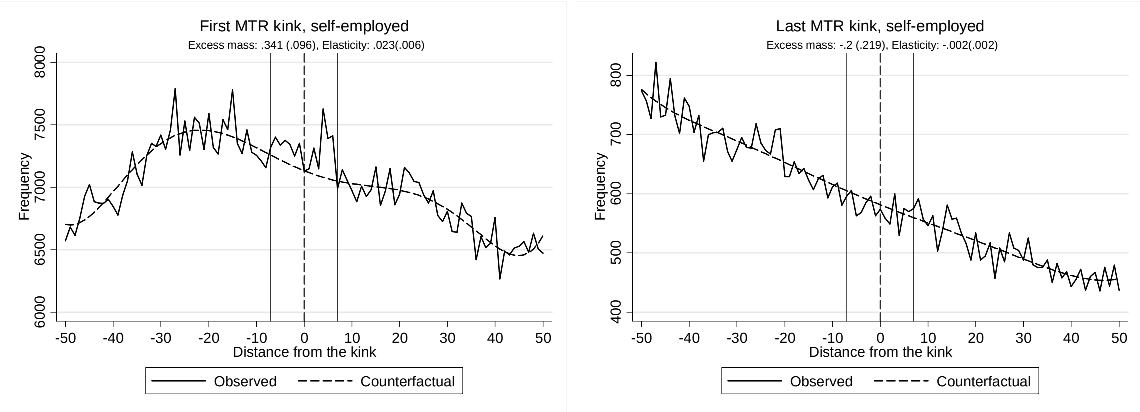

Figure 10: Bunching at MTR kink points: Self-employed individuals, 1999-2011

of self-employed bunching at convenient round numbers, it suggests that entrepreneurs have some ability to affect their location in the income distribution.

Figure 11 shows that the self-employed bunch sharply at gross earned income of 10,000€ and 20,000€.[15] This behavior also occurs in larger round numbers (30k, 40k, 50k etc.) as well as in round numbers of Finnish marks (100k, 200k, 300k) before the implementation of the euro in 2002. Furthermore, we find that significant round-number bunching never occurs among regular wage earners.

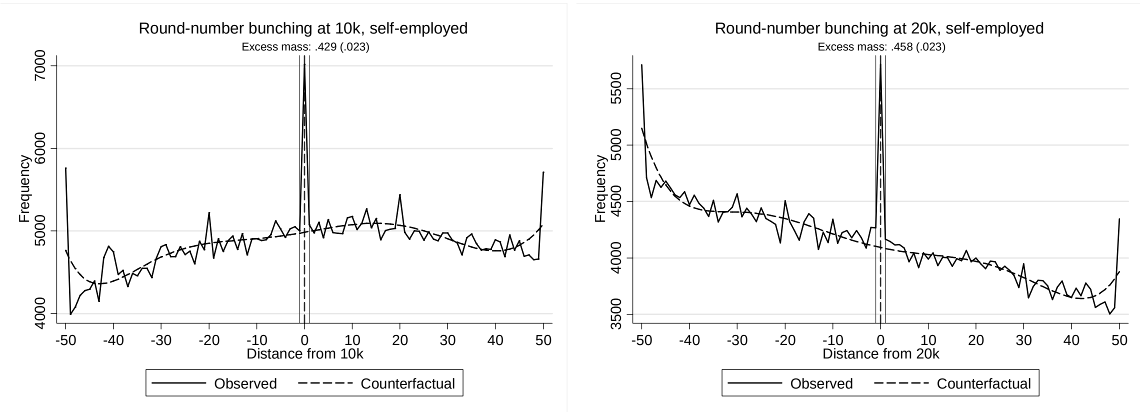

Figure 11: Round-number bunching, gross earned income: Self-employed individuals, 2002-2011

Combining the evidence from Figures 10 and 11 suggests that inability to respond might not explain the no bunching result at kink points for the self-employed individuals. In contrast to different responses among students at notches and MTR kink points which both induce changes in tax incentives, there is no "payoff" from bunching at round numbers. Based on standard economic theory, locating just below the kink point instead of a round number would induce some (small) utility gain. Overall, it seems that either

[15] As round-number bunching is very sharp by nature, we use a bunching window of +/- 100€ on both sides when defining excess bunching at round numbers.

unawareness of the details of the MTR schedule or low underlying elasticity at smaller changes in incentives might be driving the results, but we cannot precisely separate between the two mechanisms. However, we discuss the potential issues related to awareness of the tax rules in the next subsection.

5.3 Unawareness

Students To study the unawareness friction, we first analyze students who previously located themselves in the dominated region just above the notch. In this region, students could earn more disposable income by earning less gross income. In addition, students who exceed the income limit receive a letter from the Social Security Institution which states that (at least) one month of the subsidy needs to be paid back (with 15% interest). Thus for the students who are just over the income limit, there are both large incentives to adjust behavior in the future as well as increased awareness of the incentives and the existence of the income limit due to the received letter.

Figure 12 shows the income distribution around the notch for those students who were located in the dominated region in any of the three previous years. Figure shows that students bunch actively at the notch after locating in the dominated region before. The elasticity estimate at the notch for this group is 0.112 (0.051). However, a notable share of individuals still fail to optimize and are located in the dominated region also in future years. This suggests that inability to respond largely matters even with large incentives and when awareness is generally increased. However, the non-monotonic shape of the income distribution around the notch for this particular group induces notable variation in the estimates, which thus need to be interpreted with caution.

Second, we characterize the effects of the study subsidy reform of 2008. In the reform, the income limits increased by approximately 30%. For the default 9 months of the subsidy, the reform increased the income limit from 9,260€ to 12,070€. At the same time, the overall study subsidy was increased from 461€ to 500€ per month.

First, Figure 13 shows the income distribution around the study subsidy notch point for all students before (1999-2007) and after (2008-2010) the reform. From the figure we can see that there is excess mass at the notch point both after and before the reform. This indicates that students are aware of the income limit and its changes. Furthermore, the excess mass at the old income limit disappears immediately after the reform. Figure 16 in the Appendix shows the income distribution around the old income limit for all students in 2008-2010.

However, compared to 1999-2007, the excess mass is smaller after the reform. This tentatively suggests that either students are not as aware of the new notch point as they are of the old one, or it takes time to learn the new rules. Supporting this, the elasticity

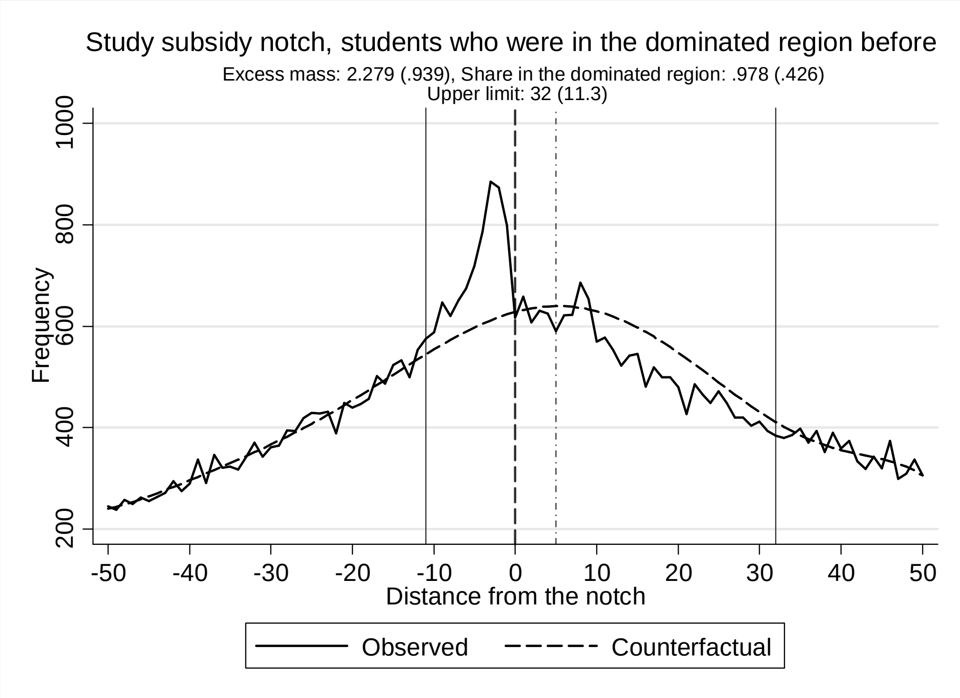

Figure 12: Bunching at the study subsidy notch: Students who were in previous years in the dominated region ($t-1$, $t-2$ or $t-3$,), 1999-2010

estimate from before the reform (0.092(0.011)) is somewhat larger than the observed elasticity at the notch after 2008 (0.054 (0.013)).

Gradual learning and gradual increase in awareness over time is also tentatively supported when we study how students respond to the notch in different years before 2008. The study subsidy system with current income limits was introduced in 1998. Thus the system was still relatively new in late 1990s and early 2000s. Indeed, Figure 17 in the Appendix shows that the excess mass has increased over time when we compare years 1999-2001, 2002-2004 and 2005-2007, but the difference are in general not statistically significant. Importantly, we have no general reason to assume that the ability to respond to the notch would be different between different years. Furthermore, the income limits have remained unchanged over this time period, with the exception of minor adjustments after the implementation of the euro in 2002.

Nevertheless, when comparing excess bunching at the notch before and after the reform of 2008, it might be that observed behavioral responses are different at larger income levels due to different inability frictions. We discussed this issue in the previous section when characterizing the effect of different study subsidy months (Figure 9).

To characterize the effect of the change in the income limit more closely, we analyze the income distribution around the notch point after the reform of 2008 among those students who bunched at the income notch in any of the years 2005-2007 before the reform. Figure 14 shows that students who bunched at the lower income limit before

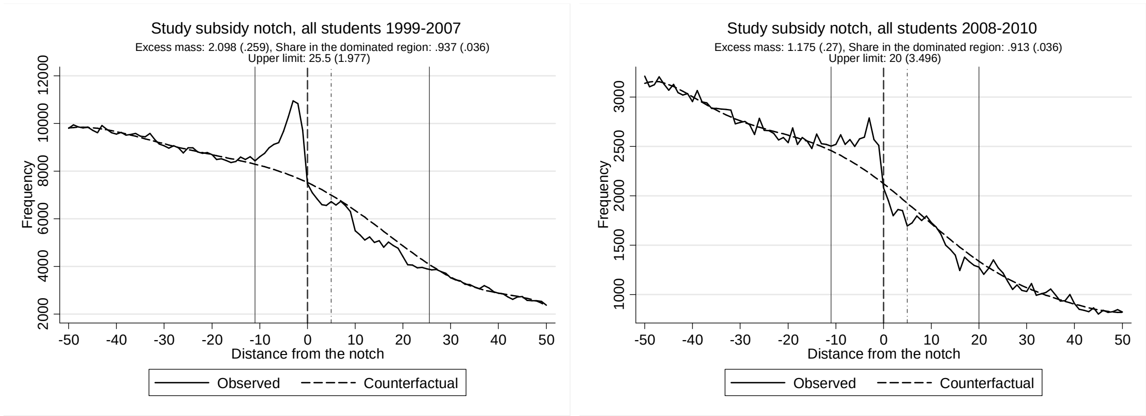

Figure 13: Bunching at the study subsidy notch: Before the reform 1999-2007 (left-hand side) and after the reform 2008-2010 (right-hand side)

also bunch actively when the income limit is notably increased. The observed earnings elasticity at the notch for this group is 0.067 (0.027). One implication of this result is that students are in general aware of the income limit, and actively adjust their behavior to changes in study subsidy regulations. However, from the Figure we can again see that a large number of students are located in the dominated region above the notch. Thus this behavior occurs even among the same individuals who before located just below the notch. This lends more support for the earlier conclusion that inability frictions related to real labor supply decisions play an important role even with large behavioral incentives of which taxpayers are in general aware of.

Self-employed individuals Our finding of no distinctive bunching behavior among self-employed individuals differs from recent studies in other Nordic countries. In contrast to Sweden (Bastani and Selin 2014) and Denmark (Chetty *et al.* 2011), we do not find sharp bunching at MTR kink points for the self-employed. This is especially intriguing since, for example, Finland and Sweden have rather similar overall tax systems and other institutional features.

One issue explaining different responses could be the size of the local change in incentives. However, the relative size of the kink points are rather similar in Denmark and Sweden compared to the largest kink points in Finland. For Denmark, the first jump in the MTR causes (approximately) 11% fall in net-of-tax rate, and the second kink 30% (Chetty *et al.* 2011). For Sweden, the first kink point decreases net-of-tax rates by around 34%, and the second kink by 10% (Bastani and Selin 2014). In Finland, the first kink point causes a decrease of 22-53% in net-of-tax rates, and the last kink decreases net-of-tax rates by 9-16% (depending on the year in question). Thus there is no dramatic difference between the size of the change in incentives.

However, one important difference could be the number of kink points and the salience

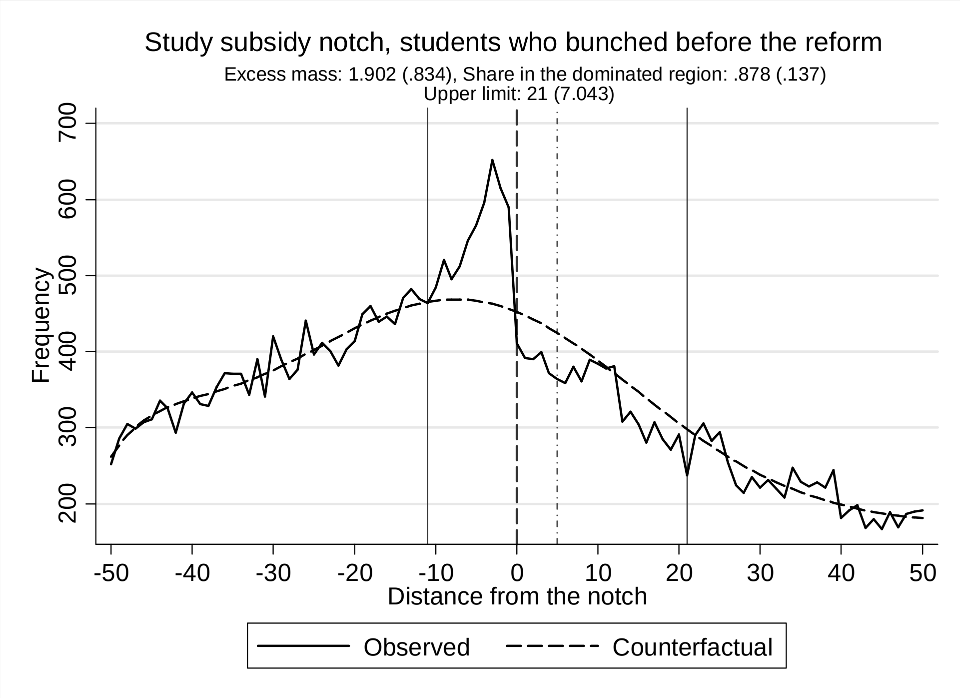

Figure 14: Bunching at the study subsidy notch: Students who bunched before the reform (2005-2007), 2008-2010

of the tax schedule. Compared to Sweden and Denmark, the Finnish income tax schedule includes more kink points. In Sweden and Denmark there are only two distinctive jumps in marginal tax rates (Chetty *et al.* 2011 and Bastani and Selin 2014). In Finland, there are 4-6 kink points in the central government tax schedule in the period we study. At least to some extent, the small number of kinks might make the tax schedule more transparent in Denmark and Sweden, compared to the Finnish tax schedule. Thus assuming that self-employed individuals have similar underlying preferences in Finland and Sweden, the difference of the response might be due to lower awareness and transparency of the tax system in Finland. However, as discussed in Bastani and Selin (2014), there might be relevant differences between the tax systems with respect to the ability to affect reported income through, for example, tax avoidance or tax evasion. This might also have a notable effect on observed bunching.

Overall, as noted before, the negligible bunching at MTR kink points among the self-employed might be due to different frictions, and it is challenging to distinguish between different mechanism. In future work we aim at a more careful distinction between different frictions by analyzing different subgroups of self-employed individuals, including the owners of privately held corporations.

6 Implications and conclusions

In this paper we study the role of individual preferences and different optimization frictions in explaining taxpayers responses to tax incentives. We compare the behavioral effects induced by different tax incentives within the same institutions and subpopulations. We apply the bunching method to kinks and notches of different strength in order to produce clear, comparable and visually convincing evidence.

We find no bunching at kink points of the marginal income tax rate schedule. This result holds for any subgroup we study, and for kink points of any size in any year. Intriguingly, the result of negligible bunching holds for the self-employed, although earlier studies find notable and sharp bunching behavior among this group (see e.g. Chetty *et al.* 2011 for Denmark, and Bastani and Selin 2014 for Sweden). We present clear evidence that the self-employed in Finland are able to control their reported income, as they actively bunch at round numbers of reported gross income. This evidence suggests that the inability to respond is not fully explaining no bunching at kink points.

We find that students bunch actively at the income notch induced by the study subsidy system. Since even the same students who bunch at the notch do not bunch at marginal tax rate kink points, we focus on explaining why the behavioral responses differ. First, notches induce notably larger incentives, and should in theory create more significant bunching behavior. However, even with a relatively small elasticity we should observe at least some bunching at kink points, which we can, however, rule out with our large data set. Therefore, different frictions related to these different institutions might be explain the differences.

One important factor is the visibility of tax incentives and awareness of tax rules. The study subsidy, like many other means-tested benefits, need to be applied for. Moreover, the income limit is relatively salient, and we find that students clearly acknowledged recent changes in the income limits. However, the marginal tax rate schedule is presumably less salient, and unawareness might partly explain the non-response at kink points. Importantly, for students we can hold the inability to respond constant, as they are in principle as able to bunch at the notch as they are at the kink point.

We observe that many students are located in the dominated region above the notch. This holds even for the same students who optimized and located at the notch in previous years. This evidence points to the direction that the inability to respond related to labor market rigidities plays an important role. Majority of students who work are wage earners, and altering reported income is not easy for them in the Finnish context. If students want to affect their annual income, they can, for example, either find another job or stop working abruptly at a certain point of time during the year when the income limit is reached. These types of decisions might have relatively large costs, which translates into large frictions.

Our results so far point to the following implications: First, behavioral responses to kink points might be at least partly attenuated because of frictions related to unawareness. Unaware individuals do not respond to tax incentives, and it is possible that they will not respond in the future either, at least without a notable change in awareness of the regulations. Then the long-run elasticity would be close to the observed behavioral responses locally at kink points. This would indicate near zero local elasticity of taxable income, at least for small changes in incentives.

Second, when individuals are aware of incentives that are strong enough, we observe clear behavioral responses. These stronger responses are associated with changes in average tax rates. However, our empirical evidence suggests that these responses are attenuated by the inability to respond, and that the underlying long run structural elasticity might be somewhat larger than the observed one if taxpayers can adjust their behavior over time.

In summary, different reasons for responding and not responding to tax incentives can entail different welfare and policy implications. Therefore, it is important to distinguish which types of taxes create behavioral responses, and what types of frictions affect individual behavior in different institutional contexts. In future work we aim at a more careful distinction between different frictions by using changes in policy rules and a more careful divided sample analysis.

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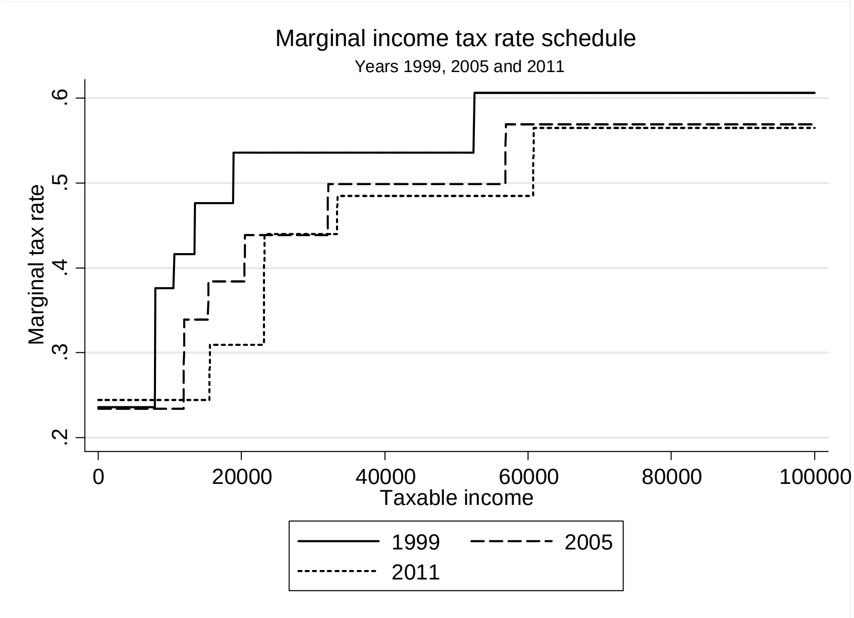
Appendix

Year	Taxable income (in euros)	Marginal tax rate	Year	Taxable income (in euros)	Marginal tax rate
1999	7,905-10,596	5,5	*2005*	12,000-15,400	10,5
	10,596-13,455	15,5		15,400-20,500	15
	13,455-18,837	19,5		20,500-32,100	20,5
	18,837-29,601	25,5		32,100-56,900	26,5
	29,601-52,466	31,5		56,900-	33,5
	52,461-	38	*2006*	12,200-17,000	9
2000	8,006-10,697	5		17,000-20,000	14
	10,697-13,623	15		20,000-32,800	19,5
	13,623-19,005	19		32,800-58,200	25
	19,005-29,937	25		58,200-	32,5
	29,937-52,979	31	*2007*	12,400-20,400	9
	52,979-	37,5		20,400-33,400	19,5
2001	11,100-14,296	14		33,400-60,800	24
	14,296-19,678	18		60,800 -	32
	19,678-30,947	24	*2008*	12,600-20,800	8,5
	30,947-54,661	30		20,800-34,000	19,0
	54,661-	37		34,000-62,000	23,5
2002	11,500-14,300	13		62,000 -	31,5
	14,300-19,700	17	*2009*	13,100-21,700	7
	19,700-30,900	23		21,700-35,300	18
	30,900-54,700	29		35,300-64,500	24
	54,700-	36		64,500 -	30,5
2003	11,600-14,400	12	*2010*	15,200-22,600	6,5
	14,400-20,000	16		22,600-36,800	17,5
	20,000-31,200	22		36,800-66,400	22,5
	31,200-55,200	28		66,400 -	30
	55,200-	35	*2011*	15,600-23,200	6,5
2004	11,700-14,500	11		23,200-37,800	17,5
	14,500-20,200	15		37,800-68,200	22,5
	20,200-31,500	21		68,200 -	30
	31,500-55,800	27			
	55,800-	34			

Note: Finnish marks are converted to euros before 2002.

Table 1: Central government marginal income tax rates, 1999-2011



Note: Marginal tax rate includes central government income taxes, average municipal income taxes and average social security contributions.

Figure 15: Nominal marginal tax rates (MTR) on earned income, years 1999, 2005 and 2011

	Before 2008		*After 2008*	
Study subsidy months	Income limit	Relative income loss at the margin if income limit is exceeded	Income limit	Relative income loss at the margin if income limit is exceeded
1	17,340	3.1%	22,550	2.5%
2	16,330	3.2%	21,190	2.7%
3	15,320	3.5%	19,930	2.9%
4	14,310	3.7%	18,620	3.1%
5	13,300	4.0%	17,310	3.3%
6	12,290	4.3%	16,000	3.6%
7	11,280	4.7%	14,690	3.9%
8	10,270	5.2%	13,380	4.3%
9	9,260	5.7%	12,070	4.8%

Note: The relative loss from marginally exceeding the income limit is calculated using the full study subsidy (461 euros and 500 euros before and after 2008, respectively) plus 15% interest collected by the Social Insurance Institution.

Table 2: Income limits in the study subsidy system and the relative marginal loss if the income limit is exceeded (in proportion to gross income at the limit), before and after the reform of 2008 (academic years 2006/2007 and 2008/2009, respectively)

Variable	N	Mean	Std. Dev.
Taxable earned income	45,494,860	22,981	31,048.75
Gross earned income	45,494,615	25,520	31,986.62
Taxable capital income	45,494,860	1,803	50,947.13
Age	45,494,860	43.06	14.816
Female	45,494,860	0.498	.50
Size of the household	44,963,949	2.68	1.438

Table 3: Summary statistics, all taxpayers, 1999-2011

All students	N	Mean	Std. Dev.
Taxable income	3,970,775	6,115	5,072.32
Gross income (subject to income limit)	2,711,754	7,614	8,619.77
Age	3,980,502	23.30	5.093
Subsidy months	3,255,567	7.15	2.762
Income limit	3,249,902	11,730	3,206.64
Students with 9 months of study subsidy	N	Mean	SD
Taxable income	1,163,189	5,024	3,879.44
Gross income (subject to income limit)	708,525	5,587	6,492.77
Age	1,163,617	22.54	4.486
Subsidy months	1,163,617	9	0
Income limit	1,163,189	9,770	1,083.15

Table 4: Summary statistics, students, 1999-2010

Variable	N	Mean	Std. Dev.
Taxable earned income	3,351,466	25,601	26,860
Gross earned income	3,385,734	26,970	27,734.4
Capital income	2,236,182	7,096	561,620.2
Turnover (firm-level)	3445810	149,931	663,409.8
Net assets (firm-level)	2956521	15,211	217,001.8
No. of employees (firm-level)	2189383	.661	2.587

Table 5: Summary statistics, self-employed (sole proprietors and partners of partnership firms), 1999-2011

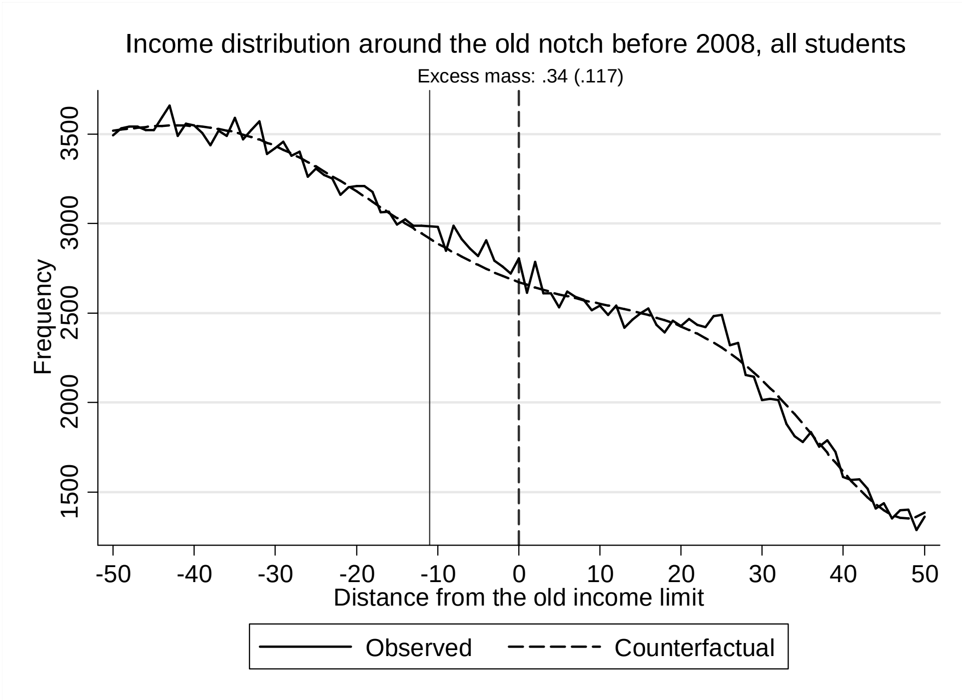


Figure 16: Income distribution around the old income limit before the reform of 2008, all students 2008-2010

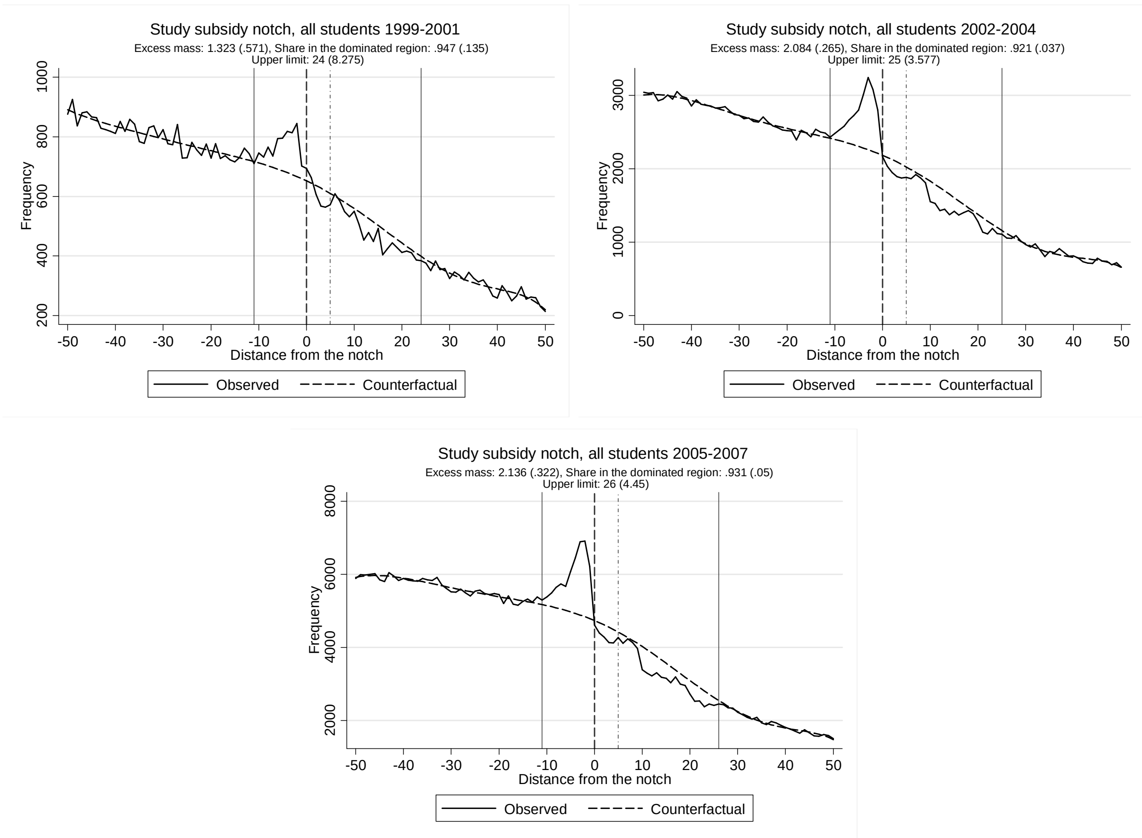


Figure 17: Bunching at the study subsidy notch in different years