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Multiple Misbehaving:

Loss Averse and Inattentive to Monetary Incentives*

Per Engström† Katarina Nordblom‡ Arnaldur Stefánsson§

May 3, 2018

Abstract

We study what determines taxpayers' deduction behavior when filing tax returns. Preliminary deficits might be viewed as losses assuming zero preliminary balance as reference point. Swedish taxpayers may escape these losses by claiming deductions after receiving information about the preliminary balance. Furthermore, the Swedish income tax system has a substantial kink (20 percentage points) where the central government tax applies. Taxpayers slightly above the governmental tax kink have substantially higher (standard economic) incentives to claim deductions than taxpayers slightly below the kink. Using a regression kink and discontinuity approach with individual fixed effects, we study a panel of 4.1 million Swedish taxpayers in 1999 to 2006. We find strong causal effects of preliminary deficits on the probability of claiming deductions. The initial empirical evidence for a kink in deduction probability at the central government threshold, anticipated by standard economic theory, is weaker but significant. However, a more detailed analysis reveals that the kink at the tax threshold is not likely due to the tax incentives per se. When controlling for the preliminary tax deficit, the kink at the tax threshold disappears. Taxpayers just above the tax kink are namely more likely to run a preliminary tax deficit than those just below it. Hence, the most plausible explanation also for the kink at the tax threshold is therefore loss aversion and not standard economic incentives. The Swedish taxpayers are thus "misbehaving", in a Thaler (2015) sense, on two separate margins: they are highly loss averse but surprisingly inattentive to standard monetary incentives.

Keywords: tax compliance, loss aversion, prospect theory, quasi-experiment, regression kink, regression discontinuity

JEL Codes: C21, D91, H24, H26

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1 Introduction

Recently, tax deductions have been attracting attention in the literature. E.g., Doerrenberg et al. (2017) find that deductions are important tools of adjusting taxable income, in the same way as e.g., Kreiner et al. (2014) find that top managers may retime bonus payments and shift regular income across the years in response to tax reform. Paetzold (2018) studies low-income Austrians and finds strong evidence that they use deductions to target kink points. Matikka (2018) finds small, but still responses from marginal tax rates on work-related deductions in Finland. Hence, there are studies that indicate that deduction behavior may be important to consider when analyzing the elasticity of taxable income. However, deductions (just as many other things) may also be used in less rational ways. Engström et al. (2015) find that having taxes due increases the likelihood of claiming a certain deduction by about 50 percent compared to expecting a refund. Also Rees-Jones (2018) finds evidence that people use deductions in a loss averse manner when filing their tax returns.

With a panel covering the universe of Swedish working-age taxpayers during eight years we analyze and compare two competing deduction motives, namely loss aversion and the standard neoclassical one. We analyze loss aversion by comparing deduction behavior among those who have taxes due and those who expect a refund. The neoclassical motive is analyzed by making use of the largest and most salient kink in the tax schedule and comparing behavior depending on marginal tax rate.

In April, Swedish taxpayers receive their pre-filled income tax returns from the Tax Agency. It contains information about third-party reported incomes from the previous year and the taxpayer either confirms all the reported items, or has the possibility to make changes, e.g., claim deductions. Together with the tax return, the Tax Agency attaches a preliminary tax balance. Based on the third-party reports and taxes withheld, the taxpayer may have taxes due or may get a refund. On the last row it is stated how much one is expected to pay or get back based on the preliminary records.[1] This information allows us to analyze whether loss aversion matters for claiming deductions. We think of taxpayers who are informed that they have taxes due as facing a loss, while those who expect a refund face a gain. If those with a loss are more likely to claim deductions than those in the gain domain, we may conclude that tax filers act in a loss averse manner. The other piece of information we make use of is about the central government tax. On the information sheet taxpayers are informed how much they pay to the local government and if and how much to the central government. Most Swedish taxpayers only pay tax to the local government. However, above a certain income (SEK 306,000 in 2006) an additional 20 percent is paid to the central government.[2] Hence, at the kink point, the marginal tax rate increases from

[1] See Figure 18 in the appendix.

[2] In 2006, this income corresponded to EUR 33,063.

about 31 % to 51 %. This is the largest and most salient kink point in the Swedish income-tax schedule and one gets clear information whether one is above or below the kink at the time of filing. If taxpayers respond according to the standard neoclassical model, they would be more inclined to claim deductions when facing the higher marginal tax rate.

We use a regression kink and discontinuity approach to analyze whether there is a causal effect from the two running variables (initial tax deficit and income, respectively) to actual tax filing behavior. This regression technique allows us to eliminate potential problems of endogeneity and selection by comparing those slightly below to those slightly above the specific threshold (where the initial tax deficit is zero and the threshold for the marginal tax rate, respectively). The specific behavior we analyze is whether or not one claims deductions for "other expenses for earning the income". The reason for restricting the analysis to this specific deduction rather than including all tax-sheltering measures available is that we want an action with as little potential selection as possible. This tax-manipulation tool is available to everyone to the same extent. It could contain more or less anything and one is not punished for trying even if the deduction shows to be erroneous.[3] There are other kinds of deductions available to Swedish taxpayers, but they are all due to specific requirements, such as a sufficient commuting distance or certain saving schemes. Hence, the specific deduction of our study is the most easily accessible way to reduce tax liability in a legal or illegal way. We find that those who have a small tax deficit (taxes due) are significantly more likely to claim this particular deduction than those who expect a small refund. However, we find no corresponding effect along the neoclassical dimension. We thus conclude that the Swedish taxpayers are misbehaving in two respects: they are both loss averse and inattentive of the monetary values of the deduction.

Rees-Jones (2018) and Engström et al. (2015) are two recent contributions that also find that taxpayers use deductions in a loss averse manner when filing their tax returns. Using cross-sectional data covering 3.6 million Swedish taxpayers, Engström et al. find that those with taxes due are significantly more likely to claim deductions than those who expect a refund. Analyzing available covariates, they draw the conclusion that the effect is causal and that loss aversion is indeed driving the deduction behavior. However, there are limits to cross-section analysis, where one cannot control for any unobserved heterogeneity, which could affect both the probability of ending up with a deficit and the propensity to claim deductions. Therefore, the present study, which uses panel data and fixed effects to control for unobserved heterogeneity, gives a more credible result, but confirms the conclusions drawn by Engström et al. (2015). Rees-Jones makes his study in the US context and regards tax manipulating measures in general. He finds that such measures are much more likely for taxpayers with taxes due than for those who expect a refund. When separately studying different kinds of tax manipulations, he shows that itemized deductions seems to be a very important component in reducing tax liability. His analysis is a bit different from ours:

[3] According to RSV (2001), after random audits 90–95 percent of the deductions were not approved.

While we study the likelihood of claiming deductions, Rees-Jones analyzes the magnitude of tax manipulation by studying bunching at the threshold between loss and gain. He finds extensive excess mass, indicating that tax manipulation is indeed used to avoid ending up with taxes due.[4]

This loss averse tax-filing behavior may be contrasted with standard neoclassical theory, according to which one is instead more inclined to deduct when the monetary value of the deduction is higher. To test this motive, we make a corresponding analysis of deduction behavior near the threshold for central governmental income tax, where the marginal tax rate increases by 20 percentage points. Initially, we find a small effect indicating that a larger share of those just above the tax threshold claim the deduction than of those just below it. However, there is a mechanical selection effect where those just above the tax kink are significantly more likely to have taxes due than those just below it. When we control for the preliminary deficit (i.e., the loss-aversion motive), the neoclassical effect totally disappears. Hence, our results are far from those by Doerrenberg et al. (2017), who find that German taxpayers' deductions are responsive to changes in marginal tax rates and by Paetzold (2018), who finds that deductions are used to target a salient kink in the Austrian tax structure. In his study, low-income earners and part-time workers constitute the studied subjects contrary to much of the existing tax-sheltering literature, which to a large extent deals with high-income earners. A yearly income below EUR 10,000 was tax free in Austria, while the marginal tax rate was 38.33 percent on incomes exceeding that amount. One reason for the large discrepancy between our results and Paetzold's may thus be that his studied kink is not only a larger discrete jump (38 compared to our 20 percentage points); it is also a jump from zero to a strictly positive marginal tax rate. Claiming the deductions below the kink is of no use when the tax liability is zero, while our Swedish taxpayers have a positive return from deductions also below their kink.

Paetzold (2018) concludes that Austrian taxpayers are highly aware of the salient tax kink and adjust their deductions accordingly. Flood et al. (2013) find that Swedes are not particularly knowing about exactly where the first central governmental tax kink is, so it is tempting to explain the lack of response along the neoclassical dimension with ignorance. However, although the exact location of the kink is not that well-known, Flood et al. (2013) also find that a majority of employees have a good knowledge of their marginal tax rate. In addition, at the same piece of paper where it says whether one has taxes due or may expect a refund, one gets informed about whether one pays central-governmental tax or not; hence, although people may not be aware of the exact kink, they should have a good view of whether they are above or below it.

Our results corroborate those by Bastani and Selin (2014), who focus on the same

[4]There are also earlier studies using actual tax payments indicating that the threshold between taxes due and a refund is correlated with compliance, see, e.g., Cox and Plumley (1988), Chang and Schultz Jr (1990) and Persson (2003). Although they point in the same direction as Rees-Jones (2018) and Engström et al. (2015), these studies have not been able to prove causality.

Swedish tax kink, but not specifically on the same deduction as we do. They find almost no bunching in taxable income around the tax kink among wage earners, in contrast to self-employed, who have access to many more measures to adjust their taxable income and therefore bunch at this kink point to a very large extent.

Since we focus on one specific deduction among several, it makes little sense to analyze it in terms of bunching, like Paetzold (2018), Bastani and Selin (2014) or Rees-Jones (2018). They are all mainly interested in excess mass in the ex post distributions of taxable income near kinks relevant for loss aversion or neoclassical theory. Thereby the total amount of deductions and/or other measures to reduce tax liability becomes relevant. We are instead, just like Engström et al. (2015), interested in what affects actual behavior, in our case claiming a specific deduction. We therefore estimate the likelihood of claiming this deduction at either side of two thresholds, relevant for two deduction motives.

In a completely different setting, List (2003) compares neoclassical theory with prospect theory in the sportscard market. In his experiment, loss aversion had strong predictive power for inexperienced subjects, while those who were experienced were more likely to behave according to neoclassical theory.[5] In our study, age could be a proxy for experience. When running separate regressions for older and younger taxpayers, we do find that the loss-aversion kink is more pronounced for the younger, but also the older and more experienced taxpayers are significantly loss averse. Moreover, neither young nor old react to neoclassical incentives. Hence, our results suggest that the threshold between taxes due and a refund is more salient than the one concerning the marginal tax rate also among experienced taxpayers. Information about both margins is given together with the tax return, but only the information about the sign and magnitude of the deficit affects the probability to claim deductions for "other expenses for earning employment income".

The paper proceeds as follows. The two competing theories are described more formally and predictions for the empirical analysis are made in Section 2. Section 3 explains the Swedish setting and our data, followed by some descriptive results in Section 4. Section 5 provides the results from our regressions and Section 6 concludes the paper.

[5]However, also Pope and Schweitzer (2011) find significant loss aversion among highly experienced agents, namely professional golfers.

2 Theoretical predictions

This section aims at giving a short theoretical motivation for our following empirical sections. In subsections 2.1 and 2.2 we briefly present the two competing theories and what they predict in terms of deduction behavior.

2.1 Prospect Theory

Originally, Kahneman and Tversky (1979) defined prospect theory, of which we mainly focus on reference dependence and loss aversion. Rather than a utility function of an absolute amount of e.g., income, prospect theory implies a value function where outcomes are evaluated in relation to a reference point. Receiving more than the reference point is considered a gain, while receiving less is a loss, which is also more salient than a corresponding gain. That loss averse individuals value losses more than gains implies that the value function is kinked at the reference point. In our particular application a zero balance in preliminary tax payments is such a reference point. Having some taxes due then implies a higher marginal value of extra income than getting a refund of the same amount. Those with a preliminary tax deficit would consequently be more inclined to take the chance of claiming a deduction.[6]

2.1.1 Predictions using prospect theory

Here, we illustrate what predictions for deductions that could be made from prospect theory. The following is mainly part of the model and the predictions presented in Engström et al. (2015), to which we refer for further details.

Consider a taxpayer, i who is to decide on whether or not to claim the (fixed size) deduction $\delta > 0$, a deduction which comes at a cost c_i, which may vary across taxpayers; $c_i \sim U[0, \bar{c}]$.[7] Prior to a potential deduction, the taxpayer has received information about the preliminary tax balance, D_i^p, where $D_i^p > 0$ implies a preliminary deficit, i.e., more taxes due, and $D_i^p < 0$ implies a refund (a negative deficit). We assume that $D_i^p = 0$ constitutes the reference point. With a constant marginal tax rate $t > 0$, the monetary value of the deduction is always $t\delta$. However, for a loss averse individual, the value depends on D_i^p and whether δ would alter the domain one ends up in. Denoting the value of an outcome V^B, the value of claiming the deduction is

[6] See, e.g., Yaniv (1999), Bernasconi and Zanardi (2004), and Dhami and al Nowaihi (2007) for theoretical results on the link between loss aversion and tax compliance. Also the models presented by Engström et al. (2015) and Rees-Jones (2018) show that measures to reduce tax liability are more frequent in the loss than in the gain domain.

[7] The cost may be administrative (Benzarti, 2017) or moral if the deduction is not fully legitimate.

$$V^B(D_i^p - t\delta) - V^B(D_i^p) = \begin{cases} \nu t\delta & \text{if } D_i^p \leq 0 \\ \nu(t\delta + D_i^p(\lambda - 1)) & \text{if } D_i^p \in (0, t\delta] \\ \lambda \nu t\delta & \text{if } D_i^p > t\delta \end{cases} \quad (1)$$

where $\lambda > 1$ is the coefficient of loss aversion.[8] These values are also illustrated in Figure 1. The individual claims the deduction, δ if the value as reported in (1) exceeds the cost, c_i. Since the cost of claiming the deduction, $c_i \sim U[0, \bar{c}]$, we can easily predict the share of taxpayers who claim δ for the three segments of D_i^p, which is illustrated in Figure 2. For expositional reasons we have assumed a fixed deduction δ, but also if we do not restrict the deductions to be of fixed amounts, Engström et al. (2015) show that "The share of individuals who claim a positive deduction will kink upwards at $D = 0$ and the share of individuals who claim a deduction will always be higher on the deficit side".[9]

It is obvious that we would expect a larger share claiming δ among those with taxes due ($D_i^p > 0$) than among those who get a refund ($D_i^p < 0$). We are, however, interested in what happens at the very kink, where $D_i^p = 0$. Note that the derivative of s depicted in Figure 2 is not defined in $D_i^p = 0$. Hence, the kink is really defined as the difference in the derivative if we approach zero from above and from below. The kink is thus defined as:[10]

[8] $\lambda = 1$ corresponds to the neoclassical case.

[9] Engström et al. (2015), Prediction 4.

[10] The share in the middle segment (where D^p approaches 0 from above) is defined as

$$s(D^p) = \int_0^{\nu(t\delta + D^p(\lambda-1))} f(c)dc = \frac{\nu(t\delta + D^p(\lambda - 1))}{\bar{c}} \text{ for } D^p \in (0, t\delta]. \quad (2)$$

and the derivative of this share is

$$\left.\frac{\partial s}{\partial D^p}\right|_{D^p = 0^+} = \frac{\nu(\lambda - 1)}{\bar{c}}. \quad (3)$$

The share claiming δ in the gain domain (where D^p approaches 0 from below) is

$$s(D^p) = \int_0^{\nu t\delta} f(c)dc = \frac{\nu t\delta}{\bar{c}} \text{ for } D^p \leq 0, \quad (4)$$

where the derivative with respect to D^p is

$$\left.\frac{\partial s}{\partial D^p}\right|_{D^p \leq 0} = 0. \quad (5)$$

Thus, the kink is defined as the difference between (3) and (5):

$$\left.\frac{\partial s}{\partial D^p}\right|_{D^p = 0^+} - \left.\frac{\partial s}{\partial D^p}\right|_{D^p = 0^-} = \frac{\nu(\lambda - 1)}{\bar{c}} - 0.$$

$$\left.\frac{\partial s}{\partial D^p}\right|_{D^p=0^+} - \left.\frac{\partial s}{\partial D^p}\right|_{D^p=0^-} = \frac{\nu(\lambda-1)}{\bar{c}} - 0 = \frac{\nu(\lambda-1)}{\bar{c}} \equiv \beta_{1,B}. \tag{6}$$

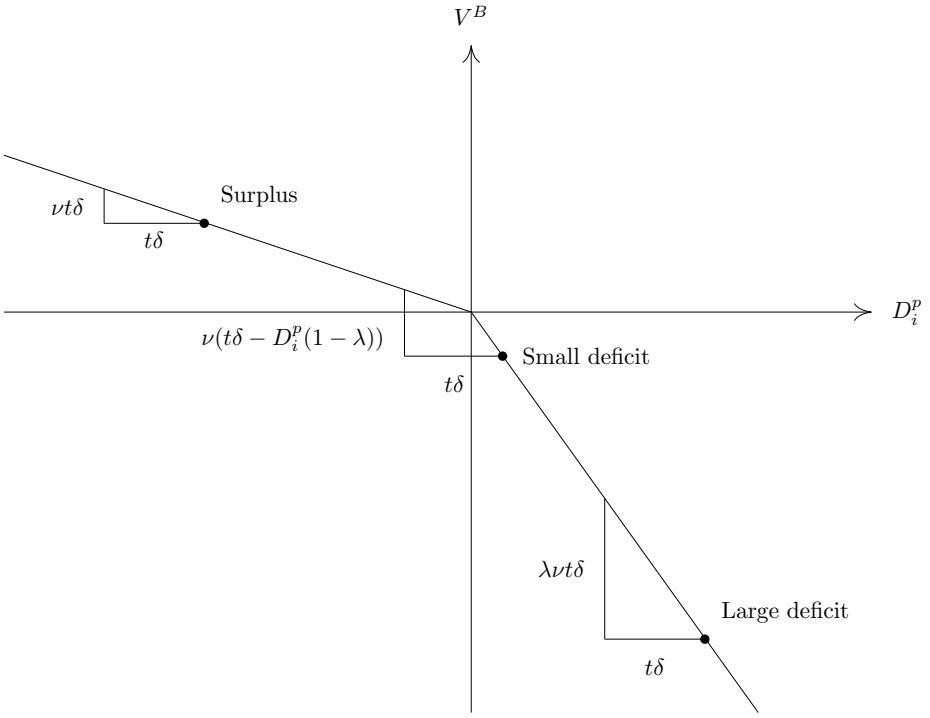
According to (6) there will be a positive kink at the reference point whenever the coefficient of loss aversion, $\lambda > 1$ and the stronger the loss aversion, the more pronounced will the kink be. Hence

Prediction 1. *If loss aversion motivates deduction behavior, the share of taxpayers who claim the deduction is higher among those with taxes due than among those who get a refund in the proximity of the reference point, $D^p = 0$. Moreover, the share kinks at $D^p = 0$.*

(6) also shows that the kink, i.e. the change in the slope, is independent of the tax rate.[11] However, from (1) it is clear that the value of claiming the deduction is increasing in the tax rate. Hence, a larger share of the taxpayers should find it worthwhile to claim the deduction when facing a higher tax rate.

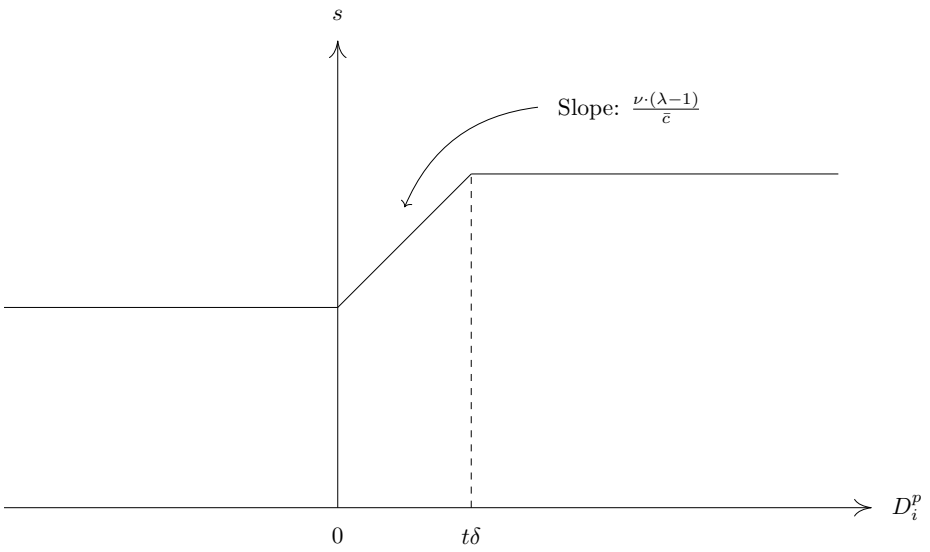
Prediction 2. *A larger proportion of taxpayers in the loss and gain domains, respectively, claim the deduction when the marginal tax rate is higher. Even though the slope of the kink is independent of the tax rate, the domain with positive slope will be proportional to the tax rate, which means that the kink will disappear as the tax rate tends to zero.*

[11] What values of D_i^p are considered a "small deficit", however, depends on the tax rate, implying that the width of the middle segment ($t\delta$) is larger for higher tax rates.



Note: The value of a deduction of size δ given three initial values of preliminary deficit, each denoted by a black circle. The x-axis, D_i^p, denotes preliminary deficit, and the y-axis, V^B, the value derived from the deficit. The horizontal lines in the two triangles and the quadrilateral denote the amount by which the deficit decreases, $t\delta$, where t is the marginal tax rate. The vertical lines in the two triangles and the quadrilateral denote denote the value of the deduction, where ν is the marginal value of consumption (assuming linear utility), and λ is the coefficient of loss aversion.

Figure 1: Value of deducting in a behavioral model



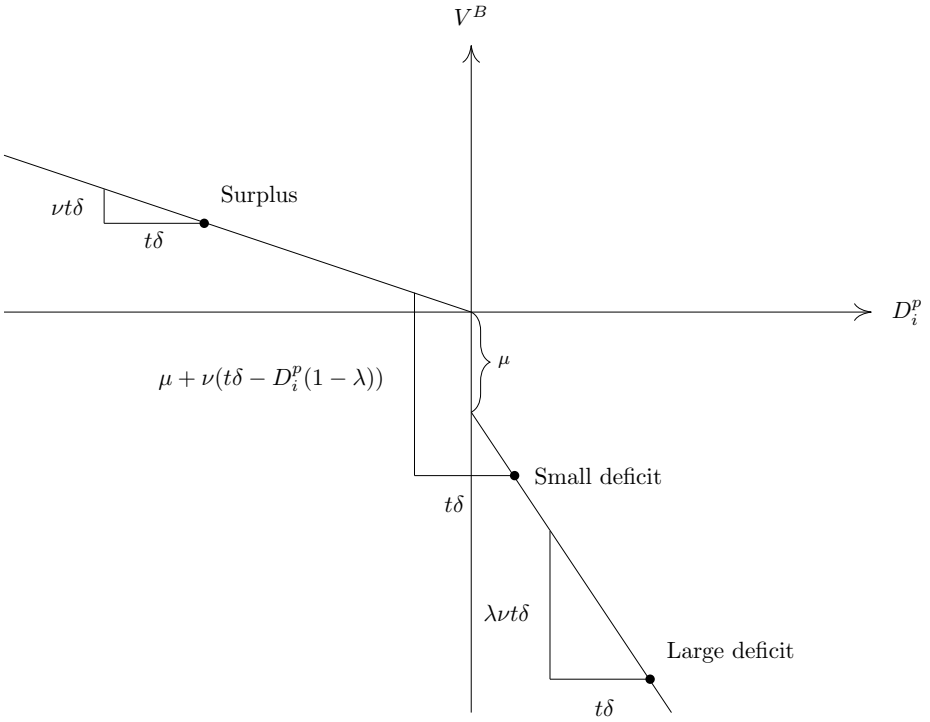
Note: The share of individuals claiming a deduction as a function of preliminary deficit D_i^p. Each individual can claim a deduction of a fixed size δ, at a cost $c_i \sim U(0, \bar{c})$, and has a marginal tax rate of t. A linear utility is assumed, where ν is the marginal utility of consumption, and λ is the coefficient of loss aversion.

Figure 2: Share deducting in a behavioral model

2.1.2 Extreme loss aversion

Most studies define loss aversion as just creating a kink at the reference point. I.e., the value, V^B at the reference point is the same if we approach it from below or from above, while the slopes differ. However, in their theoretical model Diecidue and Van De Ven (2008) consider an "extreme version of loss aversion", which also includes a jump.[12] With this notion, there is a discrete value loss from ending up in the loss domain, irrespective of how large the loss is. In our context, this would imply that not only the marginal value of income is higher in the loss domain, there would also be a fixed drop in the value from ending up with taxes due, which we denote μ. In presence of such value reduction, the benefit from claiming the reduction that brings the taxpayer from the loss to the gain domain would be even larger than from the mere kink, as depicted in Figure 3

[12]See, e.g., Levy and Levy (2009) and Allen et al. (2017) for empirical evidence.



Note: The value of a deduction of size δ given three initial values of preliminary deficit, each denoted by a black circle. The x-axis, D_i^p, denotes preliminary deficit, and the y-axis, V^B, the value derived from the deficit. The horizontal lines in the two triangles and the quadrilateral denote the amount by which the deficit decreases, $t\delta$, where t is the marginal tax rate. The vertical lines in the two triangles and the quadrilateral denote denote the value of the deduction, where ν is the marginal value of consumption (assuming linear utility), and λ is the coefficient of loss aversion.

Figure 3: Value of deducting in a behavioral model with a jump

The counterpart to (1) including a jump, thus reads:

$$V^B(D_i^p - t\delta) - V^B(D_i^p) = \begin{cases} \nu t\delta & \text{if } D_i^p \leq 0 \\ \nu(t\delta + D_i^p(\lambda - 1) + \mu) & \text{if } D_i^p \in (0, t\delta] \\ \lambda\nu t\delta & \text{if } D_i^p > t\delta \end{cases} \tag{7}$$

The difference in value of δ where D^p approaches 0 from above and below is then

$$s(D^p)|_{D^p=0^+} - s(D^p)|_{D^p=0^-} = \int_0^{\nu(t\delta+\mu)} f(c)dc - \int_0^{\nu t\delta} f(c)dc = \frac{\nu\mu}{\bar{c}} \equiv \beta_{0,B} \tag{8}$$

Prediction 3. *If extreme loss aversion motivates deduction behavior, the share of taxpayers who claim the deduction is higher among those with taxes due than among those who get a refund in the proximity of the reference point, $D^p = 0$. Moreover, the share jumps at $D^p = 0$, where the magnitude*

of the jump is $\beta_{0,B} = \frac{\nu\mu}{\bar{c}} > 0$.

2.2 Neoclassical Theory

2.2.1 Predictions using neoclassical theory

Let us now turn to the neoclassical case, where the taxpayer is not loss averse, but merely cares about the monetary outcome. We still let taxpayer i choose whether or not to claim the fixed deduction δ, which comes at cost $c_i \sim U(0, \bar{c})$. The monetary value of the deduction depends on the marginal tax rate. Denote income above the kink I_i and let t_0 be the marginal tax rate below the kink and $t_0 + \tau$ the marginal tax rate above it. For comparability with the behavioral model, we still denote the marginal utility of income ν. The value of claiming deduction δ in a neoclassical model is then:

$$V^{NC}(I_i - \delta) - V^{NC}(I_i) = \begin{cases} \nu t_0 \delta & \text{if } I_i \leq 0 \\ \nu(t_0\delta + \tau I_i) & \text{if } I_i \in (0, \delta] \\ \nu(t_0 + \tau)\delta & \text{if } I_i > \delta \end{cases} \tag{9}$$

These values are illustrated in Figure 4. Also here, the individual claims the deduction if its value exceeds the cost. Since the value of δ depends on I_i and these incomes vary across individuals, we can predict the shares of taxpayers who claim δ for different values of I_i, which is illustrated in Figure 5.

According to the neoclassical model, we would expect a larger share claiming δ among those with gross income above the tax kink than among those below it and just like in the behavioral model, we are interested in what happens at the very kink where $I_i = 0$:

The derivation of the neoclassical kink is analogous to that of the behavioral:[13]

[13]The share claiming δ in the middle segment (I approaches 0 from above) around the neoclassical kink is

$$s(I_{\text{kink}}) = \int_0^{\nu(t_0\delta+\tau I)} f(c)dc = \frac{\nu(t_0\delta + \tau I)}{\bar{c}} \quad \text{for } I \in (0, \delta], \tag{10}$$

which we differentiate with respect to income:

$$\left.\frac{\partial s}{\partial I}\right|_{I=0^+} = \frac{\nu\tau}{\bar{c}} \equiv \beta_{1,NC}. \tag{11}$$

The share claiming δ with marginal tax rate t_0 (where I approaches 0 from below) is

$$s(I) = \int_0^{\nu t_0\delta} f(c)dc = \frac{\nu t_0 \delta}{\bar{c}} \quad \text{for } I \leq 0, \tag{12}$$

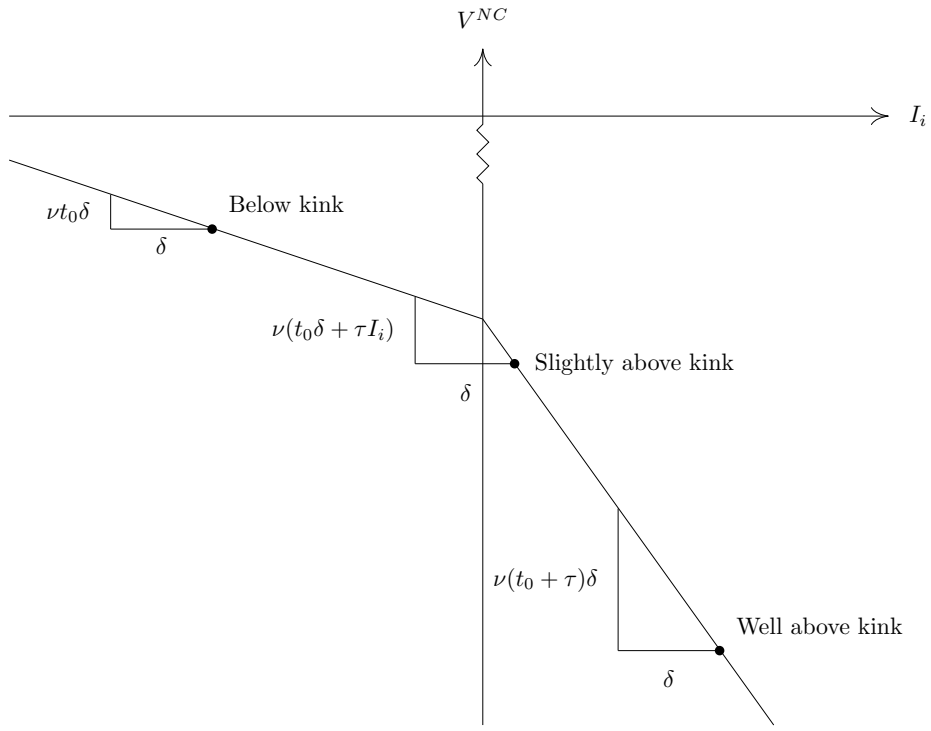
where the derivative with respect to I is

$$\left.\frac{\partial s}{\partial I}\right|_{I=0^-} = 0. \tag{13}$$

$$\left.\frac{\partial s}{\partial I}\right|_{I=0^+} - \left.\frac{\partial s}{\partial I}\right|_{I=0^-} = \frac{\nu\tau}{\bar{c}} \equiv \beta_{1,NC}. \tag{14}$$

According to (14) there will be a positive kink at the tax kink, and the larger the increase in marginal tax rate, τ, the more pronounced will the kink be. Hence

Prediction 4. *If neoclassical theory motivates deduction behavior, the share of taxpayers who claim the deduction is higher among those with marginal tax rate $t_0 + \tau$ than among those with marginal tax rate t_0. Moreover, the share kinks at the tax kink.*

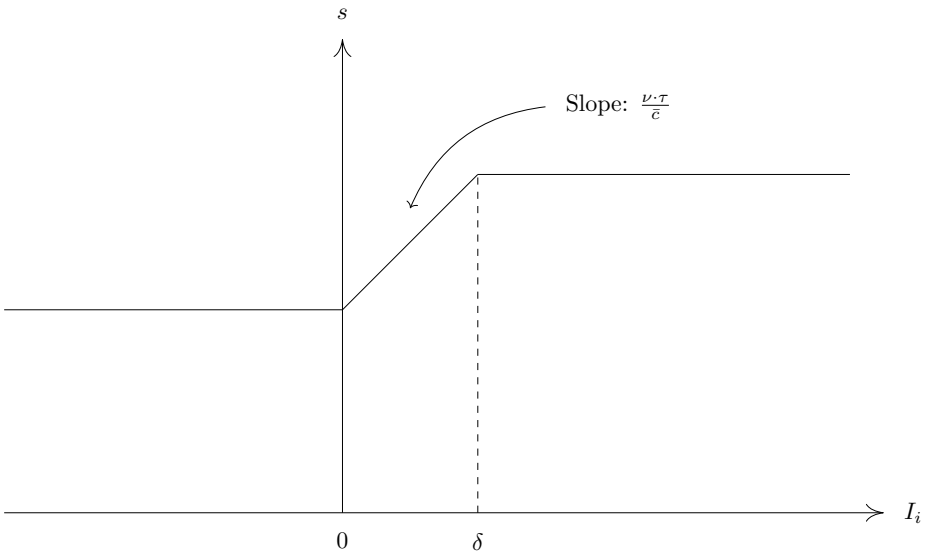


Note: The value of a deduction of size δ given three initial values of taxable income, each denoted by a black circle. The x-axis, I_i, denotes taxable income relative to the first central government kink (CGK), and the y-axis, V^{NC}, the value of the forgone consumption due to taxes. The horizontal lines in the two triangles and the quadrilateral denote the amount by which the taxable income decreases, δ. The vertical lines in the two triangles and the quadrilateral denote the value of the deduction, where ν is the marginal value of consumption (assuming linear utility), t_0 is the marginal tax rate below the first CGK, and τ is the jump in the marginal tax rate at the first CGK.

Figure 4: Value of deducting in a neoclassical model

Thus, the kink is defined as the difference between (11) and (13):

$$\left.\frac{\partial s}{\partial I}\right|_{I=0^+} - \left.\frac{\partial s}{\partial I}\right|_{I=0^-} = \frac{\nu t_0 \delta}{\bar{c}} - 0.$$



Note: The share of individuals claiming a deduction as a function of taxable income relative to the first central government kink (CGK) I_i. The marginal tax rate is t_0 below the first CGK, and jumps by τ at the kink. Each individual can claim a deduction of a fixed size δ, at a cost $c_i \sim U(0, \bar{c})$, and has a linear utility, where ν is the marginal utility of consumption.

Figure 5: Share deducting in a neoclassical model

3 Data and Institutional settings

Our data set is a panel covering all Swedes 16–67 years old with employment income, filing their tax returns for the income years 1999–2006. The upper age limit depends on our dependent variable, the deduction for "other expenses for earning employment income", as retirees do not make such earnings.[14]

Sweden has a dual income-tax system, where capital income is taxed at a flat national rate of 30 percent and employment income is taxed progressively and by both the central and local governments.[15] Focus here is entirely on employment income, which is taxed individually and not based on household income. The marginal tax rate as a function of taxable income in 2003 is shown in Figure 6.[16] Most Swedes only pay the local employment income tax, which in 2003 ranged from 28.90 to 33.72 percent (after general deductions). Above a threshold (SEK 284,300 in 2003) an additional 20 percent is paid in central governmental income tax and another 5 percent on the taxable employment income that exceeds a

[14]People could of course retire earlier or go on working longer, but since we cannot distinguish between earned and pension income, the age limit 67 is the best indicator we can get.

[15]See Engström et al. (2015) for a more detailed description of the Swedish tax system and the tax-filing procedure.

[16]The structure has been approximately the same during the full study period, although the exact income thresholds have increased over time.

second threshold that was SEK 430,000 in 2003.[17] Although the local marginal tax rate differs across municipalities, the income thresholds for the central government tax is the same for the whole country and in our analysis we will focus on the first central governmental kink (CGK), where the marginal tax rate increases by 20 percentage points.

Our objective is to study the deduction behavior when filing the tax returns. During the income year, employers withdraw preliminary taxes and pay directly to the Tax Agency. The following year, tax returns are sent out to the individuals together with information about how much earnings one had the previous year, how much taxes one paid, how much taxes one *should* pay (divided into local and central governmental taxes) and consequently whether one could expect a refund or to pay taxes due.[18] The individual taxpayer is then able to make changes, e.g., claim deductions, before submitting the tax return to the Tax Agency, which then decides on the final taxes. For most taxpayers the actual tax liability does not differ very much from the preliminary tax payments, so the initial deficit or surplus tends to be rather small; see Figure 8 for the distribution of initial balances. Since employment income is third-party reported, there is little room for taxpayers to make changes in their tax returns. At the time of our study, however, deductions exceeding SEK 1,000 for "other expenses for earning employment income", were allowed.[19] A wide range of expenses are approved if they are essential for earning the employment income, but not provided by the employer.[20] The taxpayer only has to claim the amount on the tax return; no receipts have to be submitted unless there is an audit. Although many expenses are in principle deductible, the requirements for approval are often high. In random audits, 90–95 percent of the claims were not approved and especially claims in the range SEK 1,000 – SEK 5,000 were found to be erroneous.[21] In some cases taxpayers may simply not be aware that they are not entitled to the deduction, but in other cases they may take a chance to reduce their tax in an evasive manner. Such a chance is risk free as the worst thing that could happen is that the deduction is not approved – there is no punishment for trying to deduct expenses you had. In spite of that, only a minority of taxpayers actually claimed this specific deduction during the years of our study. Figure 7 shows that only 9 percent made claims.

We want to study the causal effect of: i) the preliminary tax balance and; ii) the taxable income relative to the first governmental tax threshold, on the likelihood of claiming the deduction. Hence, we want the exact balance and gross taxable income announced by the Tax Agency to be exogenous to the tax payer, in the sense that it is not perfectly fine-tuned by the taxpayer. We therefore want to exclude individuals who have almost perfect control over their preliminary balance and/or their taxable income. The most important group to exclude is the self-employed since they have various possibilities to adjust their

[17] In 2003, these incomes corresponded to EUR 31,150 and EUR 47,125, respectively.
[18] See Figure 18 in the Appendix for an example.
[19] The law changed 2007. Deducted amounts now have to exceed SEK 5,000.
[20] It could be safety equipment, tools, phone calls, office space, etc.
[21] See RSV (2001) and Persson (2003).

taxable incomes as well as various deduction possibilities that are not available to wage earners. Bastani and Selin (2014) find that the self-employed, unlike wage earners, bunch at the central governmental tax threshold, which indicates that they, to a large extent can manipulate their taxable earnings. In our analysis, we regard a person as self-employed if income from self-employment (or from a closely held corporation) is not zero for a particular year. Hence, some individuals are included some years, but not others due to self-employment.[22] Furthermore, we restrict the analysis of the preliminary balance to taxpayers with "normal" taxable incomes. We follow Engström et al. (2015) and define normal incomes as in the range SEK 100 000 to SEK 1 000 000 (2012 year prices). Note that this requirement makes us exclude those with incomes in the interval essential to the study by Paetzold (2018), who analyzes deductions among Austrian taxpayers around the threshold income EUR 10,000, where the marginal tax rate jumps from 0 to 38 %.

The construction of our samples is summarized in Table 1. Our full sample for regressions using the preliminary balance as a running variable (after conditioning on age, wage-earners, and normal incomes) constitutes 31.3 million observations.

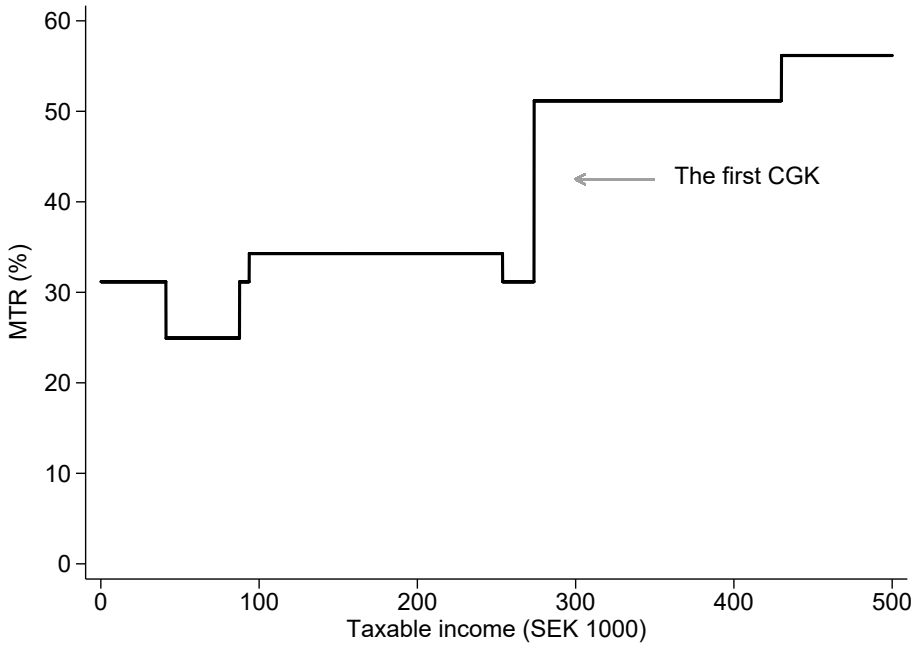
When studying the causal effects, we need the individuals not to have perfect control (or, even knowledge) over the size of the running variable in relation to the threshold. The closer we get to the threshold, the higher is the likelihood that this is truly exogenous to the individual. E.g., for someone who ends up with more than SEK 20,000 in taxes due, this probably does not come as a surprise (and may be due to some specific actions during the income year). In our regressions, we therefore restrict our sample to those who are most likely to exogenously end up at either side of the threshold. In their cross-section analysis, Engström et al. (2015) chose a preliminary tax balance of ± SEK 3,000 as their maximum bandwidth. Our much larger data set allows us to reduce the bandwidth further; hence, our maximum bandwidth is a preliminary tax balance of ± SEK 1,000. Table 2 shows descriptive statistics of both the full sample and of the maximum bandwidth sample consisting of 4.9 million observations when using preliminary deficit as running variable. Engström et al. (2015) found a positive correlation between income and the absolute value of the preliminary tax balance. It is therefore expected that when we reduce the bandwidth to ± SEK 1,000, mean income in the sample is also reduced.

This maximum bandwidth sample consists of the roughly 15 % observations closest to the threshold with a zero preliminary tax balance. For comparison, we would like a maximum bandwidth of similar magnitude around the threshold where the marginal tax rate increases by 20 percentage points. A majority of the Swedish income earners are well below the CGK, so including about the same share of the taxpayers requires a rather large bandwidth. We let the maximum bandwidth be a yearly income of ± SEK 30,000 relative to the CGK, which covers 5.2 million observations.[23] The taxpayers should not be able to affect

[22] If we adopt the definition of Bastani and Selin (2014), where those who have self-employment income in one year are excluded in every year our results remain approximately unchanged.

[23] This corresponds to a difference in monthly income of about ± EUR 250 in 2012 prices

exactly where they end up in this interval. This is not a farfetched assumption considering the results by Bastani and Selin (2014) who find no tendency of bunching around the CGK among wage earners contrary to self-employed who target the kink to a very large extent. The descriptive statistics of this sample are displayed to the right in Table 2. We see that the preliminary deficits differ a lot for those below and above the CGK, an issue we will get back to in the empirical analysis.



Note: Based on the 2003 tax systen
Source: Rietz et al. (2015) and own calculations

Figure 6: The first central government kink

Year	Full sample	Age[a]	Wage earners[b]	Normal incomes[c]
1999	9,008,295	5,875,852	5,322,137	3,819,912
2000	9,029,641	5,903,322	5,354,095	3,900,235
2001	9,057,050	5,941,469	5,398,746	3,942,001
2002	9,092,831	5,986,053	5,341,214	3,894,046
2003	9,130,827	6,032,367	5,392,919	3,900,059
2004	9,169,342	6,080,230	5,459,212	3,928,715
2005	9,213,475	6,132,942	5,519,067	3,941,170
2006	9,283,538	6,205,656	5,603,847	3,984,526
Total	72,984,999	48,157,891	43,391,237	31,310,664

[a] Between 16 and 67 years old.
[b] (a), and do not have income from self-employment.
[c] (a), (b), and have taxable income (in 2012 prices) between 100,000 and 1,000,000 SEK.

Table 1: Construction of samples

	Full sample	Maximum bandwith sample for prel. deficit regressions			Maximum bandwith sample for taxable income regressions		
	All	Prel. surplus	Prel. deficit	All	Below first CGK	Above first CGK	All
Number of obs.	31,310,664	2,794,279	2,131,102	4,925,381	3,024,678	2,191,967	5,216,645
Deducting, share	.09	.074	.087	.079	.124	.131	.127
Preliminary deficit[(*)]	1.85	-.51	.47	-.09	-.16	1.12	.38
Has preliminary deficit, share	.35	0	1	.43	.29	.35	.32
Taxable income[(*)]	266.2	224.6	227.5	225.9	291.6	321.7	304.3
Above CGK, share	.26	.13	.15	.14	0	1	.42
Men, share	.51	.47	.47	.47	.63	.67	.65
Age, years	44.2	42.9	44.3	43.5	44.3	44.8	44.5
Moving, share	.04	.03	.03	.03	.03	.03	.03
Unemployed, share	.12	.16	.17	.16	.05	.04	.05
Marginal tax rate, %	38.4	36.1	36.5	36.3	31.6	51.1	39.8

Note: The maximum bandwidth sample usded for regressions with preliminary deficit as running varable has preliminary deficit in the interval ± SEK 1,000 (2012 prices).
Note: The maximum bandwidth sample usded for regressions with taxable income relative to CGK as running varable has preliminary deficit in the interval ± SEK 30,000 (2012 prices).
[(*)] SEK 1,000 (2012 prices).

Table 2: Descriptive statistics

4 Graphical evidence

In this section we present graphical evidence of the deduction pattern in relation to the two thresholds: the zero preliminary balance and the central government tax threshold. Figure 7 and 9 below can be thought of as the empirical counterparts to the key theoretical predictions in Figures 2 and 5 above. Furthermore, we present the corresponding frequency plots over the thresholds in Figures 8 and 10. These provides initial graphical evidence of potential selection patterns in relation to the thresholds, which would weaken a causal interpretation of any apparent effects. The formal tests of the covariates behavior over the

threshold, and the corresponding graphical evidence, are left to Section 5 below.

As can be seen from Figure 7 below, the deduction pattern around the zero preliminary balance matches the theoretical predictions in Figure 2 almost perfectly. The deduction rate remains relatively flat on the surplus side (left of the cut-off) and begins a dramatic increase as soon as we enter the deficit side. The simple theory based of equal sized deductions for all also predicts a negative kink at $t\delta$ to the right of the cut-off. As discussed in Engström et al (2015), this kink will not prevail in a more realistic model with endogenous deduction size. Hence, we would not expect it to show up in the empirical evidence. Turning to Figure 8, we see no graphical evidence of selection based on the frequency distribution over the cut-off – the frequency evolves smoothly over the cut-off.

Figure 9 below shows the corresponding deduction pattern in relation to the central government tax break. Figure 5 above shows the theoretical prediction of a positive kink at the threshold also in this case. Just as for the preliminary deficit case, the negative kink at δ on the positive side is an artificial effect stemming from the unrealistic assumption that everyone makes deductions of the same size. We would therefore not expect this negative kink to manifest in the data, and there is no graphical evidence of its presence. What is more interesting is that there is hardly any evidence of a kink at the cut-off either, at least not as clear as for the behavioral kink discussed above. There is a small tendency of a positive kink at the threshold but we leave it to the formal analysis to show whether it is statistically and/or economically significant. We conclude this section by noting that the frequency plot in Figure 10 does not show any signs of selection in relation to the threshold – the frequency evolves smoothly over the threshold.

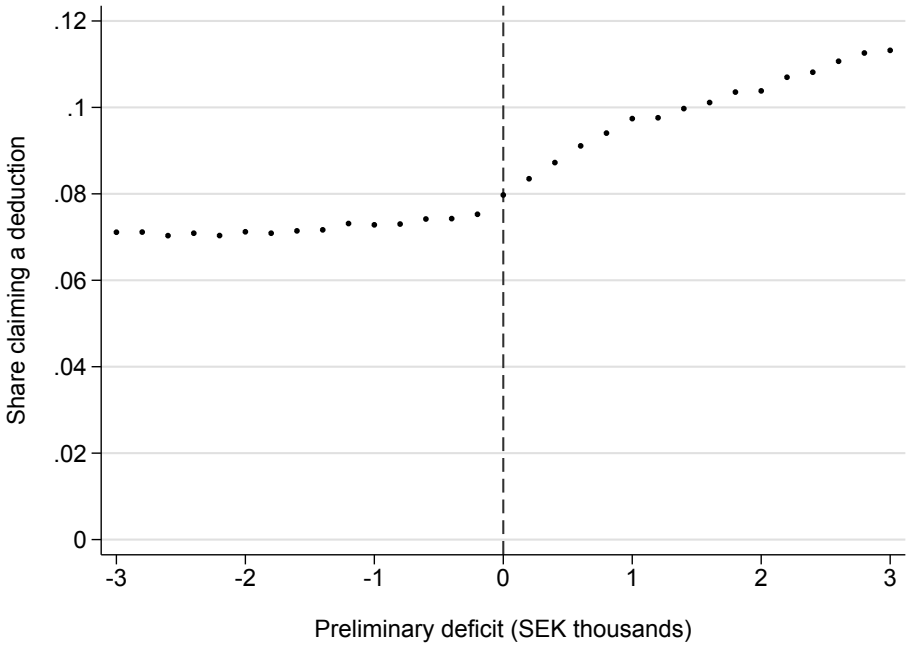


Figure 7: Deductions by preliminary deficit

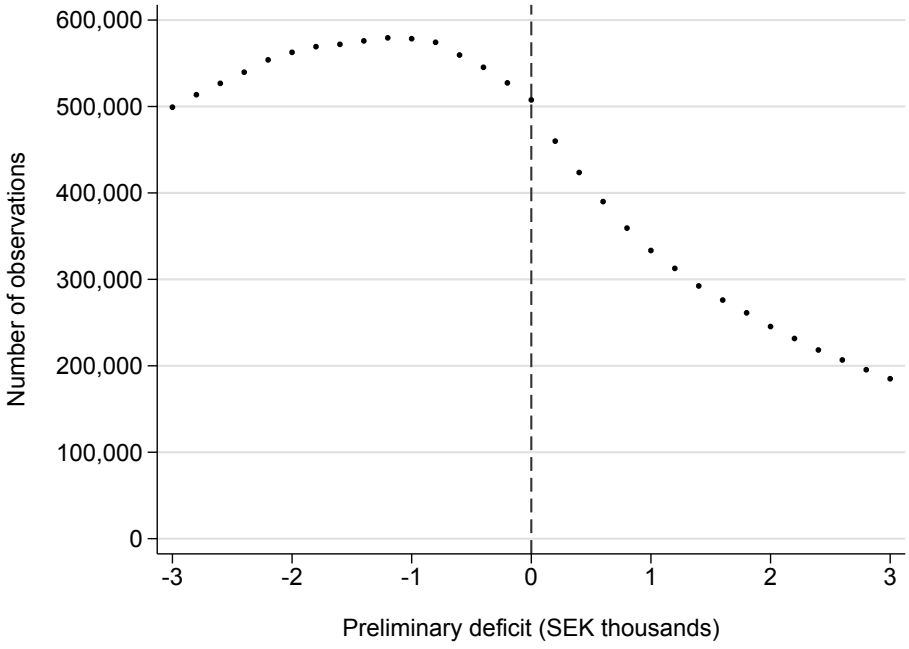


Figure 8: Distribution of preliminary deficit

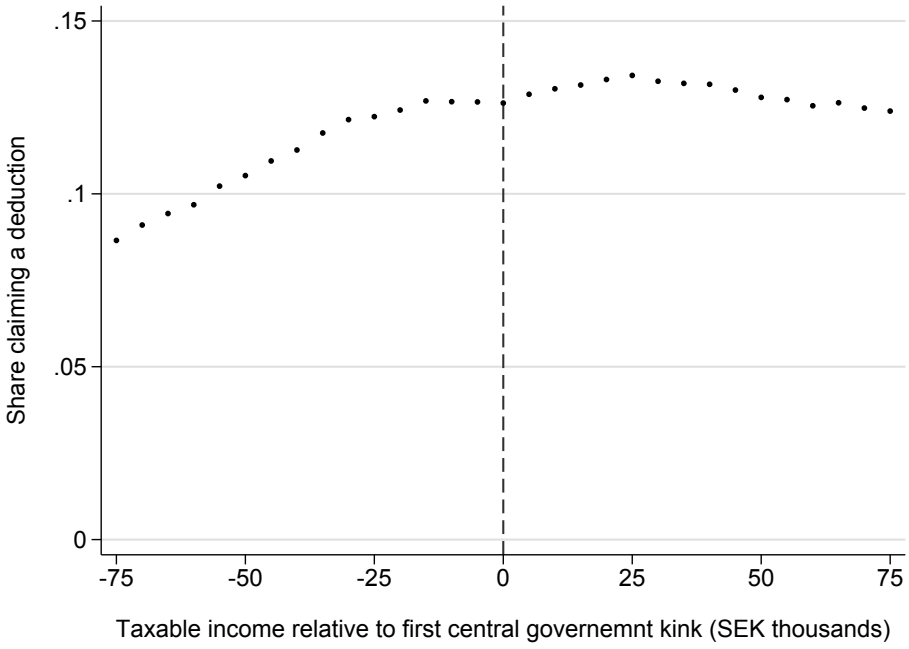


Figure 9: Deductions by taxable income

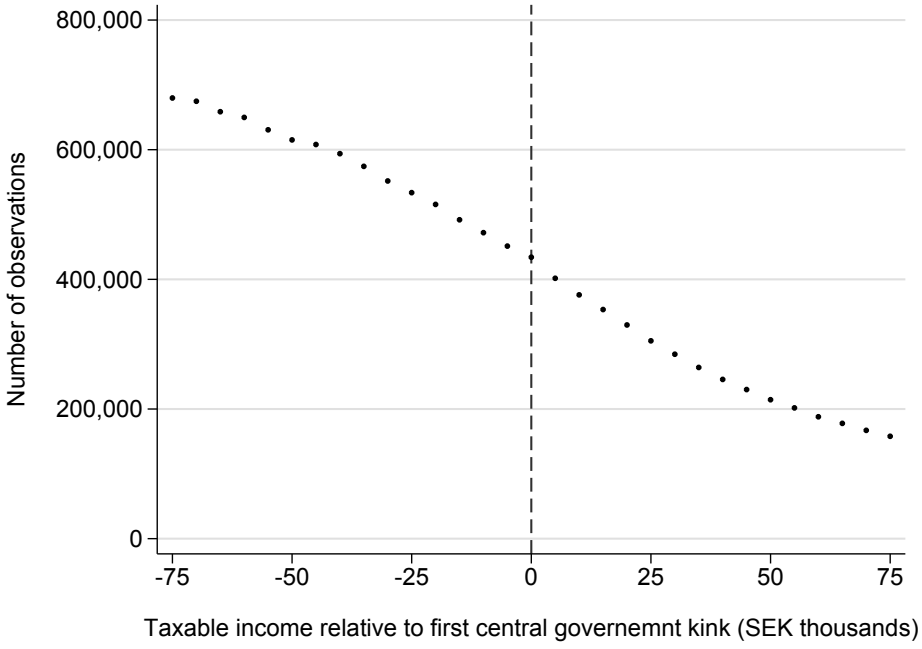


Figure 10: Distribution of taxable income

5 Regression analysis

5.1 Baseline models

In this section we formally test whether there is a causal relationship between: i) preliminary deficits and deductions and; ii) taxable income relative to the first CGK and deductions. Below we refer to preliminary deficits and taxable income relative to the first CGK as the running variables. We follow some of the empirical strategies suggested in previous work on the regression discontinuity design (Lee and Lemieux, 2010) and regression kink design (Card et al., 2009). The empirical tests essentially consist of answering two questions:

- Does the relationship between the running variables and deductions have a statistically significant kink and/or discontinuity around the reference points?
- Can we rule out corresponding statistically significant kinks and/or discontinuities for the predetermined covariates?

If the answer is "yes" to both these questions, it is reasonable to interpret the relationship as causal. Using the fixed effects model, we estimate the probability of claiming a deduction and our available covariates as spline models allowing for kink, as well as for discontinuity specifications (additional covariates and yearly dummies, are suppressed):

$$\Delta_{it} = \sum_{k=0}^{\kappa} \alpha_k x_{it}^k + \sum_{k=0}^{\kappa} \beta_k \Upsilon_{it} x_{it}^k + \eta_i + \tau_t + \epsilon_{it}, \tag{15}$$

where Δ_{it} is the outcome variable, x_{it} is the running variable, Υ_{it} is an indicator for a positive running variable, η_i is the individual fixed effect, τ_t year fixed effects, and ϵ_{it} is an error term. The coefficient α_0 measures the intercept, β_0 measures a potential discontinuity at the reference point (zero preliminary deficit or taxable income at the first CGK), and β_1 measures a possible kink at the reference point.[24] The polynomial κ will be set to 1 throughout the analysis. The analysis is thus limited to the linear polynomial. This seems reasonable from the graphical evidence and given the relatively narrow bandwidths we will be using. However, in some cases we will find it necessary to make robustness checks using the second order specification.

The additional covariates used in both the behavioral and neoclassical specifications are: i) an indicator for whether the tax payer has moved to a different municipality since last year and ii) an indicator for whether the tax payer has received unemployment benefits during the income year. Both these variables are indicators of dramatic changes in the tax-payers economic circumstances, that may affect deduction behavior as well as both running variables, i.e. preliminary deficit and distance to the CGK. Standard controls such

[24] c.f., the theoretical expressions in (6), (8) and (14).

as age, gender and home municipality will be automatically dropped due to the inclusion of individual fixed effects.

In addition to the two general controls we will add the following specific controls in respective specification. In the behavioral regressions we will include a linear income effect as well as the interaction between taxable income and an indicator for being above the CGK. In the neoclassical analysis we will, by symmetry, include the preliminary deficit and the interaction between preliminary deficit and an indicator for positive preliminary deficit. We thus control for the neoclassical margin when analyzing the behavioral response, and vice versa. As sensitivity checks we have also included all the corresponding quadratic controls and we have found the results robust to these alternative specifications.

5.2 Loss aversion

Figure 7 suggests that something drastic is happening right at a zero-balance, but we cannot be certain that the pattern is not due to selection, i.e. that some unknown feature of the preliminary tax system makes individuals that are relatively deduction prone during the specific year to sort into the deficit side. Using the fixed effects model, we estimate the probability of claiming a deduction as a function of preliminary deficit. That is, in the estimated specification (15), the running variable x_{it} is now preliminary deficit. Using symmetric bandwidths around the zero reference point, we iterate the estimation for a large number of bandwidths, starting from a preliminary deficit of SEK ±1,000 at the most (4,925,831 observations) to SEK ±200 at the least (1,034,940 observations). Figure 11b shows the discontinuity estimates, i.e., the estimates of β_0 for the various bandwidths. It is clear that the larger bandwidths give more precise estimates due to a larger sample size. However, the discontinuity is stable and significant for all bandwidths. Also the kink estimates, i.e., the estimates of β_1 are relatively stable and significant at bandwidths of ±600 (3,023,424 observations) and above, as shown in Figure 11a.

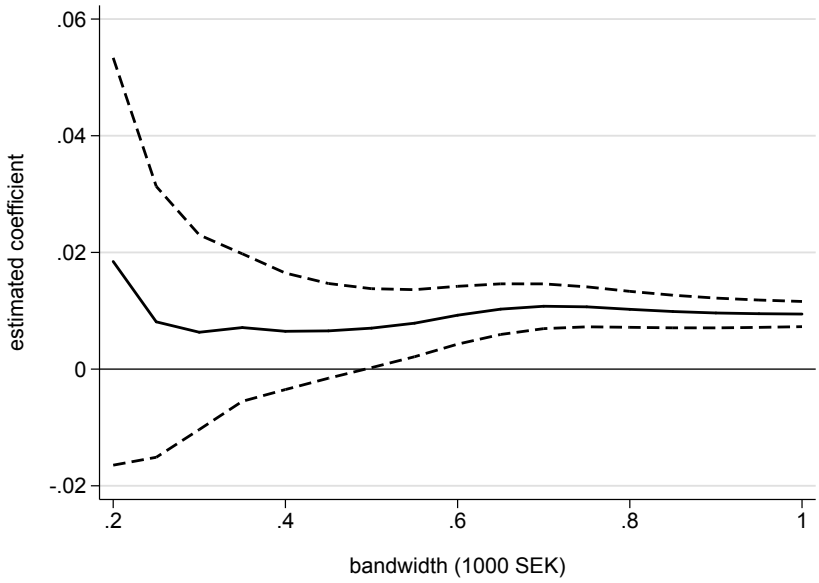
There is clear evidence that the probability of claiming the deduction significantly both kinks and jumps at a zero reference point, even when we include individual fixed effects. Furthermore, the kink estimates are of similar magnitudes as in Engström et al (2015), which used only 2006 data and no fixed effects. Engström et al (2015) varied the bandwidth between SEK ±3000 and SEK ±500 and the kink estimate turned insignificant around SEK ±700. It is thus reassuring that the kink estimate remains significant as low as SEK ±200 in the fixed effect estimation with additional years. A discontinuity is not predicted by a standard version of loss aversion, but rather from an extreme loss aversion model that also includes a fixed cost of losing, as noted in section 2.1.2 above. The discontinuity estimate in Engström et al (2015) was unstable and dropped towards zero for small bandwidth. In contrast, our fixed effects estimate is stable and statistically significant albeit arguably economically insignificant.

The next step in the analysis is to check whether the covariates also kink and jump at

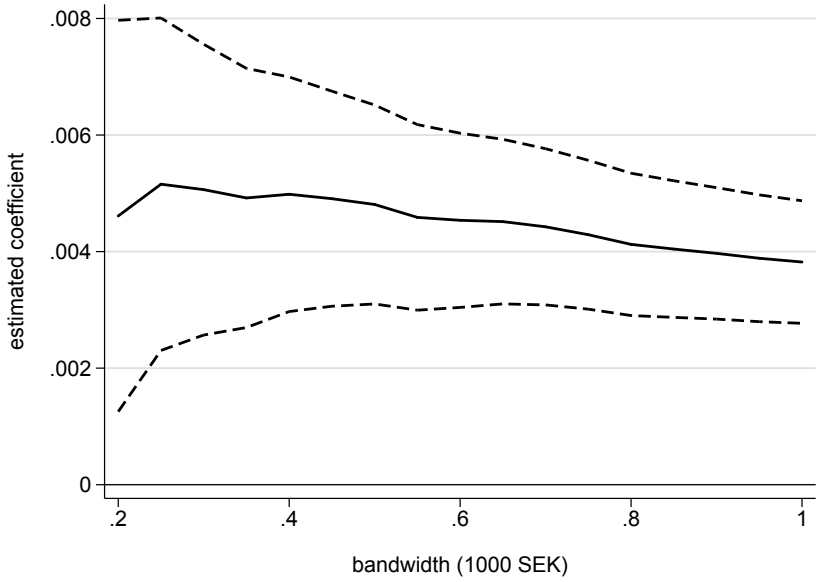
the reference point. The graphical evidence is reported in Figure 12 below. The income measure looks problematic, see Figure 12a. There is a negative slope on the surplus side and a positive slope on the deficit side, and the relationship seems to kink almost at zero deficit. This pattern is no surprise since it looked very similar in Engström et al (2015). Furthermore, there is a simple intuitive explanation for the pattern. The preliminary tax rates are chosen with zero deficit (or a very small surplus) as the target. Now, any deviation from zero will scale up proportionately with higher income. This means that there will be a mechanical relation between income and the expected absolute distance to the target, i.e. zero or a very small surplus. The fact that the income measure kinks close to zero is thus not a sign of unobservable selection, which is what we are afraid of; it is possible to control for observable selection but not for unobservable selection. The formal estimates of kinks and discontinuities in the income variable are shown in Figure 13a and Figure 13b below. There is no indication of a discontinuity but the kink is picked up by the model and remains statistically significant for bandwidths larger than SEK ±650.

We now turn to the two last covariates, the residence change and unemployment indicators. The raw graphical evidence is reported in Figures 12b and 12c. There is no graphical evidence of any dramatic changes around zero preliminary deficit for any of the two variables. The formal analysis confirms the graphical evidence. Figure 13d shows the discontinuity estimates for a dummy variable indicating whether individuals have changed residence. Again, we conclude that there is no significant discontinuity in that variable. Similarly, when looking at the kink estimates in Figure 13c we find no significant kink. The same goes for the indicator for receiving unemployment benefits: Figure 13e and 13f indicate no statistical kink or discontinuity at the reference point.

Engström et al. (2015) estimate a somewhat larger coefficient of loss aversion among younger taxpayers than among older although the difference is not significantly different. As a robustness check, we therefore split our sample and run separate regressions for taxpayers above and below 40 years of age. The results are available on request and corroborate those from Engström et al: The kink estimates are significant, indicating that both age groups are indeed loss averse. For bandwidths smaller than SEK 700, there is no significant difference between the groups.



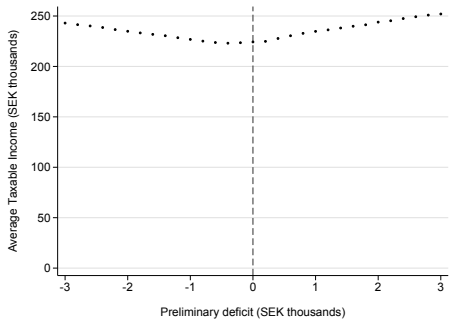
(a) Loss aversion kink from FE estimation



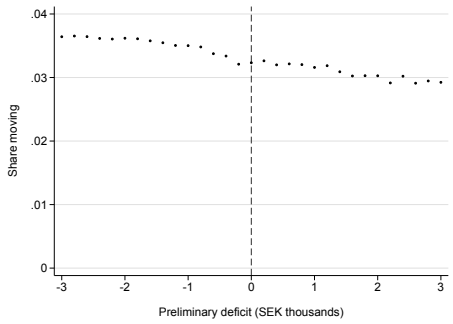
(b) Loss aversion discontinuity from FE estimation

Note: FE estimates and 95% confidence intervals of β_1 (11a) and β_0 (11b) from (15), using a dummy variable indicating deductions for "other expenses" as outcome variable (Δ_{it}), preliminary deficit as running variable (x_{it}), $\kappa = 1$, and a triangular kernel.

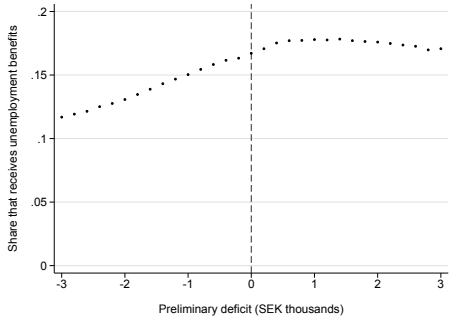
Figure 11: Kink and discontinuity from FE estimation in loss aversion analysis



(a) Income

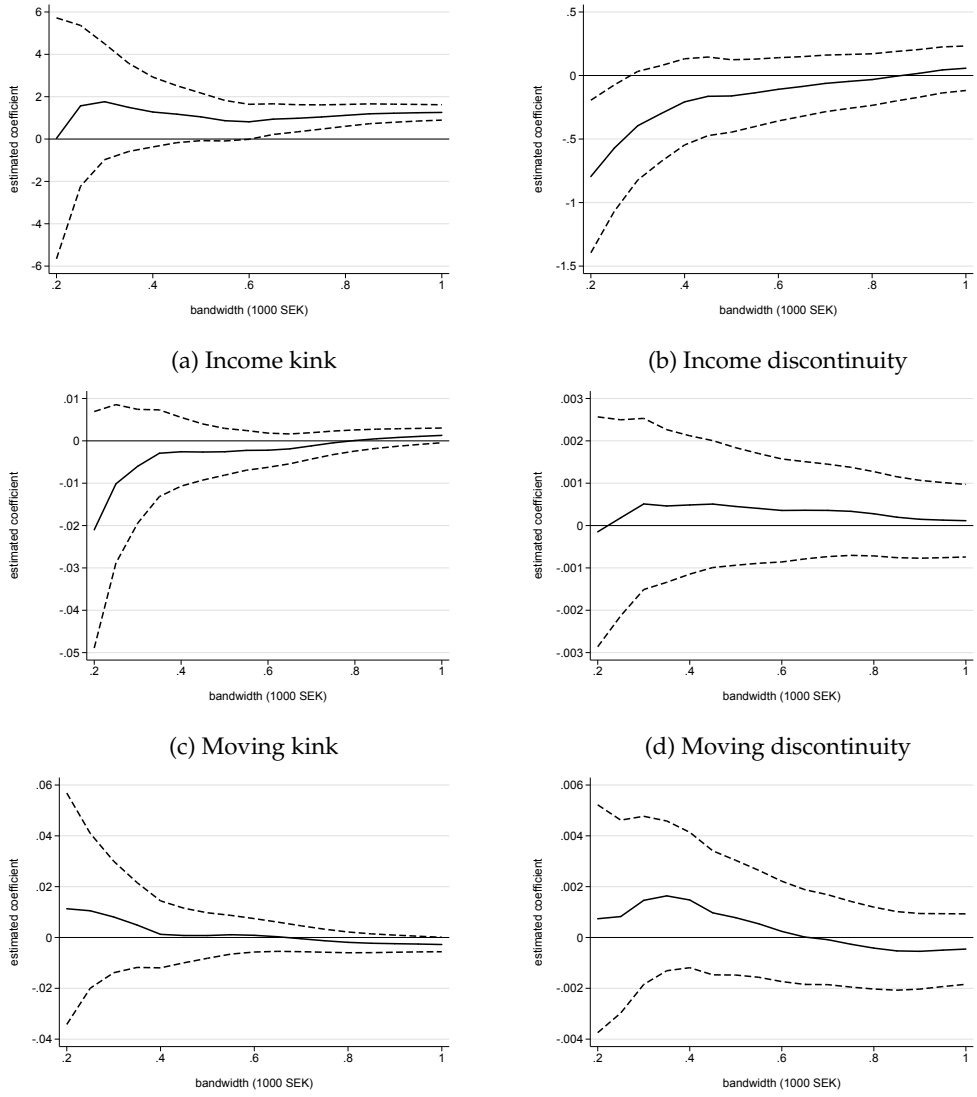


(b) Moving



(c) Unemployed

Figure 12: Loss aversion covariates by deficit



(a) Income kink

(b) Income discontinuity

(c) Moving kink

(d) Moving discontinuity

(e) Unemployed kink

(f) Unemployed discontinuity

Note: FE estimates and 95% confidence intervals of β_0 ((b), (d) and (f)) and β_1 ((a), (c) and (e)) from (15), with $\kappa = 1$, and a triangular kernel. All regressions use preliminary deficit as running variable (x_{it}). Figures (a) and (b) use taxable income ex-ante as outcome variable, Figures (c) and (d) use a dummy variable indicating whether individuals have changed residence as outcome variable, and Figures (e) and (f) use a dummy variable indicating whether individuals are unemployed as outcome variable.

Figure 13: Kink and discontinuity from FE estimation of covariates used in loss aversion analysis

5.3 Neoclassical

Figure 9 suggested that there was some tendency for a positive kink in the deduction pattern at the central government tax threshold. However, the evidence was not as clear as the behavioral kink. We now turn to the corresponding formal analysis. Using the fixed effects model, we estimate the probability of claiming a deduction as a function of taxable income relative to the first central government kink. That is, in the estimated specification (15), the running variable x_{it} is now taxable income minus the level of first central government kink. Using symmetric bandwidths around the zero reference point, we estimate (15) from a taxable income of SEK ±30,000 at the most (5,216,645 observations) to SEK ±6,000 at the least (1,064,770 observations). The maximum and minimum bandwidths are chosen to roughly match the sample sizes of the corresponding maximum and minimum bandwidths in the behavioral analysis above.

For reasons that will be discussed below, we start by running the regressions without including the preliminary deficit variables (the preliminary deficit and preliminary deficit interacted with positive deficit) as controls. Figure 15a shows the discontinuity estimates, i.e., the estimates of β_0 for the various bandwidths. The discontinuity is significant for very low bandwidths, but becomes insignificant at bandwidth SEK ±7,500 (1,321,060 observations) and above. The kink estimates, i.e., the estimates of β_1 are significant at bandwidths of SEK ± 21,000 (3,665,869 observations) and above, as shown in Figure 14a. The regression analysis thus seem to support that the positive kink, predicted by theory, is present in the data.

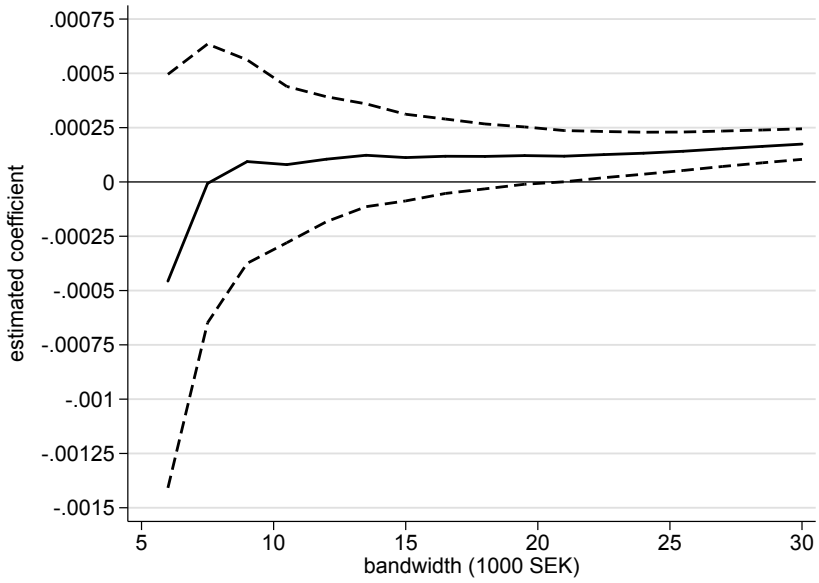
We proceed by performing the same analysis for the covariates to check for potential selection. We start with the change in residence and unemployment indicators. The graphical evidence is seen in Figures 16b and 16c. Both variables seem to evolve smoothly over the threshold. Figure 17d shows the discontinuity estimates for a dummy variable indicating whether individuals have changed residence. Again, we conclude that there is no significant discontinuity in that variable. Similarly, when looking at the kink estimates in Figure 17c we find no significant kink, apart from in a small window (bandwidths SEK ± 9,000 to SEK ± 10,000). The same holds true for the unemployment indicator. There is no strong evidence of a kink or discontinuity in Figure 17e and 17f below.

We now turn to the covariate that we left out of the analysis above, i.e. the preliminary deficit. It is immediately clear from the graphical evidence in Figure 16a below that something dramatic is happening at the threshold; there is a small discontinuity and a very large kink at the threshold. Clearly, individuals that are above the central government tax threshold are much more prone to get a preliminary deficit than individuals with lower incomes. This should not come as a surprise given that there is a random component to income. Consider an individual that has a regular income that would put her slightly below the threshold on a yearly basis. Her preliminary taxes will then typically not include a central government component. If her income increases unexpectedly, for any reason such

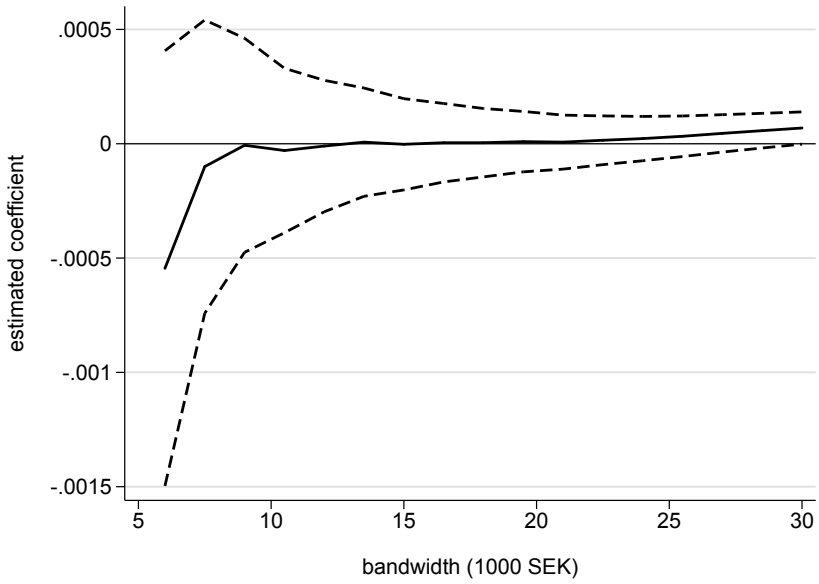
as overtime or a retroactive pay-raise, and the preliminary taxes paid on the extra income is the same as on her regular payments, she will end up above the threshold and her deficit will increase. The mirror image, unexpected reductions in the yearly income due to e.g. unemployment or sickness absence, will push her below the threshold with a reduced deficit. The dramatic change in preliminary deficit around the CGK is thus mechanically driven and indicates that there is indeed a random component to income as well as preliminary deficit. The formal kink and discontinuity estimates reported in Figures 17a and 17b below confirm that the dramatic pattern in Figure 16a is significant.

All this implies that the small kink in deduction pattern, visible from the graphical evidence in Figure 9 and confirmed econometrically in Figure 14a above (for larger bandwidths) may instead be driven by a behavioral response to increased deficits. To test this hypothesis formally we rerun the analysis in Figures 14a and 15a above with deficit, and deficit interacted with positive deficit, included as additional covariates. The results, shown in Figures 14b and 15b, confirm the intuition described above. There is no longer any indication of a kink in deduction at the CGK; the estimates are extremely small and insignificant for high bandwidths and turns negative and still insignificant for smaller bandwidths. The discontinuity is also reduced compared to Figure 15a above; it is now negative for larger bandwidths and positive for smaller bandwidths, however insignificant throughout the whole range. We can interpret the comparison between the estimates in Figures 14a and 15a above and Figures 14b and 15b below as a horse-race between the behavioral effect and the neoclassical effect. The small apparent neoclassical effects vanish when we include the controls that capture the behavioral margin.[25] The results in List (2003) suggest that the more experienced, i.e., older, taxpayers would react more in accordance with neoclassical theory than younger. Splitting the sample in taxpayers above and below the age of 40 we cannot reject the hypothesis is zero for either group. Hence, not even among the experienced taxpayers we find reactions to standard economic incentives. In sum, all these comparisons strengthen our interpretation that individuals are loss averse but do not react to the standard monetary incentive to claim deductions.

[25] We have also ran the reversed experiment by doing the analogous comparison for the behavioral effects estimated in Figures 11a and 11b above. In these regressions we included the controls that capture the neoclassical reason to claim deductions, i.e., income and income interacted with income above the CGK. However, the behavioral responses are completely unaffected by the inclusion of these covariates.



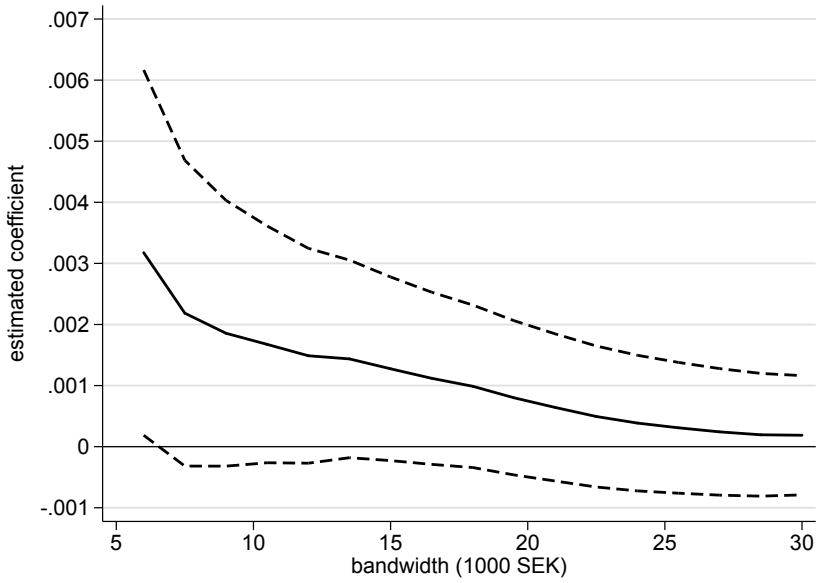
(a) Neoclassical kink from FE estimation, without preliminary deficit as a covariate



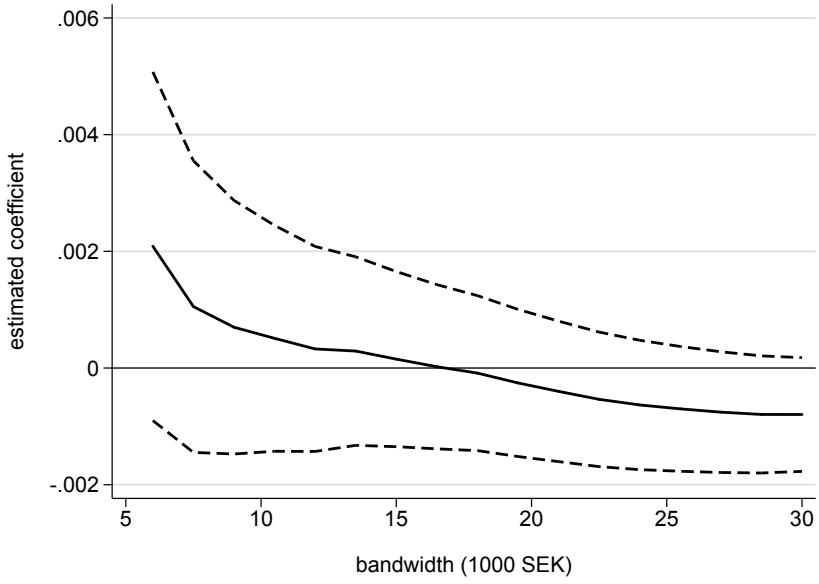
(b) Neoclassical kink from FE estimation, with preliminary deficit as a covariate

Note: FE estimates and 95% confidence intervals of of β_1 from (15), using a dummy variable indicating deductions for "other expenses" as outcome variable (Δ_{it}), taxable income relative to first CGK as running variable (x_{it}), $\kappa = 1$, and a triangular kernel.

Figure 14: Kink from FE estimation in neoclassical analysis



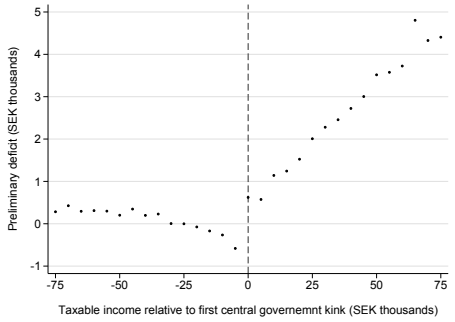
(a) Neoclassical discontinuity from FE estimation, without preliminary deficit as a covariate



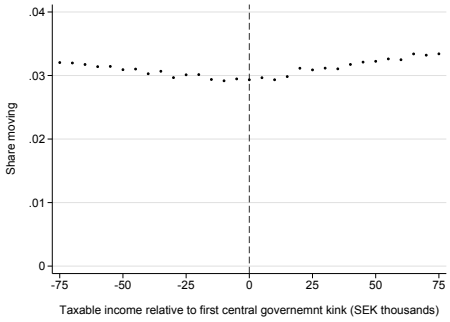
(b) Neoclassical discontinuity from FE estimation, with preliminary deficit as a covariate

Note: FE estimates and 95% confidence intervals of β_0 from (15), using a dummy variable indicating deductions for "other expenses" as outcome variable (Δ_{it}), taxable income relative to first CGK as running variable (x_{it}), $\kappa = 1$, and a triangular kernel.

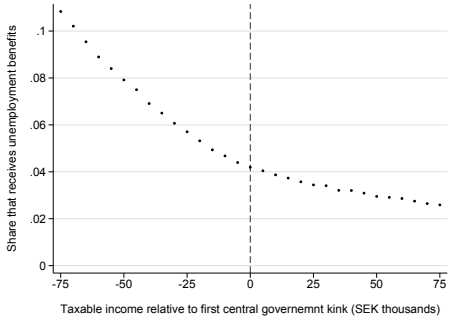
Figure 15: Discontinuity from FE estimation in neoclassical analysis



(a) Preliminary deficit

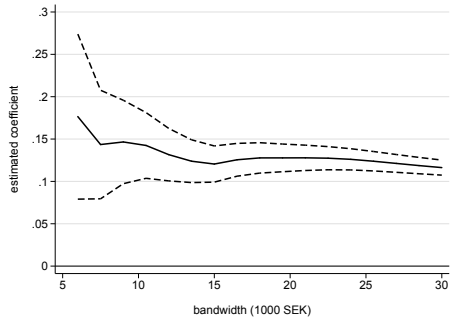


(b) Moving

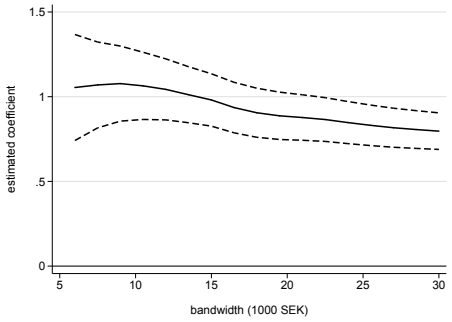


(c) Unemployed

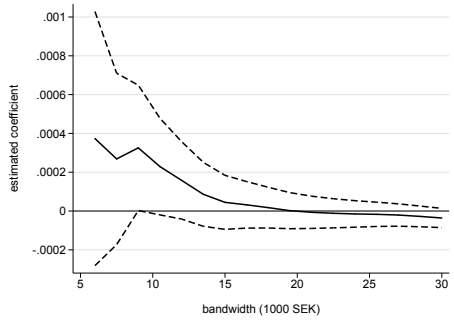
Figure 16: Neoclassical covariate (moving) by income



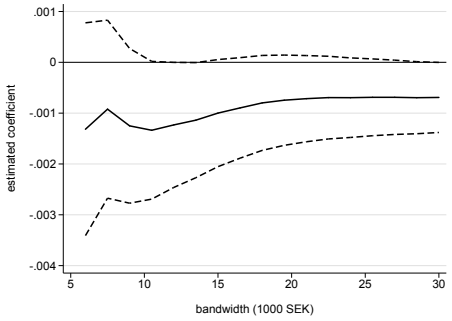
(a) Preliminary deficit kink



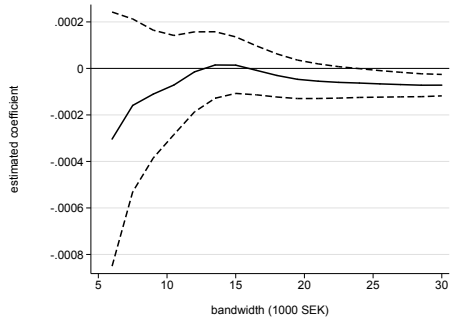
(b) Preliminary deficit discontinuity



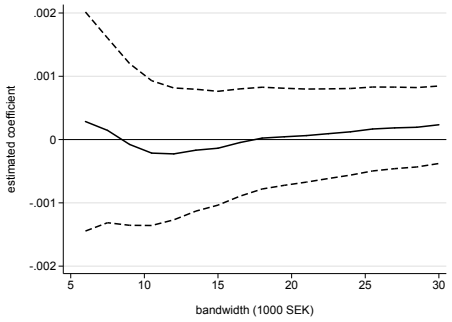
(c) Moving kink



(d) Moving discontinuity



(e) Unemployed kink



(f) Unemployed discontinuity

Note: FE estimates and 95% confidence intervals of β_0 ((b), (d) and (f)) and β_1 ((a), (c) and (e)) from (15), with $\kappa = 1$, and a triangular kernel. All regressions use taxable income relative to first central government kink as a running variable (x_{it}). Figures (a) and (b) use preliminary deficit as outcome variable, Figures (c) and (d) use a dummy variable indicating whether individuals have changed residence as outcome variable, and Figures (e) and (f) use a dummy variable indicating whether individuals are unemployed as outcome variable.

Figure 17: Kink and discontinuity from FE estimation of covariates used in neoclassical analysis (moving dummy)

6 Conclusion

We study a panel of Swedish working age taxpayers' behavior when filing their tax returns for the income years 1999–2006. The Swedish tax system provides two natural experiments related to deduction behavior along two separate margins: i) the preliminary tax deficit and ii) a large kink (20 percentage points) in the income tax schedule, where a central government tax kicks in. If taxpayers are loss averse, with zero preliminary balance as a reference point, their incentives to make deductions increase sharply when entering the domain with preliminary tax deficit. Also, taxpayers slightly above the governmental tax kink have substantially higher (standard economic) incentives to claim deductions than taxpayers slightly below the kink.

The research method is quasi-experimental using a regression kink and discontinuity approach. Our findings indicate that the Swedish taxpayers are highly reference dependent and loss averse and they do not react to standard monetary incentives. First, we find a significant change in deduction behavior at zero preliminary deficit. That is, taxpayers who have a preliminary tax deficit are more likely to claim deductions for "other expenses for earning employment income" than those who have a preliminary surplus. The empirical fixed-effects analysis indicates no selection on unobservables around the zero balance threshold, which strengthens the causal interpretation. Loss aversion is the obvious candidate for explaining the result. Second, when not adjusting for incentives explained by loss aversion, i.e., preliminary deficit, we do find some evidence of an increase in deduction behavior at a threshold where the marginal tax rate jumps by 20 percentage point. These preliminary findings are thus consistent with standard economic incentives. However, taxpayers above the CGK have dramatically higher preliminary tax deficits compared to taxpayers below the CGK. This is a mechanical relationship caused by the random component of earned income. When we control for tax deficit, the kink in deduction behavior around the CGK completely disappears. That is, the observed kink around the CGK is also due to loss aversion, driven by the increased preliminary deficit. We thus find very strong evidence that taxpayers suffer from loss aversion but no evidence of them reacting to standard economic incentives.

How can we make sense of these results? The lack of response to the standard economic incentives is consistent with many studies on wage earners bunching behavior (se e.g. Saez (2010) and Bastani and Selin (2014)). When focusing on labor supply adjustments, the lack of bunching can be explained by optimization frictions. However, when the margin of adjustment is deduction, optimization frictions arguably make less sense. The fact that we find strong loss-aversion reactions indicates that deductions are indeed sensitive to incentives, and that individuals react without frictions when trying to avoid losses. So why do tax payers not respond just as strongly to standard economic incentives? The usual suspect is lack of salience. Having a tax deficit is arguably very salient. Perhaps much

more salient than being above or below the CGK. Can we really expect people to know exactly where the CGK is located? Earlier studies indicate that taxpayers have a very low knowledge of the exact income threshold where the central government tax kicks in (see Flood et al. (2013). This low knowledge may indeed help explain why wage earners do not bunch at the kink point by adjusting their labor income, as discussed in Bastani and Selin (2014). However, when filing tax returns, workers do receive information regarding whether they are above or below the CGK. This information is actually written on the preliminary tax return, on the same page the preliminary balance is reported (see Figure 18 in the appendix). The preliminary tax returns clearly state how much money you should pay in central government tax; if the figure is zero, you are below the kink, and if it is positive, you are above the kink. A rudimentary understanding of the income tax system would thus suffice. This means that the average taxpayer would have to be highly inattentive in order to not have a rough knowledge of her incentives to make a deduction.

In his recent bestseller, Richard Thaler coins the term "misbehaving" (Thaler, 2015) to indicate when people deviate from standard economic theory. Embracing this terminology, we can conclude that Swedish tax-payers are certainly not well behaved: not only are they highly loss averse, they also fail to react to textbook economic incentives.

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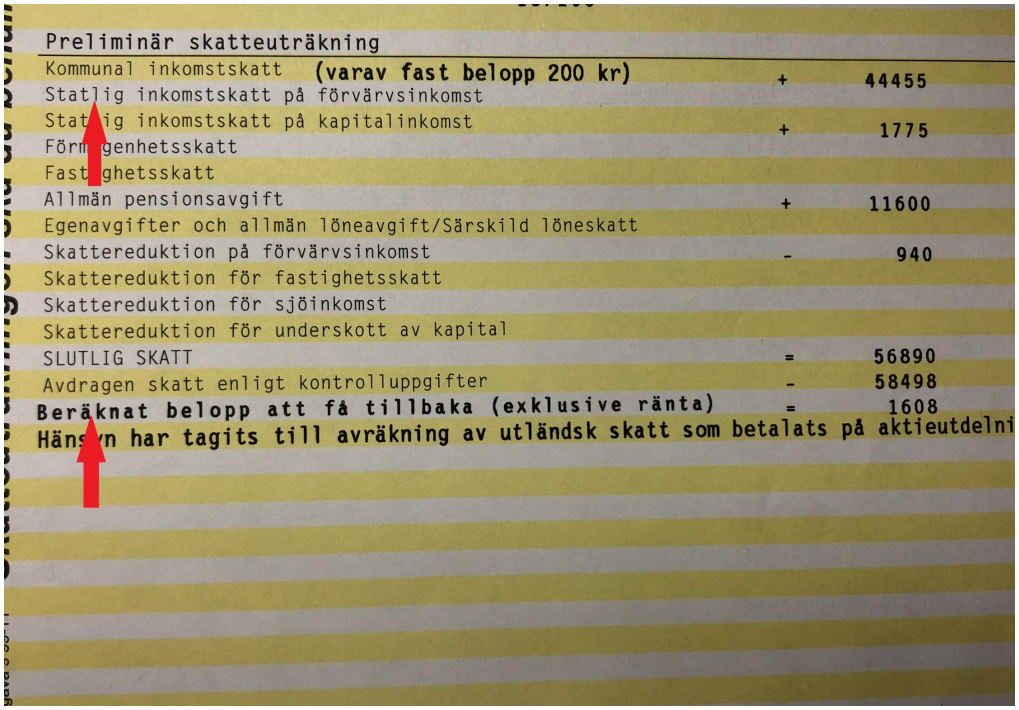
A Appendix

Figure 18 shows an example of the preliminary tax return where the first red arrow indicates the information about central governmental tax. This specific taxpayer was not supposed to pay this tax during this specific year; hence, the line is left blank. The second one indicates whether the taxpayer has taxes due or could expect a refund (in this case a refund).



Note: An example of the page in the preliminary tax return with information about both central governmental tax and preliminary deficit. The upper red arrow indicates the row with information about central governmental tax. This specific taxpayer was not supposed to pay central governmental tax in this year; hence, the second column in the central government tax row is left blank. For those who are above the central government threshold, the column states the amount of the individuals' annual central governmental tax. The lower red arrow indicates the row with information about whether the taxpayer has taxes due or could expect a refund. The second column shows the amount of the preliminary surplus. In this case the taxpayer has a surplus of SEK 1,608. If the taxpayer had a deficit of the same amount, the column would state a negative amount, SEK -1,608.

Figure 18: Preliminary tax return