Adjustment Cost and Incentives to Work: Evidence from a Disability Insurance Program

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Abstract

How important is adjustment cost for individuals who face a change in work incentives induced by a policy change? I provide the first estimate of adjustment cost in the context of a Disability Insurance (DI) program by exploiting a policy change that increased work incentives by increasing the exemption threshold. I use bunching at the thresholds to estimate adjustment cost and earnings elasticity. The estimates of adjustment cost are quite sizeable and heterogeneous. The estimates of earnings elasticity, from both static and dynamic models, are larger than the elasticity estimated with no adjustment cost, suggesting that adjustment cost attenuates the responses to work incentives. Policies designed to increase labor supply will work if the work incentives are large enough to offset the adjustment cost. Accounting for adjustment cost then might explain the disparate findings on the effects of an increase in work incentives on the labor supply of beneficiaries of DI programs.

JEL classification: H24, H53, H55, J14, J18, J21, J22.

Keywords: Adjustment cost; Optimization friction; Bunching; Kink; Disability Insurance; Earnings elasticity; Dynamic labor supply.

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1 Introduction

Models of labor supply commonly assume that workers can alter their supply of labor with no adjustment cost.[1] However, adjustment cost is real: finding a new job, negotiating increased or reduced hours with an employer, and adjusting non-work schedules all cost time and money. Adjustment cost is important in evaluating the welfare effects of a policy change (Chetty, 2009). Adjustment cost can also explain the differences in estimated elasticity of earnings in micro versus macro studies (Chetty et al., 2011; Chetty, 2012; Chetty et al., 2012). However, there is very little empirical evidence on the existence and the size of adjustment cost, except for Gelber et al. (2020).

In this paper, I estimate the size of the adjustment cost individuals face when they change their labor supply in response to a change in work incentives. I exploit a policy change in a Disability Insurance (DI) program in Alberta, Canada –"Assured Income for the Severely Handicapped" (AISH)– in April 2012. This policy change increased work incentives by increasing the monthly earnings exemption threshold to C$800 from C$400. Earnings below the threshold do not affect the DI payments, but for every C$2 of earnings accumulated above the threshold, individuals would lose C$1 of their monthly payment. This is comparable to a non-linear tax schedule on earnings with a kink at the exemption threshold where the implicit marginal tax rates below and above the threshold are respectively zero and 50%. Such a kink creates incentives for individuals to locate right below the threshold to avoid the higher marginal tax rate above the threshold. I document sharp excess mass –called "bunching"– at the exemption thresholds, suggesting strong behavioral responses to the work incentives. However, a puzzling observation is that individuals continue to bunch at the former threshold after the policy change. This suggests that they face adjustment cost when changing their labor supply. I use the bunching at the former and the new thresholds to provide the first estimate of adjustment cost in the context of a DI program, using the method proposed by Gelber et al. (2020). I investigate both immediate and longer-run responses using, respectively, static and

[1] Some exceptions are Chetty, 2009; Chetty et al., 2011; Chetty, 2012; Chetty et al., 2012, 2013; Kleven and Waseem, 2013; Kleven, 2016. However, none of these studies estimate the size of the adjustment cost.

dynamic models. In the dynamic model, I explore the transition of bunching from the former to the new threshold and estimate the probability of drawing zero adjustment cost by each period in addition to the adjustment cost and earnings elasticity.

I use administrative data on monthly earnings of AISH beneficiaries which spans two years of pre- and two years of post-policy change from April 2010 to March 2014. The data has information on beneficiaries' earnings and their characteristics, including sex, age, marital status, family size, age and date of entry into the program, type of disability, and the location of residence. My study sample includes 18–64-year-old individuals with non-physical disabilities who do not have any dependent.[2] I exclude those who entered into the program after the policy change since they do not bunch at the former threshold at post-policy change periods (see Figure 4). My data includes only beneficiaries with non-physical disabilities, but studying this group of beneficiaries is still informative. Their decision to work might be more sensitive to adjustment cost because most of them are the marginal entrants into the DI programs (Autor and Duggan, 2006; Liebman, 2015) who might have at least some ability to work (Maestas et al., 2013).

My empirical analysis provides five conclusions. First, there are strong behavioral responses to work incentives in DI programs, as evidenced by sharp bunching at the exemption threshold. However, bunching at the former threshold at post-policy change periods suggests that individuals face adjustment cost when changing their labor supply. The estimated adjustment cost from the static model –capturing the immediate responses to the policy change– is C$13, which is about 5% of the average monthly earnings in my sample.

Second, the estimate of earnings elasticity using the static model –accounting for adjustment cost– is 0.20, which is twice the size of the elasticity estimated without adjustment cost using the method of Saez (2010).

Third, the estimate of adjustment cost using the dynamic model –capturing the longer-run responses over a two-year post-policy change period– is about C$28, which is twice the

[2]The monthly exemption threshold for beneficiaries with dependent – less than %10 of all beneficiaries – also increased from C$975 to C$1,950. They do not bunch at the exemption threshold, so I exclude them from my study sample.

size of the estimate from the static model (10% versus 5% of the average monthly earnings in the study sample). The estimate of earnings elasticity is 0.15, which is smaller than the estimate from the static model. The estimated cumulative probability of drawing zero adjustment cost increases over time –in proportion with the emergence of bunching from the former to the new threshold– but it does not reach one within a two-year post-policy change period.

Fourth, the estimates of the earnings elasticity, from both static and dynamic models, are larger than the estimates from the model without adjustment cost. This suggests that adjustment cost can attenuate both immediate and longer-run responses to work incentives induced by a policy change.

Fifth, the estimates of the earnings elasticity and adjustment cost, from both static and dynamic models, are heterogeneous by beneficiaries' age, sex, disability type, and location of residence. The estimated adjustment costs from the dynamic model are relatively larger and are more heterogeneous than the estimates from the static model. The estimates of earnings elasticity from the dynamic models are more homogeneous and smaller than the estimates from the static model, but still larger than the estimates with no adjustment cost.

The bunching estimates use a sub-sample of individuals with relatively high initial earnings –and potentially higher ability (Bastani and Waldenström, 2020)– compared to the rest of DI recipients who could bunch. The adjustment cost could be much higher for those with lower earnings, and my estimates are a lower bound on the size of the adjustment cost individuals face when changing their labor supply.

My results provide evidence on the labor supply responses in DI programs, an important policy domain. These programs provide benefits to individuals with health conditions, which limit the kind or amount of paid work they can perform. These programs are among the largest social assistance programs in developed countries. On average, OECD countries spend more than 2.5% of their GDP on DI programs (OECD, 2010), and there are concerns about governments' high spending on these programs. In most DI programs, benefit recipients lose all or part of their benefits if they work, providing a disincentive to work. Therefore, many countries have implemented – or are considering – policies to remove this disincentive by gradually reducing benefits when DI recipients work. A more gradual reduction of the benefits encourages DI recipients to start working and eventually exit the program.[3]

For instance, as part of the Ticket to Work and Work Incentives Improvement Act of 1999 in the United States, the Social Security Disability Insurance (SSDI) program undertaken the Benefit Offset National Demonstration (BOND), a random assignment test of a $1 for $2 offset applied to annual earnings above the SSDI's Substantial Gainful Activity (SGA). BOND allows the beneficiaries in the treatment group to retain some of their monthly cash benefits while earning more than the SGA, whereas entirely suspending the benefits for the control group. Various evaluations find no confirmatory evidence of an impact of BOND on average earnings (SSA, 2018; Weathers II and Hemmeter, 2011; Wittenburg et al., 2015).

While policies that provide work incentives to DI beneficiaries aim at getting them into the labor force, empirical findings on the effectiveness of such policies are not conclusive. Hoynes and Moffitt (1999), Benitez-Silva et al. (2011), Weathers II and Hemmeter (2011) and Bütler et al. (2015) find no effects from financial incentives to work in the United States and Switzerland. Meanwhile Campolieti and Riddell (2012), Kostol and Mogstad (2014) and Ruh and Staubli (2019) find positive responses respectively in Canada, Norway and Austria. Beyond a change in financial incentives, medical reassessment of DI recipients and trial work periods in the United States do not appear to affect the labor supply (Autor and Duggan, 2006). Moore (2015) finds positive effects on the labor supply of those who lost their benefits after the removal of drug and alcohol addictions as qualifying conditions for DI programs in the United States. Borghans et al. (2014) and Staubli (2011) examine the effects of terminating benefits and stricter eligibility criteria in DI programs in the Netherlands and Austria, respectively. They find that individuals

[3]The United Kingdom, Norway, and Switzerland are among the countries which recently implemented policies to increase the labor supply in their DI programs. United Kingdom's program allows beneficiaries to keep half of their benefits for up to a year if they work. In Norway's program, benefits are reduced by $0.6 for every $1 earned above an exemption threshold (See Kostol and Mogstad (2014) for an evaluation of the program). Switzerland tested a program which offered a conditional cash payment if DI recipients started to work or increased their earnings (See Bütler et al. (2015) for an evaluation of the program).

substitute DI benefits by collecting more from other social assistance programs. Lemieux and Milligan (2008), Fortin et al. (2004), Gruber (2000) and Gelber et al. (2017) find that providing more generous benefits has negative effects on labor supply in social assistance programs in Canada and the United States. Adjustment cost might explain the mixed findings on the effects of an increase in work incentives on labor supply in DI programs. The increase in work incentives induced by a policy change must be large enough to offset the adjustment cost if the goal is to increase the labor supply of the DI beneficiaries.

My paper also is related to the literature on adjustment cost. Earlier works discuss the effects of search costs, hours constraints, and institutional constraints on labor supply decisions (Pencavel, 1986; Altonji and Paxson, 1988; Dickens and Lundberg, 1993; Blundell and Mccurdy, 1999; Chetty et al., 2011; Aghion et al., 2017; Tazhitdinova, 2020; Kosonen and Matikka, 2020). Altonji and Paxson (1992) suggest that individuals face adjustment cost when changing their labor supply since the changes in hours of work are lumpy. Several other works also suggest that individuals face adjustment cost changing their behavior in response to policy changes (Chetty, 2009; Chetty et al., 2011; Chetty, 2012; Chetty et al., 2012, 2013; Kleven and Waseem, 2013). Chetty et al. (2011) shows that adjustment cost affects estimates of the elasticity of labor supply. None of the previous works provide an estimate of the adjustment cost. Gelber et al. (2020) are the first to specify a model to quantify the adjustment cost empirically. They use their model to estimate adjustment cost in the context of the Social Security Earnings Test in the United States. I contribute to this literature by providing the first estimate of adjustment cost in the context of a DI program using the method of Gelber et al. (2020).

For the remainder of the paper, I proceed as follows. I describe the institutional background of AISH and the data I use for my analysis in Section 2. I present the model for estimating adjustment cost and elasticity of earnings in Section 3. I present my estimates in Section 4 and then I conclude in Section 5.

2 Institutional background and data

2.1 DI programs in Canada

The federal DI program in Canada provides benefits to individuals with medically verifiable physical or non-physical disabilities which limit the kind or amount of paid work they can do. The federal program provides short-term benefits, and the eligibility criteria are based on individuals' employment history. This program aims to enable benefit recipients (and their dependent) to live independently as possible in their communities. However, most of the individuals with lifelong and severe disabilities would not be eligible for the federal program –due to lack of employment history– and need long-term assistance. The provincial DI programs complement the federal program, providing long-term benefits to those not eligible for the federal program, or needing more assistance. Each province operates its DI program under different ministries, but they all provide similar benefits. The amount of benefits and the size of the programs, however, differ substantially across the provinces.

2.2 Assured Income for the Severely Handicapped program

The "Assured Income for the Severely Handicapped" (AISH) is Alberta's provincial DI program. AISH is a means-tested program where eligible individuals are entitled to a prescribed amount of assistance. The eligibility to enter the program is determined based on applicants' disability, age, income, and assets. Eligible individuals must be permanently disabled where there is no curative therapy to improve their condition materially (SASR, 2010). They must also be 18 years or older, live in Alberta, and be a Canadian citizen or permanent resident. The total assets of an eligible benefit recipient and their partner –excluding their primary residence and means of transportation– cannot be worth more than C$100,000. The final decision on an application file is made by a social worker, after receiving all the relevant medical reports from a qualified health professional. Entitled individuals receive monthly payments and supplemental assistance, such as health benefits and subsidized transport.

Once an individual enters into the program, there are two main pathways out of it. First, a benefit recipient may die. Second, they may no longer be eligible to receive the benefits. For example, a benefit recipient may reach the retirement age of 65 years and be eligible to receive Guaranteed Income Support or Old Age Security pensions or a benefit recipient may no longer meet the medical or income and asset criteria for receiving the benefits. Eligibility-based exits account for a tiny fraction of the exits from the program.

AISH beneficiaries are allowed to work while receiving DI benefits, but there is an exemption threshold, the earnings below which do not affect the benefits, but DI payments are gradually phased out for the earnings accumulated above the exemption threshold. This is comparable to a non-linear tax schedule on earnings with a zero marginal tax rate on earnings below the exemption threshold. Earnings above the exemption threshold, up to the second earnings threshold, are implicitly taxed at a marginal rate of 50%. That is, the monthly DI payments are reduced by C$1 for every C$2 of earnings accumulated between the exemption threshold and the second threshold. Earnings above the second threshold are implicitly marginally taxed at a 100% rate, where the monthly DI payments are reduced by C$1 for every C$1 of earnings accumulated above the second threshold.

2.2.1 Policy change

After Alberta's 2012 provincial election, the new premier decided to change the ministry responsible for AISH and make changes in the benefits in April 2012, which had two components. First, the monthly exemption threshold increased from C$400 to C$800. Second, the monthly DI payments increased by 35% to C$1,588 from C$1,188.[4] Figure 1 presents the budget constraints before and after the policy change. The horizontal axis denotes the monthly earnings, and the vertical axis denotes the total income, which is the after-tax earnings and the monthly DI payments added together. The exemption thresholds do not overlap with thresholds from any other program since those who entered the program after the policy change bunch only at the new threshold, and they do not

[4] This is the policy change for beneficiaries with no dependent. The exemption threshold was increased to C$1,950 from C$975 for those with dependent, and the increase in the monthly payments was the same as beneficiaries with no dependent. See Figure C.1 in the Appendix.

bunch at the former threshold (see Figure 4).

2.3 Data and study sample

I use administrative data on the monthly earnings of AISH beneficiaries from April 2010 to March 2014. My data includes two years of pre- and two years of post-policy change period, which I obtained from the Human Services of the Government of Alberta. Observing monthly earnings is essential for estimating adjustment cost since the earnings thresholds are monthly based. The data includes information on individuals' sex, age, marital status, family size, age and date of entry into the program, type of disability, and the location of residence. My study sample includes 18–64-year-old individuals with non-physical disabilities who do not have any dependent and entered into the program at any time before the policy change. I exclude those who entered into the program after the policy change since they only bunch at the new threshold and do not bunch at the former exemption threshold (see Figure 4). Less than 10% of all beneficiaries have dependent (see Table 1), and since they do not bunch at the exemption thresholds (see Figure C.2), I exclude them from my study sample. My sample includes only beneficiaries with non-physical disabilities because I do not have data on those with physical disabilities. Studying beneficiaries with non-physical disabilities is still informative. Non-physical disabilities, such as depression, are hard-to-verify, and individuals with these conditions are the marginal entrants into the DI programs (Autor and Duggan, 2006; Liebman, 2015) who might have at least some ability to work (Maestas et al., 2013). They might respond to an increase in work incentives if they face lower adjustment cost, for instance, if they can find a suitable job easier (Maestas et al., 2018).

Table 1 presents the summary statistics. The total sample size is 452,000 (about 9,000 individuals over four years, which is about %1 of the population of Alberta). The first panel presents the labor market statistics. Despite the increase in the DI payments, the labor supply increased after the policy change; a larger portion of the beneficiaries have positive earnings, and the average inflation-adjusted monthly earnings also increased.

There are fewer new entries into the program after the policy change.[5]

The second panel of Table 1 presents the individual characteristics. The demographic characteristics do not change post-policy change. Half of the beneficiaries are female. The mean age at entry into the program is 29 years, and the average age of beneficiaries is 39 years. About half of the beneficiaries reside in metropolitan areas. Only less than 10% of all beneficiaries have dependent. The education level of more than 80% of the beneficiaries is high school or less, and about half of all beneficiaries have non-physical disabilities (SASR, 2010). I divide non-physical disabilities into three groups of Psychotic (i.e., Schizophrenia and Bipolar disorder), Neurological (i.e., Autism and Down Syndrome), and Mental conditions (i.e., Anxiety and Depression).

3 Adjustment cost and earnings elasticity

3.1 Documenting adjustment cost

Figure 2 plots the earnings distributions of beneficiaries before and after the policy change. Panel (a) plots the earnings distribution using the pooled sample from three months before the policy change (January 2012–March 2012) where the monthly exemption threshold is at C$400. There is sharp bunching at the threshold, suggesting strong responses to work incentives induced by the kink. The higher marginal tax rate above the threshold (50% versus 0) creates incentives for many individuals to locate their earnings right below the threshold. Panel (b) plots the earnings distribution using the pooled sample from three months after the policy change (April 2012–June 2012), where the monthly exemption threshold is at C$800. As expected, there is sharp bunching at the new threshold, but there is also bunching at the former threshold at C$400. There is no bunching at the second kink at C$1,500 before neither after the policy change.[6]

[5]This could be because Alberta's economy was generally improving throughout my study period (2010–2014) as it continued to recover from the Great Recession. The new entrants are likely to have more severe disabilities than the previous ones. Also, everyone's economic prospects were improving over this period, making it more remarkable that bunching continued at the former threshold.

[6]The The second earning threshold was increased to C$1,500 from C$1,000 in July 2008, four years before the April 2012 policy change. There is no bunching at the former kink at C$1,000 (50% and 100% marginal tax rates respectively below and above the kink).

Figure 3 presents the evolution of bunching at the former exemption threshold and the slow emergence of bunching at the new threshold. Panel (a) shows that there is sharp and quite stable bunching at the exemption threshold every month before the policy change. Panel (b) shows that bunching at the former threshold gradually decreases and emerges as bunching at the new threshold in the months following the policy change. However, bunching at the former threshold does not entirely disappear, even two years after the policy change.

Figure 4 plots the earnings distribution of the beneficiaries who entered into the program after the policy change. The monthly exemption threshold for these individuals is at C$800. The distribution is quite fuzzy compared with Figure 2, there is no clear bunching at the former exemption threshold at C$400, but there is a spike at the new threshold at C$800. This figure provides a placebo test that the bunching at the former threshold in Panel (b) of Figure 2 is not caused by overlapping thresholds from other programs. If there was an overlap, the new entrants also should have bunched at the former threshold.

Figure 5 plots the earnings distribution of individuals whose monthly earnings before the policy change was close to the exemption threshold, which I define as those with earnings between C$350 and C$450 at least for six months during one year before the policy change. About 12% of the observations post-policy change is zero. The plot suggests that those who bunch at the former threshold before the policy change, also bunch there after the policy change.[7] This finding suggests it is implausible that the decrease in the bunching at the former exemption threshold is driven by beneficiaries exiting the labor force as opposed to changing their earnings post-policy change.

Bunching at the former exemption threshold after the policy change is unlikely to be driven by the higher marginal utility of leisure relative to working since bunching at the former threshold gradually fades away in the months following the policy change. The bunching is unlikely to be due to a lack of information about the policy change since all beneficiaries were informed about the policy change by their social workers. Also, all

[7]Limiting the sample only to positive earnings does not change the general findings.

beneficiaries receive monthly payments, and they would see that the amount has changed, so they are unlikely to be unaware that some changes have happened.

I document bunching at the former exemption threshold, pre-policy change, persistent bunching there, post-policy change, and the slow emergence of bunching at the new exemption threshold. All this evidence suggests that benefit recipients face adjustment cost when they change their labor supply in response to changes in work incentives induced by the policy change. If individuals do not face adjustment cost, bunching at the former threshold should fade away immediately after the policy change. Those who continue bunching at the former threshold face barriers when changing their labor supply, all of which I put in a single box and call "adjustment cost." The utility loss associated with adjustment cost offsets the utility gains from changing labor supply, and therefore some individuals continue to bunch.[8] It is worth stressing that while in short-run adjustment cost might limit labor supply responses to the policy change, it differs from the long-run when new beneficiaries eventually replace the old ones.

3.2 Model

I provide the first estimate of adjustment cost in the context of a DI program. I explore the policy change in AISH, which increased the exemption threshold, and I use the bunching at the former and new exemption thresholds to estimate both static and dynamic models using the method of Gelber et al. (2020). A static model explores the immediate responses to the policy change, where a dynamic model explores the gradual transition of bunching from the former to the new threshold over a two-year post-policy change period. Bunching at a kink conceptually increases by the earnings elasticity but also decreases by the size of adjustment cost, which is incorporated into the models as utility loss.

Gelber et al. (2020) build on Saez (2010) and develop a novel framework to jointly estimate adjustment cost and earnings elasticity using bunching at a kink. They explore a policy change in the Social Security Annual Earnings Test in the United States, which decreased the marginal tax rate above a kink. They use bunching at the kink before

[8] See Appendix A for a simple conceptual framework.

and after the policy change to estimate earnings elasticity and fixed adjustment cost interpreted as the average adjustment cost. This policy change is different from the change in AISH, which increased the exemption threshold without changing the tax rates. In the following, I present both static and dynamic models of Gelber et al. (2020) adopted the policy change in AISH.

In the following, $u(c, z; \alpha)$ denotes the utility function which depends on earnings elasticity denoted as e. z and c denote the earnings and consumption defined as the after-tax earnings. α denotes individuals' time-invariant ability, which is the only source of heterogeneity in the models. Individuals face adjustment cost $\phi > 0$ in the form of utility loss when they change their labor supply. A marginal buncher at z^* kink –with marginal tax rates of $\tau_0 < \tau_1$ respectively below and above z^*– with ability α and initial earning $z > z^*$ is indifferent between earnings z – with higher marginal tax rate of τ_1 – and enduring adjustment cost ϕ, and reducing their earnings to z^* with lower marginal tax rate of τ_0. The initial earnings of a marginal buncher denote their earnings with a flat tax rate of τ_0.

In both models, z_1^* and z_2^* denote the former and the new exemption thresholds, C$400 and C$ 800 respectively, with marginal tax rates of $\tau_0 < \tau_1$ below and above each kink respectively at 0 and 50%.

3.2.1 Static model

In the static model, there are two parameters to estimate: adjustment cost and earnings elasticity. These parameters are estimated by matching bunching at the former threshold pre- and post-policy change from the pooled distribution of earnings from three months of pre- and three months of post-policy change periods presented in Figure 2.

Panel (a) of Figure 6 illustrates a marginal buncher at z_1^* before the policy change. Their ability is denoted by $\alpha^{m_{10}}$ and their initial earnings is $\underline{z}_{10} > z_1^*$. They are indifferent between staying at $\underline{z}_{10}$ – with higher marginal tax of τ_1 – or enduring utility loss ϕ and decreasing their earnings to z_1^* where marginal tax is lower at τ_0. The *marginal buncher* equation at z_1^* before the policy change is:

$$u\left((1-\tau_0)z_1^*, z_1^*; \alpha^{m_{10}}\right) = u\left((1-\tau_0)z_1^* + (1-\tau_1)(\underline{z}_{10} - z_1^*), \underline{z}_{10}; \alpha^{m_{10}}\right) + \phi \tag{1}$$

In the absence of adjustment cost, individuals with initial earnings in the range of $(z_1^*, z_1^* + \Delta z_1^*]$ would bunch at z_1^*. Under mild assumptions about the underlying utility function –which holds for all quasi-linear utility functions– the gain from relocating to a kink is increasing in the distance from the kink.[9] If individuals face adjustment cost when changing their labor supply, only those whose gain from changing their earnings is higher than the adjustment cost they face would bunch at the kink. Therefore, the bunching range shrinks to $(\underline{z}_{10}, z_1^* + \Delta z_1^*]$. Figure 7 plots the counter-factual distribution of earnings with flat tax rate of τ_0 denoted as $h_0(.)$. The bunching range in the absence of adjustment cost is $i + ii + iii$, but it shrinks to $ii + iii$ with adjustment cost. Bunching at z_1^* is the area under the counterfactual distribution of earnings in the bunching range. The *bunching equation* at z_1^* before the policy change is approximated as:[10]

$$B_{10} = \int_{\underline{z}_{10}}^{z_1^* + \Delta z_1^*} h_0(\zeta) d(\zeta) \approx (z_1^* + \Delta z_{10}^* - \underline{z}_{10}) h_0(z_1^*) \tag{2}$$

When the exemption threshold at z_1^* is increased to z_2^*, bunchers at z_1^* would increase their earnings only if their utility gain from relocation exceeds the adjustment cost they face. Panel (b) of Figure 6 illustrates a marginal buncher at z_1^* after the policy change with ability $\alpha^{m_{11}}$ and initial earnings of $\underline{z}_{11} \in (\underline{z}_{10}, z_1^* + \Delta z_1^*]$. They are indifferent between continuing to bunch at z_1^* or enduring utility loss ϕ and relocating to their optimal earnings $\underline{z}'_{11}$ with the new taxes. The *marginal buncher* equation at z_1^* post-

[9] The assumption is that the size of the adjustment in earnings increases in α at a rate faster than the decrease in the marginal utility of consumption. For more details see (Gelber et al., 2013).

[10] This approximation assumes that the distribution of $h_0(.)$ on $(\underline{z}_{10}, z_1^* + \Delta z_{10}^*]$ is uniform. This is a common assumption in the bunching literature. See for instance Chetty et al. (2011); Kleven and Waseem (2013) and Kleven (2016) for a review of the recent bunching literature. Gelber et al. (2020) use earnings distribution of a different group of individuals who do not face a kink as a counter-factual earnings distribution for their study sample. This approach allows them to estimate the bunching with no further distributional assumptions on their counter-factual distribution. This approach, however, comes with a cost of assuming similarity between distributions of earnings between two different groups. I am not able to use this approach because all beneficiaries in my sample face a kink.

policy change is:

$$u\left((1-\tau_0)\underline{z}'_{11}, \underline{z}'_{11}; \alpha^{m_{11}}\right) = u\left((1-\tau_0)z_1^*, z_1^*; \alpha^{m_{11}}\right) + \phi \tag{3}$$

Individuals with initial earnings in the range of $(\underline{z}_{10}, \underline{z}_{11}]$ continue bunching at z_1^* after the policy change. Figure 7 illustrates the bunching range at z_1^* after the policy change. The *bunching equation* at z_1^* after the policy change is approximated as:

$$B_{11} = \int_{\underline{z}_{10}}^{\underline{z}_{11}} h_0(\zeta)d(\zeta) \simeq (\underline{z}_{11} - \underline{z}_{10})h_0(z_1^*) \tag{4}$$

(1) to (4) together form two equations which jointly can pin down the adjustment cost and earnings elasticity.

I also present the marginal buncher and bunching equations at the new threshold at z_2^*, which I will use in the dynamic model to explore the evolution of bunching from the former to the new threshold. Panel (c) of Figure 6 illustrates a marginal buncher at z_2^* with ability α_2 and initial earnings at $\underline{z}_2 > z_2^*$. Once a kink at z_1^* was introduced, a marginal buncher relocated to $\underline{z}'_2$, which is their optimal earnings with marginal tax rate of τ_1. Once the exemption threshold is increased to z_2^*, they are indifferent between staying at $\underline{z}'_2$ with marginal tax rate of τ_1 or enduring adjustment cost ϕ and decreasing their earnings to bunch at z_2^*. The *marginal buncher* equation at z_2^* is:

$$u((1-\tau_0)z_2^*, z_2^*; \alpha^{m_2}) = u((1-\tau_0)z_1^* + (1-\tau_1)\underline{z}'_2, \underline{z}'_2; \alpha^{m_2}) + \phi \tag{5}$$

In the absence of adjustment cost, individuals with initial earnings in the range of $(z_2^*, z_2^* + \Delta z_2^*]$ would bunch at z_2^*. Adjustment cost attenuates the bunching at the kink and the bunching range shrinks to v from $iv + v$. Figure 7 shows that those with initial earnings in the range of $(\underline{z}_2, z_2^* + \Delta z_2^*]$ bunch at z_2^*. The *Bunching equation* at z_2^* is approximated as:

$$B_2 = \int_{\underline{z}_2}^{z_2^*+\Delta z_2^*} h_0(\zeta)d\zeta \approx (z_2^* + \Delta z_2^* - \underline{z}_2)h_0(z_2^*) \tag{6}$$

(5) and (6) together define an additional equation of adjustment cost and earnings elas-

ticity which I use for estimating the dynamic model.

3.2.2 Dynamic model

In the dynamic model, in addition to the adjustment cost and earning elasticity, I also estimate parameters indicating the cumulative probability of drawing zero adjustment cost by each period. These parameters are estimated by matching bunching at the former and new thresholds at each period.

A dynamic model incorporates the gradual evolution of bunching over time, as presented in Figure 3. It is essential to point out two key features of the data. First, there is a delayed response to the policy change. Second, there is a lack of anticipatory responses to the policy change, since there is no bunching at the new kink at pre-policy change periods (see Figure 3). As pointed out by Gelber et al. (2020), assuming that adjustment cost is drawn from a stochastic process where individuals do not anticipate the policy change could capture these two features of the data.[11] A discrete distribution captures, for instance, the stochastic arrival of job opportunities or information about the policy change. An individual may change their earnings in a given period only if the utility gain from the change is large enough to offset the drawn adjustment cost in that period. This would generate a gradual response to the policy change, observed as a gradual decrease in bunching at the former kink and a gradual increase in bunching at the new kink at post-policy change periods.

At period 0, individuals begin with their initial earnings, which is their optimal earnings under a linear tax rate of τ_0. At time one, a kink at z_1^* is introduced. The kink is implemented for T periods, after which it is moved to z_2^*. At time t, individuals draw adjustment cost from a discrete distribution $\{0, \phi\}$. I follow Gelber et al. (2020) and assume that the probability of drawing a positive adjustment cost at time t is a function of the time elapsed since the most recent policy change denoted as π_{t-t^*}. The probability of drawing a zero adjustment cost at time t is then $1 - \pi_{t-t^*}$. Individuals adjust their earnings only if the utility gain from adjusting their earnings exceeds the drawn adjust-

[11] Alternatively, individuals who anticipate the policy change could be forward-looking. See Gelber et al. (2020) for more details on a model with forward-looking agents.

ment cost. The cumulative probability of drawing a zero adjustment cost by period t is $1 - \Pi_{j=1}^{t}\pi_j$.

Bunching at z_1^* at pre-policy change period $t \in [1, T]$ is:

$$
\begin{aligned}
B_{10}^t &= \int_{\underline{z}_{10}}^{z_1^*+\Delta z_1^*} h_0(\zeta)d\zeta + (1 - \prod_{j=1}^{t} \pi_j) \int_{z_1^*}^{\underline{z}_{10}} h_0(\zeta)d\zeta \\
&= \int_{z_1^*}^{z_1^*+\Delta z_1^*} h_0(\zeta)d\zeta - \prod_{j=1}^{t} \pi_j \int_{z_1^*}^{\underline{z}_{10}} h_0(\zeta)d\zeta \\
&= B_{10}^* - \prod_{j=1}^{t} \pi_j (B_{10}^* - B_{10}) \\
&= \prod_{j=1}^{t} \pi_j B_{10} + (1 - \prod_{j=1}^{t} \pi_j) B_{10}^*
\end{aligned}
\tag{7}
$$

where B_{10}^* –specified in (C.2) in the Appendix– and B_{10} –specified in (2)– denote respectively the frictionless and immediate bunching after introducing the kink at z_1^*. The first line of (7) shows that bunching at z_1^* is composed of two components, added together. First, those in areas *ii* and *iii* in Figure 7 who immediately bunched once the kink was introduced, the same group as in the static model. Second, those in area *i* who would bunch only if they draw a zero adjustment cost. The probability that this occurs by period t is $1 - \prod_{j=1}^{j=t} \pi_j$.

Bunching at z_1^* at post-policy change period $t > T$ is:

$$
\begin{aligned}
B_{11}^t &= (1 - \prod_{j=1}^{T} \pi_j)(\prod_{j=1}^{t-T} \pi_j) \int_{z_1^*}^{\underline{z}_{10}} h_0(\zeta)d\zeta + \prod_{j=1}^{t-T} \pi_j \int_{\underline{z}_{10}}^{\underline{z}_{11}} h_0(\zeta)d\zeta \\
&= (1 - \prod_{j=1}^{T} \pi_j)(\prod_{j=t-T}^{t} \pi_j)(B_{10}^* - B_{10}) + \prod_{j=1}^{t-T} \pi_j \int_{\underline{z}_{10}}^{\underline{z}_{11}} h_0(\zeta)d\zeta
\end{aligned}
\tag{8}
$$

The first line of (8) shows that bunching at z_1^* consists of two components, added together. First, individuals in area *i* in Figure 7 who bunched once they drew a zero adjustment cost with probability of $1 - \prod_{j=1}^{j=T} \pi_j$ and they will de-bunch only when they drew a zero adjustment cost. The probability of not drawing a zero adjustment cost by period t is $\prod_{j=1}^{j=t-T} \pi_j$. Second, individuals in area *ii* who bunched immediately after the kink was introduced and they will de-bunch once they draw a zero adjustment cost.

Finally, bunching at the new kink at z_2^* at period $t > T$ is:

$$\begin{aligned} B_2^t &= \int_{\underline{z}_2}^{z_2^*+\Delta z_2^*} h_0(\zeta)d\zeta + (1 - \prod_{j=1}^{t} \pi_j) \int_{z_2^*}^{\underline{z}_2} h_0(\zeta)d\zeta \\ &= \prod_{j=1}^{t} \pi_j B_2 + (1 - \prod_{j=1}^{t} \pi_j) B_2^* \end{aligned} \tag{9}$$

where B_2^* –specified in (C.2) in the Appendix– and B_2 –specified in (6)– denote respectively the frictionless and immediate bunching after introducing the kink at z_2^*. The first line of (9) shows that bunching at z_2^* consists of two components, added together. First, those in area v in Figure 7 who immediately bunch once the kink at the z_1^* is introduced, the same group of bunchers as in the static model. Second, those in area iv who would bunch only if they draw a zero adjustment cost. The probability of such a draw by period t is $1 - \prod_{j=1}^{j=t} \pi_j$.

The static model corresponds to the special case of the dynamic model when there is only one time period with $\pi = 1$. This is the case when individuals never draw a zero adjustment cost. $\lim_{t\to\infty} B^t = B^*$ suggests that after a long enough time, bunching at a kink converges to its frictionless level.

4 Empirical implementation

I follow the previous literature and parametrize both static and dynamic models using a quasi-linear utility function as:[12]

$$u(c, z; \alpha) = c - \frac{\alpha}{1 + \frac{1}{e}} \Big(\frac{z}{\alpha}\Big)^{1+\frac{1}{e}} \tag{10}$$

where z and c denote respectively earnings and consumption, defined as disposable income[13] and e represents earnings elasticity with respect to the net-of-tax rate.

[12]Despite the limitations of a iso-elastic and quasi-linear utility function, convenience in estimation and expressing findings has made it quite popular in bunching literature (Chetty et al., 2011; Gelber et al., 2020; Kleven and Waseem, 2013; Bastani and Selin, 2014; Aghion et al., 2017). Kleven (2016) reviews all the recent studies on bunching where almost all of them use this utility function.

[13]In the absence of non-labor income, the disposable income is net-of-tax labor earnings defined as $c = z - T(z; \tau)$ where τ denotes the tax system.

I divide the data into three-month intervals (quarters), where each interval represents one time period. For instance, April 2012 to June 2012 represents the first period after the policy change. I use the data from one quarter before (January 2012–March 2012) and one quarter after (April 2012–June 2012) the policy change for estimating the static model. I use data from all quarters for estimating the dynamic model. However, since bunching at pre-policy change periods is quite stable (see Figure 3 and Figure 8), I pool all the per-policy periods into one period.[14]

I estimate bunching at a kink using a procedure described in detail in the Appendix. To do so, I set the bin size at $\delta = C\$10$ and fit a polynomial degree $D = 6$ to the observed distribution of earnings, where I exclude three bins at each side of the kink $l = u = 3$. Bunching at a kink is the difference between the fitted polynomial and the observed distribution of earnings.[15]

In the static model, the model results in two equations, which I numerically solve to pin down the two parameters of the model: earnings elasticity e and adjustment cost ϕ. In the dynamic model, I solve a non-linear system of seventeen equations to pin down eight cumulative probabilities of drawing zero adjustment cost in addition to e and ϕ.

4.1 Estimation assumptions

A crucial underlying assumption for using the amount of bunching at a kink to estimate structural parameters of a utility function is that the distribution of earnings would be smooth and continuous if a flat tax was imposed on earnings. Another key parametric assumption is that the earnings elasticity is the same for all individuals and does not change post-policy change. I also assume that individuals' ability is time-invariant and is the only source of heterogeneity in the models.

I assume that the induced income effects of the policy change are negligible, and use a quasi-linear utility function specified in (10) to parametrize my models. The annual

[14]The stable bunching at the former threshold at pre-policy change period could be because the threshold has been in place for a quite long time and all the adjustments have occurred before my study period.

[15]I investigate the robustness of the estimated bunching to the selected parameters in Table C.1 in the Appendix.

earnings of almost all of the beneficiaries fall in the lower bracket of the income tax schedule of the federal and provincial governments, which are exempted from income taxes. However, DI beneficiaries still have to contribute to the Employment Insurance (EI) – about 2–5% – which is relatively small compared to the marginal tax rates at the kinks. My estimates abstract from the income taxes and EI contributions.[16]

4.2 Inference

I use bootstrapped standard errors to make inference on the estimated parameters. I calculate standard errors using a parametric bootstrapping procedure described by Chetty et al. (2012). I draw 200 times with replacement from the estimated vector of errors ϵ_i from (B.3) to generate new earnings distributions. For each bootstrapped distribution, I then estimate the parameters of interest. I define the standard error of a parameter θ as the standard deviation of its bootstrapped distribution $S_{\widehat{\theta}}$. The standard error reflects the misspecification of the fitted polynomial to the observed distribution of earnings rather than sampling error.

To test whether an estimated parameter $\widehat{\theta}$ is significantly different from zero ($H_0 : \theta \neq 0$), I construct a t-test statistic $T = \frac{\widehat{\theta}}{S_{\widehat{\theta}}}$ for each bootstrapped distribution. The bootstrapped critical values at level β are the lower $\beta/2$ and the upper $\beta/2$ quantiles of the ordered bootstrapped test statistics. I then determine whether an estimate is significantly different from zero within a $100(1-\beta)$ confidence interval if the corresponding t-statistic lies within the critical values at level β.

4.3 Results

4.3.1 Static model

Figure 8 plots the estimated bunching at the former and new exemption thresholds during two years of pre- and two years of post-policy change periods (see Figure 3 for the corresponding distributions of earnings).[17] The horizontal axis denotes the month rela-

[16]Increasing marginal tax rates by 5% does not change the estimates. Estimates are available upon request.

[17]For details on the procedure for estimating bunching at a kink see the Appendix.

tive to the policy change, and the vertical axis denotes the estimated bunching. Panel (a) shows that the bunching at the former exemption threshold is quite stable at months before the policy change. The bunching gradually decreases in the months following the policy change, but it does not entirely disappear. Panel (b) shows that the bunching at the new threshold gradually increases. The gradual decrease in bunching at the former threshold and the gradual increase in bunching at the new threshold suggest that individuals face adjustment cost when changing their labor supply in response to changes in work incentives induced by the policy change.

Table 2 presents the estimates of earnings elasticity e and adjustment cost ϕ from the static model. These estimates capture the immediate responses to the policy change. Figure 2 plots the distribution of earnings and the fitted polynomials. The first row of the table presents the baseline estimates. The estimated adjustment cost is C$13.14, which is about 5% of the average monthly earnings in the study sample. The estimate of earnings elasticity is 0.20, which is twice the magnitude of the elasticity estimated with no adjustment using the method of Saez (2010).[18] The table also presents the estimates by age, gender, disability type, and location of residence. The estimates are quite heterogeneous, where the estimates of earnings elasticity are in the range of 0.09 to 0.33, and the estimates of adjustment cost vary between C$6.39 and C$51.08.

4.3.2 Dynamic model

Table 3 presents the estimates of earnings elasticity and adjustment cost from the dynamic model. These estimates capture the responses to the policy change within a two-year post-policy change period. The estimated adjustment cost is C$28.03 –about 10% of the average earnings in the sample– which is about twice the size of the estimate from the static model. The estimate of the earnings elasticity is 0.15, which is slightly smaller than the estimate from the static model. However, it is still larger than the estimate from the model with no adjustment cost. Figure 9 presents the estimates of the cumulative probability of drawing zero adjustment cost by each period. The cumulative probability

[18]See Table C.2 in the Appendix for the estimated earnings elasticities with no adjustment cost.

increases to about 0.75 two years after the policy change, which is in proportion with the emergence of bunching from the former to the new threshold. However, it does not reach to one since, as shown in Figure 3, there is still bunching at the former threshold two years after the policy change.

Table 3 also presents the estimates by age, gender, disability type and location of residence, but only for sub-groups with enough variation in bunching over time.[19] The estimated adjustment costs are between C$14.11 and C$42.99, which are relatively larger and are more heterogeneous than the estimates from the static model. The estimates of earnings elasticity are between 0.06 to 0.24, which are more homogeneous and smaller than the estimates from the static model, but still larger than the estimates with no adjustment cost.

Figure 9 shows that the cumulative probability of drawing zero adjustment cost is quite homogeneous across the sub-groups, increasing from 0 to about 0.75 during a two years post-policy change period, except for the group of 18–34 years old individuals and those with neurological disabilities which have the highest and the lowest estimates, respectively. The estimated probability for younger beneficiaries approaches to one since most of the individuals bunching at the former threshold de-bunch within a two-year post-policy change period (see Figure C.4). The estimated probability for those with neurological disabilities approaches only to 0.5 since there is a considerable amount of bunching at the former threshold two years after the policy change (see Figure C.5).

The estimates of the earnings elasticity, from both static and dynamic models, are larger than the estimates from the model without adjustment cost, suggesting that adjustment cost can attenuate both immediate and longer-run responses to work incentives induced by a policy change.

[19]There is not enough variation in the bunching for those above 50 years old, those with mental disabilities (relatively larger estimated elasticity in the static model). Those with higher elasticity de-bunch quickly after the policy change, and there is not much variation in periods following the policy change. Those with much smaller elasticity do not de-bunch, and therefore there is not much bunching at periods following the policy change. Therefore estimating a dynamic model for these groups is not feasible.

5 Conclusion and discussion

Many countries have recently implemented – or are considering to implement – policies aimed at increasing the labor supply of DI beneficiaries to decrease the cost of their programs. These policies involve increasing incentives to work, but findings on the effectiveness of such policies are mixed. I investigate whether adjustment cost which individuals face when changing their labor supply could explain these mixed findings. I provide the first estimate of adjustment cost in the context of a DI program by exploiting a policy change that substantially increased work incentives by increasing the exemption threshold. I document strong responses to work incentives as individuals bunch at the exemption threshold, where the marginal tax on earnings is lower. A puzzling observation is that individuals continue bunching at the former threshold after the policy change. This finding suggests that they face adjustment cost when changing their labor supply. I use the bunching at the former and the new thresholds to estimate adjustment cost and earnings elasticity –both static and dynamic models– using the method of Gelber et al. (2020).

My findings show that adjustment cost can greatly attenuate responses to large work incentives induced by a policy change. The estimates of earnings elasticity after accounting for adjustment cost are larger than the estimate without adjustment cost. Policies designed to increase labor supply will work if the work incentives are large enough to offset the adjustment cost. Accounting for adjustment cost then might explain the disparate findings on the effects of an increase in work incentives on the labor supply of beneficiaries of DI programs. My findings have important implications for designing policies and targeting heterogeneous groups in DI programs to increase the labor supply. Furthermore, effectiveness of the policies that aim to increase labor supply of DI beneficiaries would depend on the size of the induced incentives to work versus the size of adjustment cost that DI beneficiaries face when changing their labor supply. Individuals will increase their labor supply if the utility gain from the change in their labor supply is larger than the adjustment cost they face.

Bunching estimates use the information on the change in the distribution of earnings around an exemption threshold caused by a policy change to recover parameters of interest. These estimates, therefore, are local and provide an incomplete picture of the effects of the policy change on the labor supply, as they mostly capture the intensive margin effects. The policy change in AISH also decreased the marginal tax rate on earnings far away from the exemption threshold, and the overall intensive margin responses to the policy change could be larger. The policy change might also have extensive margin effects as some individuals might start working (Gelber et al., 2018).[20]

I use a sample of DI recipients who bunch at an exemption threshold. These individuals are relatively more flexible –and possibly more able (Bastani and Waldenström, 2020)– than the others in changing their labor supply. They might have better chances of finding a new job or stronger bargaining power in negotiating their wage or hours of work with a current employer. Evidence on the existence of adjustment cost, even for them, magnifies the importance of the adjustment cost in DI programs.

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[20] I investigate the effects of the policy change in AISH on the labor supply of the benefit recipients using a Regression Discontinuity Design (RDD). I explore the sharp discontinuity in the increase in work incentives at the month of the policy change. I document that large incentives to work could induce beneficiaries to increase their labor supply both in intensive and extensive margins (Zaresani, 2018).

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Tables

Table 1: Summary statistics

	Two years of pre-policy change	Two years of post-policy change
Labor market statistics		
Positive earnings (%)	48.1	48.4
Mean monthly earnings	255	285
(2012 C$)	(420)	(470)
Mean monthly net benefits	1,160	1,530
(2012 C$)	(120)	(150)
Number of new entrants	1,215	636
Individual characteristics		
Male (%)	55.3	55.4
Mean age (years)	38.5	39.8
	(12.5)	(12.8)
Mean age when	28.8	29.1
entered program	(11.1)	(11.4)
No dependent	91.3	90.8
Type of disability		
-Psychotic (%)	42.1	42.1
-Neurological (%)	50.1	51.0
-Mental (%)	7.3	6.9
Metropolitan area resident (%)	49.5	48.9
Mean number of individuals	8,940	9,890
Total number of observations	214,595	237,285

Notes: This table presents summary statistics of AISH beneficiaries between April 2010–March 2014. According to the confidentiality guidelines, mean monthly earnings and DI payments are inflation-adjusted (2012 C$) and rounded to the closest five. The metropolitan area includes Calgary and Edmonton. The standard deviation of the continuous variables are provided in the parenthesis.

Table 2: Estimates of earnings elasticity and adjustment cost from static model

	Earnings elasticity e	Adjustment cost ϕ
Base estimate	0.202***	13.137***
	(0.021)	(1.396)
A. Age		
18-34 years	0.154***	11.714***
	(0.011)	(1.018)
35-49 years	0.238***	15.308***
	(0.042)	(2.695)
Above 50 years	0.235***	13.872***
	(0.069)	(4.589)
B. Gender		
Male	0.240***	16.999***
	(0.035)	(2.685)
Female	0.164***	9.420***
	(0.047)	(4.459)
C. Disability type		
Psychotic	0.258***	16.480***
	(0.056)	(3.602)
Neurological	0.183***	12.531***
	(0.017)	(1.225)
Mental	0.657**	51.081**
	(0.236)	(22.734)
D. Location of residence		
Metropolitan area	0.338**	22.85*
	(0.053)	(13.966)
Other	0.094***	6.349***
	(0.009)	(0.696)

Note: This table presents the estimated earnings elasticities and adjustment cost from the static model. The estimates capture immediate responses to the policy change using the data from three months of pre- and three months of post-policy change period. The bootstrapped standard errors are in the parenthesis.
$*p < 0.10, **p < 0.05, ***p < 0.01$

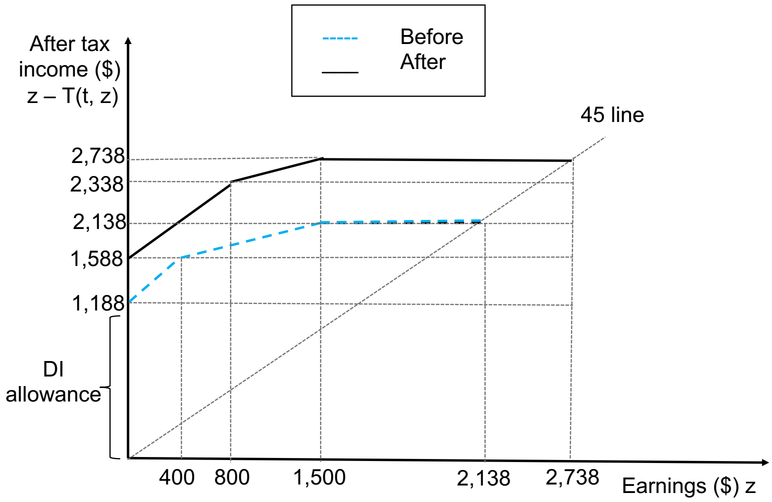
Table 3: Estimates of earnings elasticity and adjustment cost from dynamic model

	Earnings elasticity e	Adjustment cost ϕ
Base estimate	0.152	28.026***
	(0.0009)	(1.603)
A. Age		
18-34 years	0.130***	30.534***
	(0.008)	(2.348)
35-49 years	0.134***	17.528***
	(0.080)	(4.697)
B. Gender		
Male	0.134***	18.438***
	(0.009)	(1.294)
Female	0.133***	18.407***
	(0.009)	(1.292)
C. Disability type		
Psychotic	0.135***	21.292***
	(0.013)	(2.500)
Neurological	0.178***	31.349***
	(0.011)	(1.885)
D. Location of residence		
Metropolitan area	0.238***	42.999***
	(0.024)	(3.846)
Other	0.066***	14.109***
	(0.006)	(1.504)

Note: This table presents the estimated earnings elasticities and adjustment cost from the dynamic model. The estimates capture longer-run responses to the policy change using the data from two years before and two years after the policy change. The bootstrapped standard errors are in the parenthesis.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Figures

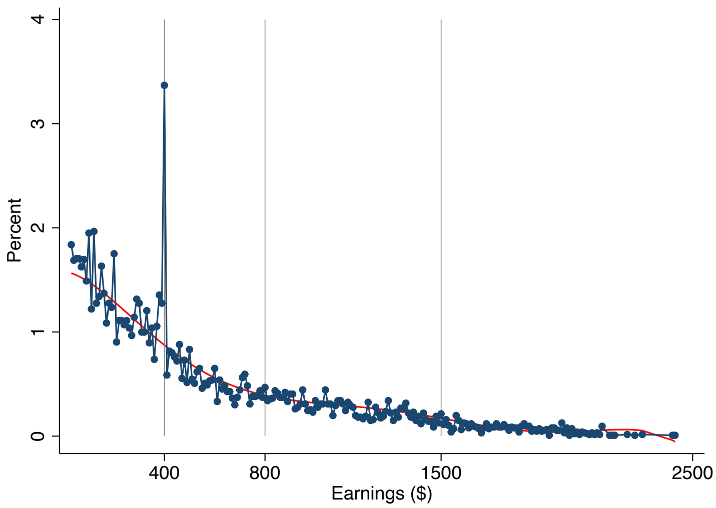
Figure 1: Budget constraint



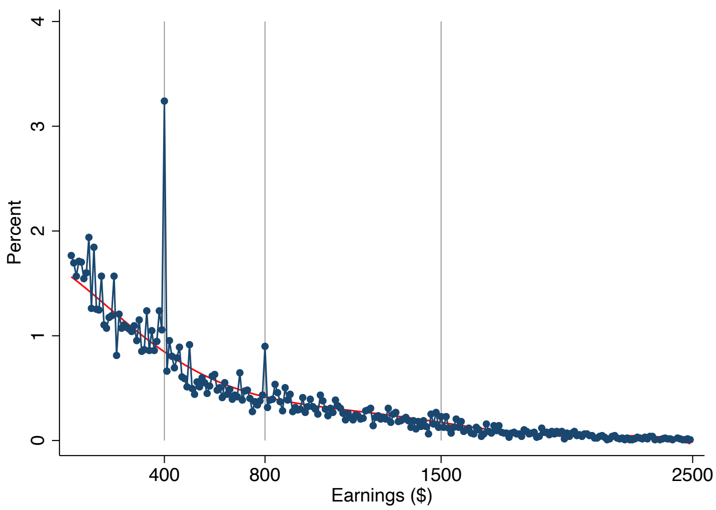
Note: This figure plots the budget constraint of the beneficiaries with no dependent before and after the policy change.The horizontal axis represents the monthly earnings, and vertical axis is the after tax income. The implicit marginal taxes at each bracket are respectively zero, 50% and 100%.

Figure 2: Distribution of earnings

(a) Before policy change



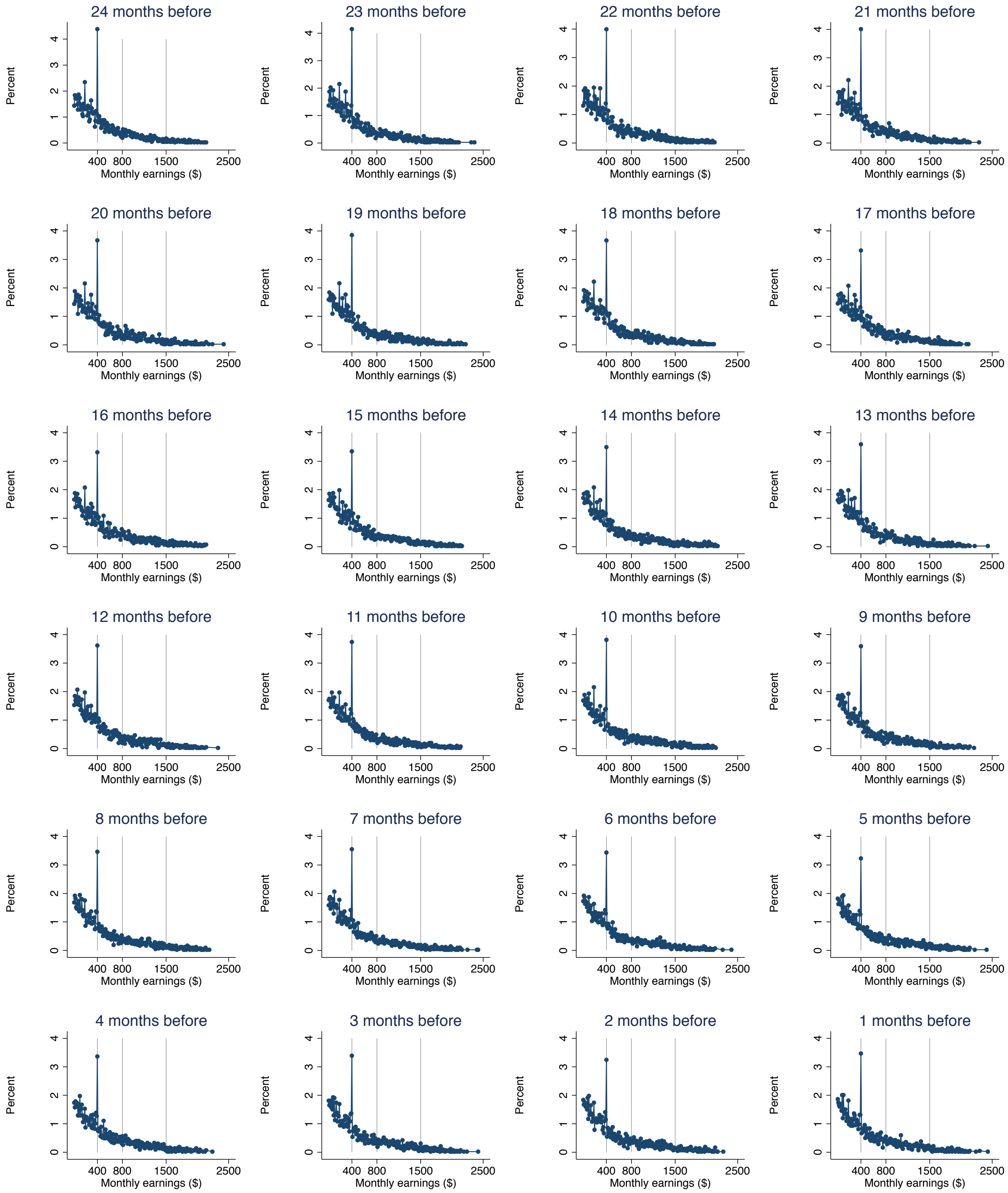
(b) After policy change



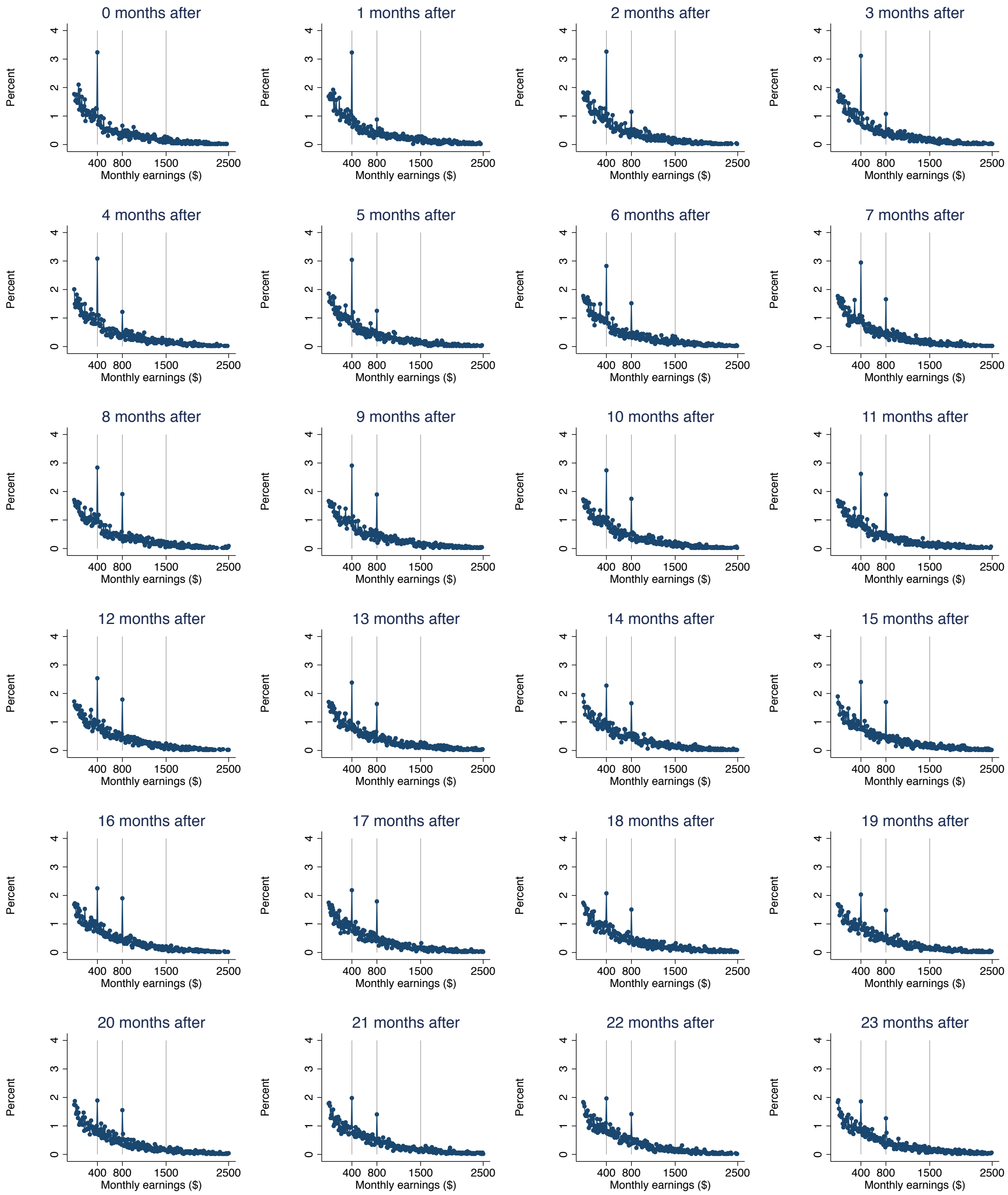
Note: This figure plots the distribution of the earnings of the beneficiaries in the study sample. Panel (a) plots the pooled data from January 2012–March 2012 and Panel (b) plots the pooled data from April 2012–June 2012. The red line is the fitted polynomial of degree $D = 6$ with bin size $\delta = 10$ and excluding three bins at each side of the kink ($l = u = 3$). There is sharp bunching at the exemption thresholds.

Figure 3: Dynamics of earnings distribution

(a) Before policy change

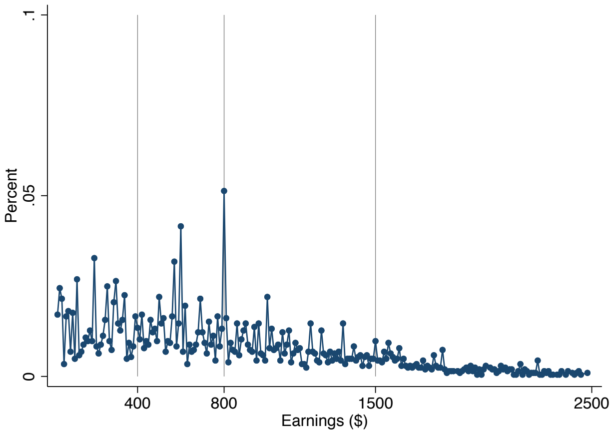


(b) After policy change



Note: This figure plots the earnings distribution of the beneficiaries in the study sample before and after the policy change with bin size $\delta = \$10$. There is bunching at the exemption threshold every month before the policy change, which is quite stable in pre-policy change months. The bunching gradually moves to the new exemption threshold at post-policy change months, but some individuals continue to bunch at the former threshold. There is no noticeable bunching at the second kink either before or after the policy change.

Figure 4: Earnings distribution of individuals entered into the program after the policy change

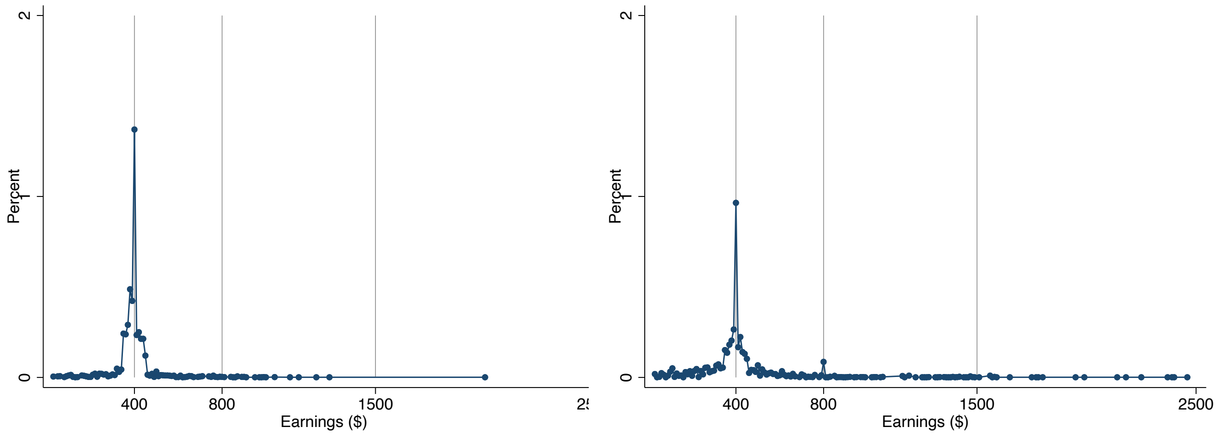


Note: This figure plots the earnings distribution of the beneficiaries who entered into the program after the policy change. There is no clear bunching at the former threshold, suggesting that the bunching at the former threshold in Panel (b) of Figure 2 is not because of the overlapping threshold from other programs. I exclude these new entrant beneficiaries from my study sample.

Figure 5: Earnings distribution of individuals bunching at the former threshold

(a) Before policy change

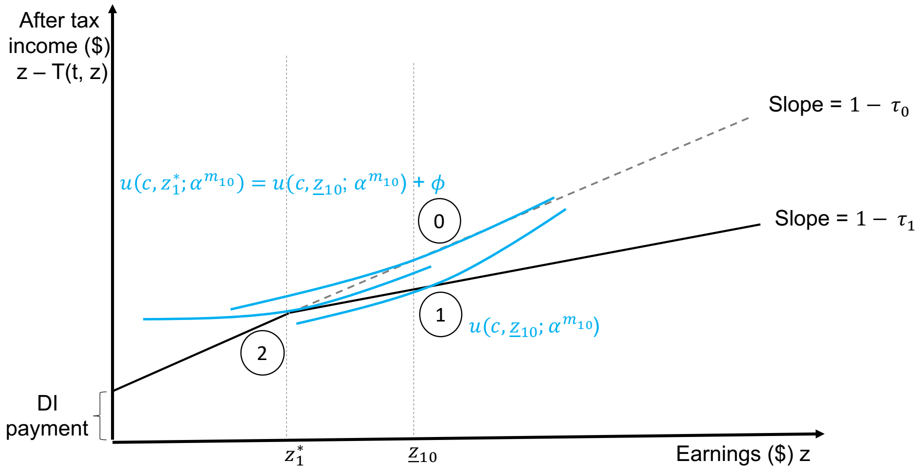
(b) After policy change



Note: This figure plots the earnings distribution of individuals whose earnings during one year before the policy change has been between C$350 and C$450 at least for six months. About 12% of the observations post-policy change is zero. The figure suggests that bunchers at the former threshold post-policy change are mostly those who also bunched there pre-policy change. Excluding zero earnings does not change the finding.

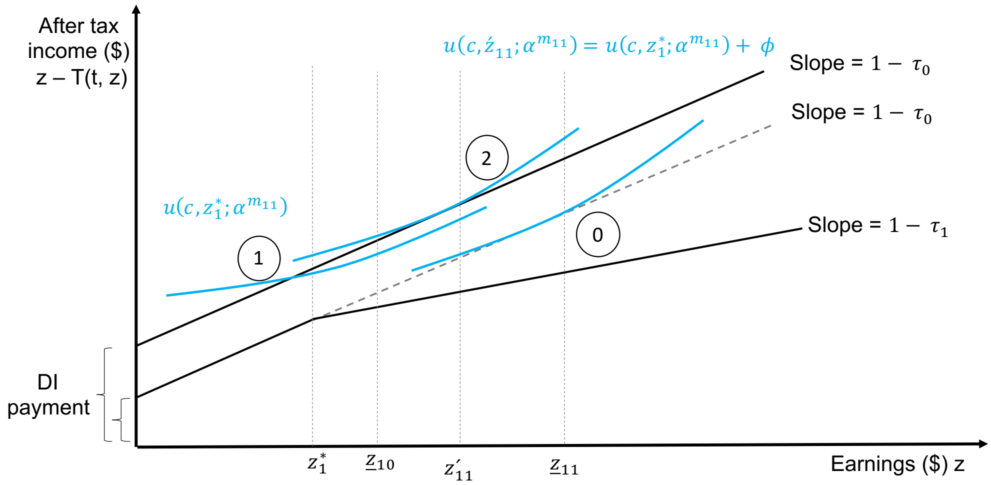
Figure 6: Earnings reponses of marginal buncher

(a) Former threshould before policy change



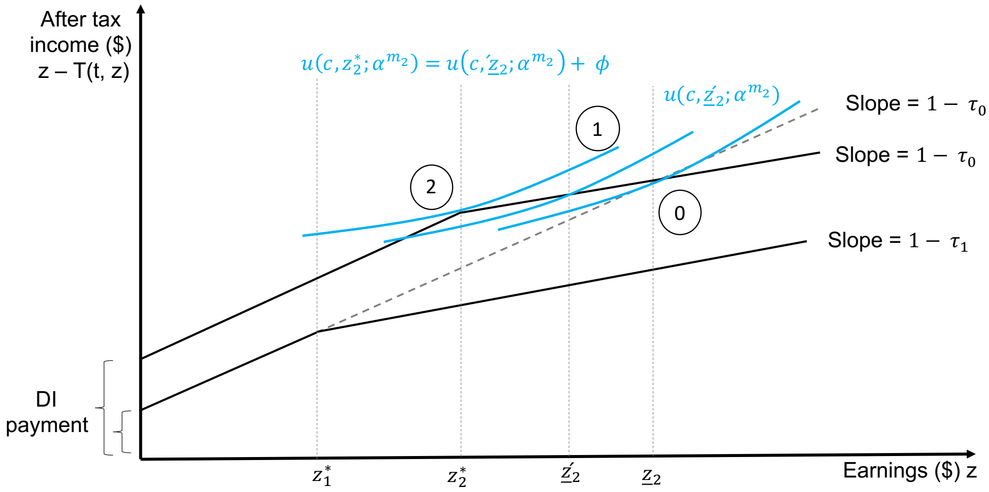
Note: This figure illustrates the change in the earnings of a marginal buncher at the former threshold z_1^* with ability $\alpha^{m_{10}}$ and initial earnings $\underline{z}_{10}$ before the policy change. They are indifferent between staying at $\underline{z}_{10}$ with a higher marginal tax rate of τ_1 or enduring adjustment cost ϕ and bunching at z_1^* with a lower marginal tax rate of τ_0.

(b) Former threshould after policy change



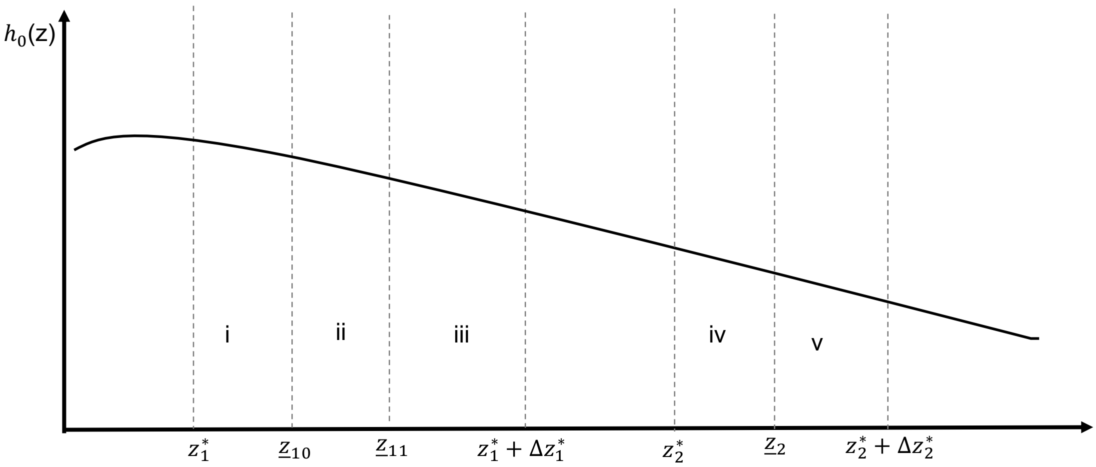
Note: This figure illustrates the change in the earnings of a marginal buncher with ability $\alpha^{m_{11}}$ and initial earnings $\underline{z}_{11}$ at the former threshold at z_1^* after the policy change. When a kink at z_1^* is introduced, they bunch at the kink. When the policy change increased the exemption threshold to z_2^*, they are indifferent between continuing to bunch at z_1^* or enduring adjustment cost ϕ and increasing their earnings to their optimal level of earnings with the new taxes at z'_{11}.

(c) New threshould



Note: This figure illustrates the change in the earnings of a marginal buncher with ability α^{m_2} and initial earnings $\underline{z}_2$ at the new threshold at z_2^*. After introducing a kink at z_1^*, they decrease their earnings to $\underline{z}_2'$. When the threshold is increased to z_2^*, they are indifferent between staying at $\underline{z}_2'$ with a higher tax rate of τ_1 or enduring adjustment cost ϕ and bunching at z_2^* with a lower marginal tax rate of τ_0.

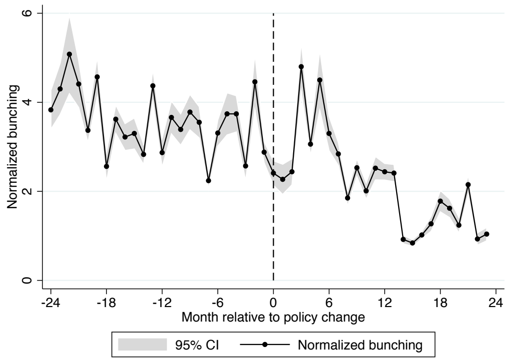
Figure 7: Counter-factual earnings distribution



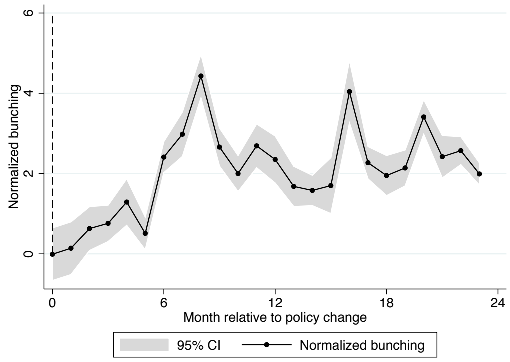
Note: This figure illustrates the counter-factual distribution of earnings and bunching ranges at z_1^* and z_2^* kinks. The bunching range at z_1^* in the absence of adjustment cost is $i + ii + iii$. If individuals face adjustment cost the bunching range shrinks to $ii + iii$. Post-policy change bunching at z_1^* is ii. Similarly, the bunching ranges at z_2^* without and with adjustment cost are respectively $iv + v$ and v.

Figure 8: Dynamics of bunching

(a) Former threshould

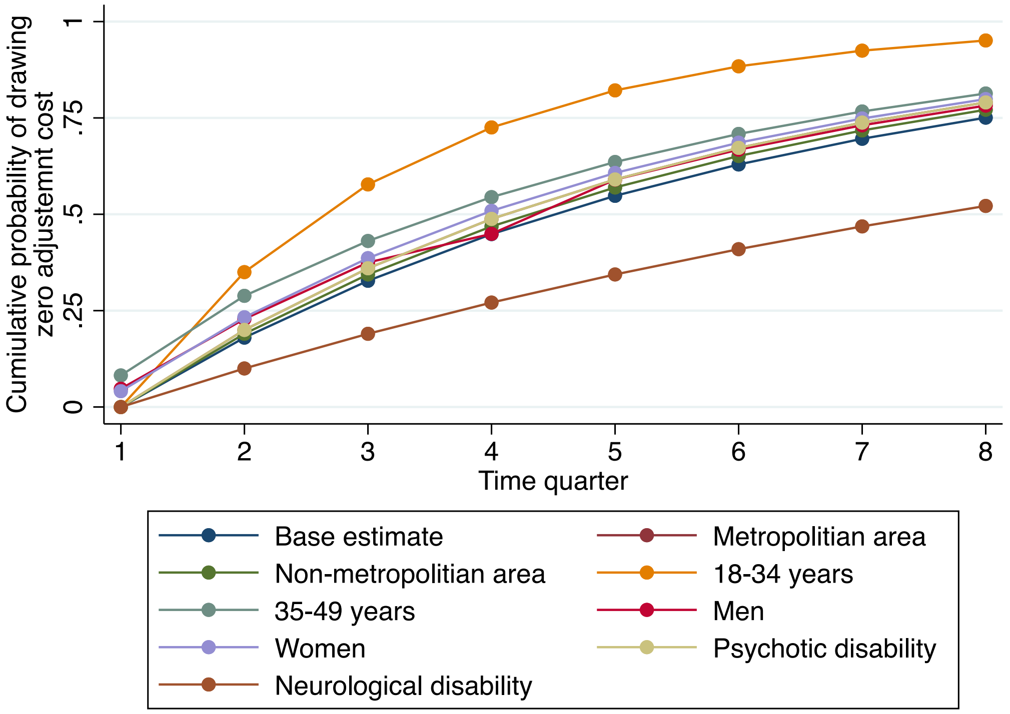


(b) New threshould



Note: This figure plots the estimated bunching at the former and new thresholds by the month relative to the policy change using the procedure described in the Appendix. The estimation parameters are set to $\delta = 10$, $D = 6$ and $l = u = 3$. Bunching at the former threshold at C\$400 is quite stable before the policy change but then gradually decreases in the months following the policy change. There is no bunching at the new threshold at C\$800 before the policy change, and the bunching gradually increases in the months following the policy change. The 95% Confidence Intervals (CI) from bootstrapped standard errors are shown in gray.

Figure 9: Estimates of cumulative probability of drawing zero adjustment cost



Note: This figure plots the estimates of cumulative probability of drawing zero adjustment cost following the most recent policy change –denoted as $1 - \Pi_{j=1}^{t}\pi_j$ from the dynamic model– for sub-samples with enough variation in bunching. The corresponding estimated adjustment cost and earnings elasticity are presented in Table 3. Using bootstrapped standard error, all the estimates are significant at %1.

Appendix

A A conceptual framework

I borrow a model from Chetty et al. (2011) to show how adjustment cost might affect individuals' labor supply decisions when a policy change increases work incentives.

Assume that individuals with ability α choose their earnings z to maximize their utility $u(c, z; \alpha)$. c denotes consumption which is net-of-tax earnings and DI payment b added together, denoted as $c = z - T(z; \tau) + b$. τ denotes a tax schedule with a kink at z^*. The marginal tax rate on earnings below and above z^* are respectively τ_0 and τ_1 where $\tau_0 < \tau_1$. Individuals have incentive to locate right at or below the kink as the marginal tax rate is lower.

A policy change increases work incentives by reducing the marginal tax rate above z^* to τ_2 where $\tau_2 < \tau_1$. Panel (a) of Figure C.3 illustrates an individual with initial earnings at z^* and ability α. If they do not face any adjustment cost when changing their earnings, they increase their earnings to z', which is their optimal earning with the new taxes.

Suppose individuals face adjustment cost when changing their earnings which is realized as dis-utility ϕ. Panel (b) of Figure C.3 illustrates an individual with initial earnings z^* in the range of $(\underline{z}, \bar{z})$ around z^* where $\underline{z}$ and $\bar{z}$ denote earnings of individuals who might not change their earnings in response to a tax reduction above the kink, described as below:

$$u(c, z^*; \alpha) - u(c, \underline{z}; \alpha) = \phi \quad \text{with } \underline{z} < z^* \tag{A.1}$$

$$u(c, z^*; \alpha) - u(c, \bar{z}; \alpha) = \phi \quad \text{with } \bar{z} > z^* \tag{A.2}$$

For individuals who do not adjust their earning, the utility gain from changing the earnings is not large enough to offset the adjustment cost. Those with initial earnings above $\bar{z}$ might increase their earnings as their utility gain might offset the adjustment cost that they face.

Panel (c) of Figure C.3 illustrates a case where the monthly DI payment is increased by ψ in addition to a reduction in the marginal tax rate above z^*. If the income effects of the policy change are negligible, then the DI payment increase might offset the adjustment cost, and therefore, more people increase their earnings.

This simple framework illustrates that work incentives induced by a policy change would increase labor supply if the induced work incentives are large enough to offset the adjustment cost.

B Estimating bunching at a kink

I follow Chetty et al. (2011) and Kleven and Waseem (2013) to construct a counter-factual distribution of earnings $h_0(.)$ by fitting a polynomial to the observed empirical distribution of earnings $h(.)$, excluding an eye ball picked range around the kink. I first divide the observed monthly earnings into z_i bins with width δ where p_i is portion of individuals with earnings in the range of $[z_i - \delta/2, z_i + \delta/2]$. I then fit a flexible polynomial of degree D to the observed distribution of earnings at a neighbourhood of $Q = [Q^l, Q^u]$ of z^* by estimating the following regression:

$$p_i = \sum_{d=0}^{D} \beta_d (z_i - z^*)^d + \sum_{j=-l}^{l} \gamma_j \mathbb{1}\{z_i - z^* = \delta j\} + \epsilon_i \tag{B.1}$$

where $\mathbb{1}(.)$ is the indicator function denoting dummies for the bunching bins around the kink in the range of $[z^* - \delta l, z^* + \delta u]$. l and u indicate the number of excluded bins respectively below and above the kink which are chosen by visual inspection of $h(.)$. These dummies isolate the effects of the bunching bins on the estimated counter-factual distribution of earnings. The estimated $h_0(.)$ is the fitted value from (B.1) where the contribution of the bunching bins around the kink is excluded and is defined as $\widehat{p_i} = \sum_{d=0}^{D} \beta_d (z_i - z^*)^d$. An initial estimate of bunching at z^* is:

$$B = \delta \sum_{j=l}^{u} (p_j - \widehat{p_j}) = \delta \sum_{j=l}^{u} \gamma_j \tag{B.2}$$

However (B.2) overestimates the true amount of bunching at a kink since it does not account for the fact that those who bunch at a kink would have located at points to the right of the threshold if flat tax τ_0 had been imposed. Furthermore, when a kink is shifted forward, those who bunch at the new kink have moved from points to the left of the threshold. Therefore, the area under the estimated counter-factual distribution is not equal to the area under the observed empirical distribution (called integration constraint in Chetty et al., 2011). I use a technique proposed by Chetty et al. (2011) and shift the estimated counter-factual distribution iteratively until the integration constraint holds. I shift the estimated counter-factual earnings distribution around the former kink at z_1^* to the right. I also shift the estimated counter-factual earnings distribution around the new kink at z_2^* to the left. To do this, I estimate the following equations recursively where n denotes the iteration counter:

$$\begin{aligned} p_i \cdot (1 + \mathbb{1}\{i > u_1\} \frac{\widehat{B_1}^{n-1}}{\sum_{q>u_1} p_q}) &= \sum_{d=0}^{D} \beta_d^n (z_i - z_1^*)^d + \sum_{j=l_1}^{u_1} \gamma_j^n \mathbb{1}\{z_i - z_1^* = \delta j\} + \epsilon_i \\ p_i \cdot (1 + \mathbb{1}\{i < l_2\} \frac{\widehat{B_2}^{n-1}}{\sum_{q<l_2} p_q}) &= \sum_{d=0}^{D} \beta_d^n (z_i - z_2^*)^d + \sum_{j=l_2}^{u_2} \gamma_j^n \mathbb{1}\{z_i - z_2^* = \delta j\} + \epsilon_i \end{aligned} \tag{B.3}$$

The stop criteria for the recursion is that the area under the estimated counter-factual distribution be equal to the area under the empirical one as $\sum_{i\in Q} p_i = \sum_{i \in Q} \widehat{p}_i$. The estimated bunching at z^* at step n of the recursion is $B^n = \delta \sum_{j=l}^{u} (p_j - \widehat{p}_j) = \delta \sum_{j=l}^{u} \gamma_j^n$. The estimated counter-factual distribution of earnings at z^* using (B.3) is $h_0(z)$:

$$\begin{aligned} h_0(z) &= \sum_{d=0}^{D} \beta_d (z - z^*)^d \\ h_0(z^*) &= \beta_0 \end{aligned} \tag{B.4}$$

I normalize the estimated bunching B by dividing it by the counter-factual mass at z^* bin from (B.4) to obtain a comparable measure of bunching within the kinks. The normalized bunching b at z^* is defined as:

$$\widehat{b} = \frac{B}{h_0(z^*)} = \frac{B}{\beta_0} \tag{B.5}$$

C Emprical implementation

C.1 Model with no adjustment cost

The model for estimating earnings elasticity with no adjustment cost (Saez, 2010) is a base for the model with adjustment cost. It explores an assumed proportional relationship between earnings elasticity and bunching at a kink. Individuals differ only in their ability to work, denoted by α, which is assumed to have a smooth distribution, implying a smooth distribution of earnings with linear taxes. Individuals choose their earnings z to maximize their iso-elastic utility specified in (10).[21]

The utility maximizer level of earnings for an individual with ability α under a linear marginal tax τ_0 is $z_\alpha = \alpha(1-\tau_0)^e$. Setting $\tau_0 = 0$ implies $z_\alpha = \alpha$, denoting ability as potential (counter-factual) earnings.

Suppose there is a kink at z^* where the marginal tax on earnings above and below the kink are respectively τ_0 and τ_1 where $\tau_0 < \tau_1$. The smooth distribution of ability implies that individuals with ability $\alpha \in [\frac{z^*}{(1-\tau_0)^e}, \frac{z^*}{(1-\tau_1)^e}]$ who would have located in the bunching range $(z^*, z^* + \Delta z^*]$ in the absence of the kink, bunch in a neighbourhood of z^*. Δz^* is the earnings response range at the z^* and is defined as:

$$\Delta z^* = z^*\Big((\frac{1-\tau_0}{1-\tau_1})^e - 1\Big) \tag{C.1}$$

Suppose $h_0(.)$ is the counter-factual distribution of earnings (with a flat tax rate τ_0). Bunching at z^* is the area under the counter-factual distribution of earnings in the bunching range. Assuming that $h_0(.)$ in the bunching range is uniform, bunching at a kink at z^* is defined as:

$$B^* = \int_{z^*}^{z^*+\Delta z^*} h_0(\zeta)d\zeta \simeq \Delta z^* h_0(z^*) \tag{C.2}$$

Appendix B provides a method for estimating counter-factual earnings and bunching at a kink. Δz^* and B^* together define earnings elasticity as $e = \frac{\Delta z^*/z^*}{(\tau_1-\tau_0)/(1-\tau_0)}$.

I use the earnings distribution from the pooled data from three months prior to the

[21] Individuals can choose hours of work h for a given wage w where earnings are $z = wh$.

policy change (January 2012 to March 2012) to estimate earnings elasticity with no adjustment cost using bunching at the exemption threshold at $z_1^* = \$400$. I first fit a degree 6 ($D = 6$) polynomial to the binned distribution of earnings ($\delta = \$10$) around the kink excluding three bins on each side of the kink ($l = u = 3$) using the regression specified in (B.3). The red line in Panel (a) of Figure 2 plots the fitted polynomial. I then estimate the bunching at the kink from (B.2). I back up Δz_1^* from (C.2) by feeding in the estimated B^* and $h_0(z_1^*)$. Substituting Δz^* in $e = \frac{\Delta z^*/z^*}{(\tau_1-\tau_0)/(1-\tau_0)}$ results into the elasticity of earnings with respect to net-of-tax rates defined as below where τ_0 and τ_1 denote the marginal tax rates below and above the kink.

$$e = \frac{\ln(1 + \frac{\delta b}{z_1^*})}{\ln(\frac{1-\tau_0}{1-\tau_1})} \tag{C.3}$$

I estimate the standard errors using the method explained in Section 4.2 to make an inference about the estimations. The estimates are presented in Table C.2.

C.2 Static model with adjustment cost

The initial earnings of a marginal buncher at z_1^* pre-policy change is $\underline{z}_{10}$. Using the utility function specified in (10) and the utility maximizing level of earnings $z_\alpha = \alpha(1-\tau)^e$, the ability of the marginal buncher is:

$$\alpha^{m_{10}} = \frac{\underline{z}_{10}}{(1-\tau_0)^e} \tag{C.4}$$

Feeding (C.4) into the marginal buncher equation presented in (1) using the utility function specified in (10) results in an equation which implicitly defines $\underline{z}_{10}$ as a function of the elasticity of earnings e and adjustment cost ϕ:

$$(1-\tau_1)(\underline{z}_{10} - z_1^*) - \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_{10} - {z_1^*}^{1+\frac{1}{e}}\underline{z}_{10}^{-\frac{1}{e}}\right) + \phi = 0 \tag{C.5}$$

Feeding Δz_{10}^* from (C.1) and the estimated B_{10} into the bunching equation specified in

(2) results in:

$$\underline{z}_{10} = \left(\frac{1-\tau_0}{1-\tau_1}\right)^e z_1^* - \delta b_{10} \tag{C.6}$$

where b_{10} is defined in (B.5). Together (C.5) and (C.6) describe an equation of e and ϕ.

I use post-policy change bunching at z_1^* to construct another equation of e and ϕ. $\underline{z}_{11}$ is the initial earnings of a marginal buncher at z_1^* with ability $\alpha^{m_{11}}$ which using the utility function specified in (10) is defined below:

$$\alpha^{m_{11}} = \frac{\underline{z}_{11}}{(1-\tau_0)^e} \tag{C.7}$$

Feeding (C.7) into the marginal buncher equation defined in (3) using the utility function specified in (10) results into:

$$(1-\tau_0)\left(z_1^* - \frac{1}{1+\frac{1}{e}}\underline{z}_{11}{}^{-\frac{1}{e}} z_1^{*1+\frac{1}{e}} - \frac{\underline{z}_{11}}{1+e}\right) + \phi = 0 \tag{C.8}$$

Feeding the estimated B_{11} into bunching condition defined in (4) results in:

$$\underline{z}_{11} = \underline{z}_{10} + \delta b_{11} \tag{C.9}$$

where b_{11} is defined in (B.5). Together (C.8) and (C.9) describe another equation of e and ϕ.

I use the pooled distribution of earnings from January 2012 to June 2012 (three months of pre- and three months of post-policy change) to estimate bunching at $z_1^* = \$400$ kink before (B_{10}) and after (B_{11}) the policy change using the procedure described in Section B. I set the parameters as $\delta = \$10, D = 6, l = u = 3$. Table C.1 presents the estimates of bunching using different parameters. Figure 2 plots the earnings distribution and the fitted polynomials. I solve (C.5) , (C.6), (C.8) and (C.9) numerically to pin down the earnings elasticity e and adjustment cost ϕ. I use the method explained in Section 4.2 to estimate standard errors and make an inference about the estimated parameters. The estimates are presented in Table 2.

C.3 Dynamic model with adjustment cost

The dynamic model explores the evolution of bunching from the former threshold at z_1^* to the new one at z_2^* with marginal tax rates of τ_0 and τ_1 respectively below and above the threshold where $\tau_0 < \tau_1$. $\underline{z}_2$ is the initial earnings of a marginal buncher with ability α^{m_2} which using the utility function specified in (10) is defined as below:

$$\alpha^{m_2} = \frac{\underline{z}_2}{(1-\tau_1)^e} \tag{C.10}$$

Feeding (C.10) into the marginal buncher equation defined in (C.11) using the utility function specified in (10) results into:

$$(1-\tau_1)\left(\frac{\underline{z}_2}{1+e}\left(\frac{1-\tau_1}{1-\tau_0}\right)^e - z_2^*\right) + \frac{1-\tau_0}{1+\frac{1}{e}}\left(\underline{z}_2^{-\frac{1}{e}} z_2^{*1+\frac{1}{e}}\right) + \phi = 0 \tag{C.11}$$

Feeding the estimated B_2 into the bunching condition defined in (6) results in:

$$\underline{z}_2 = \left(\frac{1-\tau_0}{1-\tau_1}\right)^e z_2^* - \delta b_2 \tag{C.12}$$

where b_2 is defined in (B.5). Together (C.11) and (C.12) define another equation of e and ϕ.

I use the data from March 2010 to April 2014 (two years pre- and two years of post-policy change period) for estimating the dynamic model. I divide the data into quartets (three-month intervals) where each interval represents one time period in the model. Since there is not much change in bunching at the former threshold pre-policy change, I pool all the pre-policy change quarters into one. To estimate a dynamic model, first, I estimate bunching at each kink at each period using the procedure described in Appendix B and parameters set above. Then I build a marginal bunching equation at each kink at each period as described above. I then construct bunching equations at each kink and each time period from (7), (8) and (9). This results into a system of equations with e, ϕ and $\Pi_{j=1}^t \pi_j$ as unknowns. The estimates are presented in Table 3 and Figure 9.

C.4 Tables

Table C.1: Robustness of estimates of bunching to the selected parameters

Bin size ($) δ	Degree of fitted polynomial D	Number of excluded bins at each side $l = u$	Bunching at $400 kink before policy change b_{10}	Bunching at $400 kink after policy change b_{11}	Bunching at $800 kink after policy change b_2
			Panel A: Base estimate		
10	6	3	2.920***	1.950***	1.880***
			(0.227)	(0.107)	(0.389)
			Panel B: Robustness to bin size		
5	6	6	3.460***	1.430***	0.730***
			(0.353)	(0.172)	(0.197)
15	6	2	1.020***	0.640***	0.310***
			(0.065)	(0.059)	(0.073)
			Panel C: Robustness to degree of fitted polynomial		
10	5	3	2.030***	1.400***	0.650*
			(0.131)	(0.113)	(0.408)
10	7	3	1.650***	0.880***	0.420*
			(0.115)	(0.092)	(0.327)
			Panel D: Robustness to the number of excluded bins		
10	6	2	1.860***	1.170***	0.750***
			(0.126)	(0.108)	(0.304)
10	6	4	0.760***	0.710***	-0.060
			(0.086)	(0.098)	(0.214)

Note: This table presents the estimated bunching at the kinks to the selected parameters using the procedure explained in Appendix B. The selected parameters include the bin size, degree of the fitted polynomial, and the number of excluded bins around a kink. Since changing the bin size also changes the number of excluded bins, the number of the excluded bins are also changed accordingly. The bootstrapped standard errors are in the parenthesis.
$*p < 0.10, **p < 0.05, ***p < 0.01$

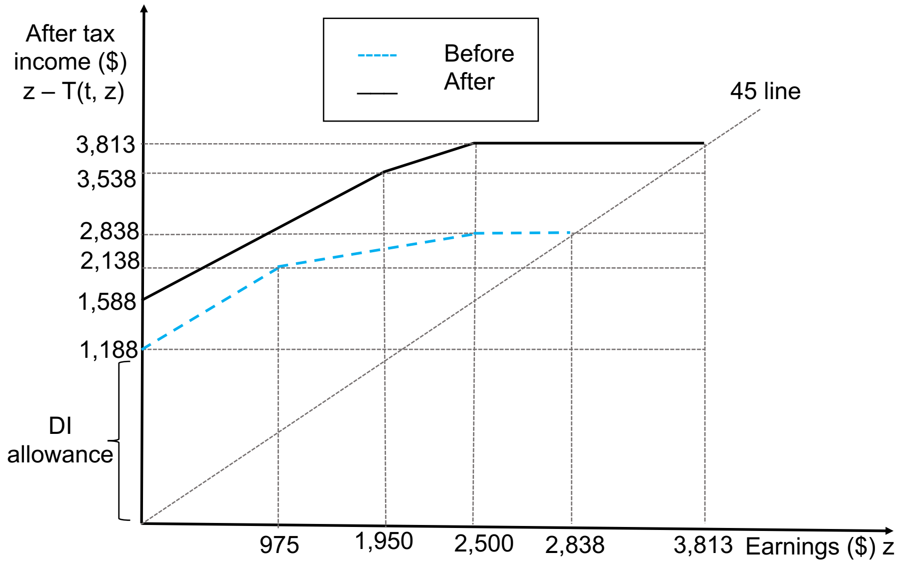
Table C.2: Estimates of earnings elasticity with no adjustment cost

	Earnings elasticity e
Base estimate	0.099***
	(0.009)
A. Age	
18-34	0.072***
	(0.072)
35-49	0.115***
	(0.019)
> 50	0.114***
	(0.030)
B. Gender	
Male	0.113***
	(0.014)
Female	0.080***
	(0.006)
C. Disability type	
Psychotic	0.124***
	(0.025)
Neurological	0.089***
	(0.007)
Mental	0.124**
	(0.034)
D. Location of residence	
Metropolitan area	0.110***
	(0.007)
Other	0.046***
	(0.004)

Note: This table presents the estimates of earnings elasticities with no adjustment cost from Saez (2010). The estimates use the data from three months before (January 2012–March 2012) and three months after (April 2012–June 2012) the policy change. The bootstrapped standard errors are in the parenthesis.
$*p < 0.10, **p < 0.05, ***p < 0.01$

C.5 Figures

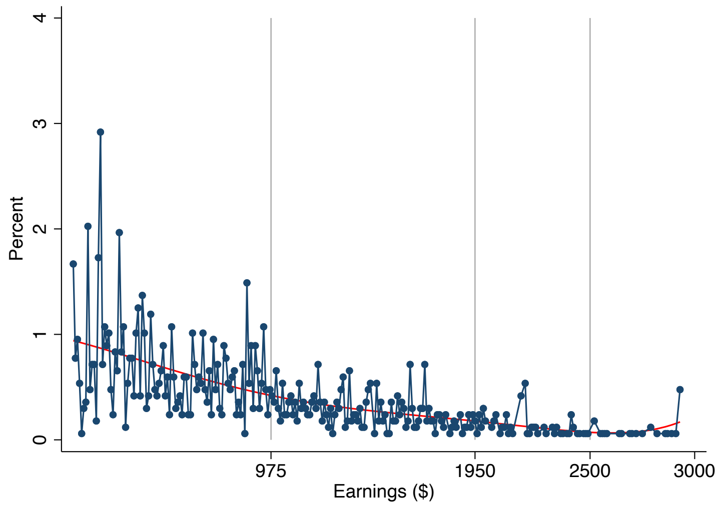
Figure C.1: Budget constraints of beneficiaries with dependent



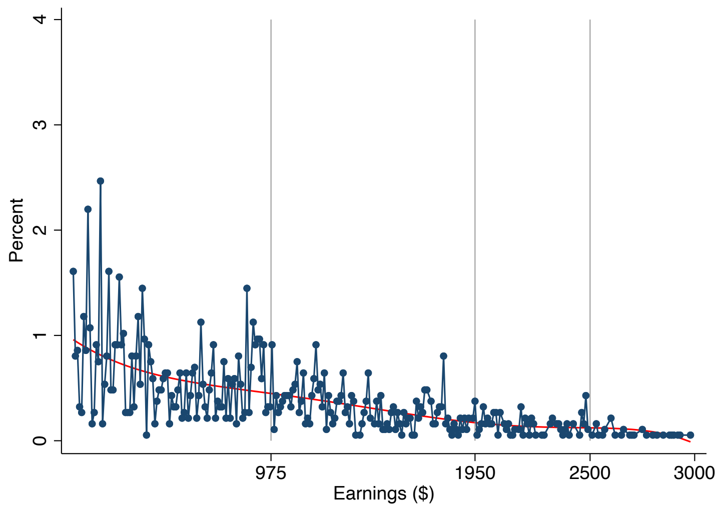
Note: This figure plots the budget constraint of the beneficiaries with dependent before and after the policy change. The horizontal axis represents the monthly earnings, and the vertical axis is the after-tax income. The implicit marginal taxes at each bracket are respectively zero, 50% and 100%.

Figure C.2: Distribution of earnings of beneficiaries with dependent

(a) Before policy change



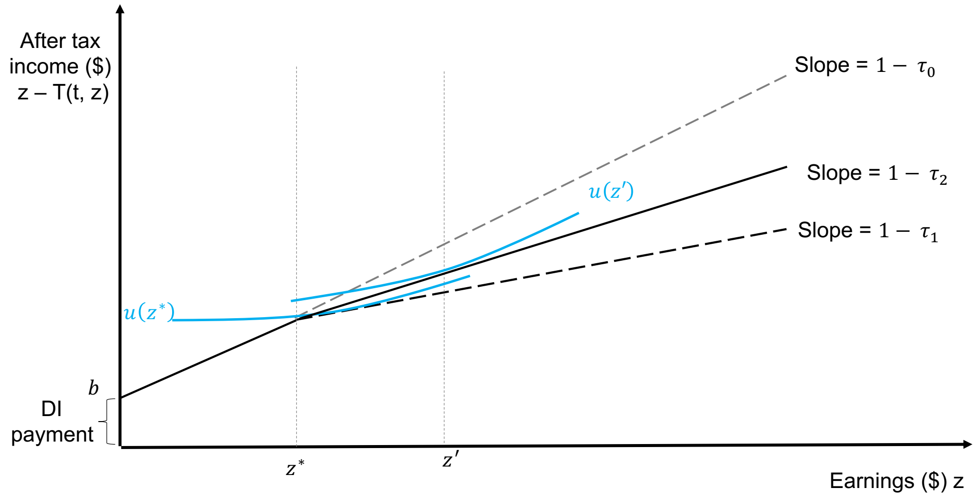
(b) After policy change



Note: This figure plots the distribution of the earnings of the beneficiaries with dependent within a six months window. Panel (a) plots the pooled data from October 2011–March 2012 and Panel (b) plots the pooled data from April 2012–September 2012. The red line is the fitted polynomial of degree $D = 6$ with bin size $\delta = 10$ and excluding three bins at each side of the kink ($l = u = 3$). There is no sharp bunching at the exemption thresholds.

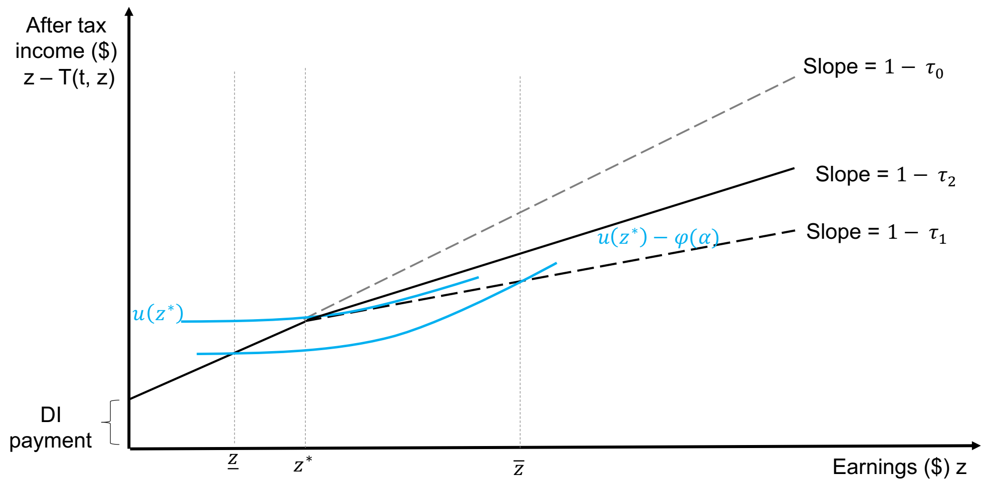
Figure C.3: Earnings responses and adjustment cost

(a) No adjustment cost



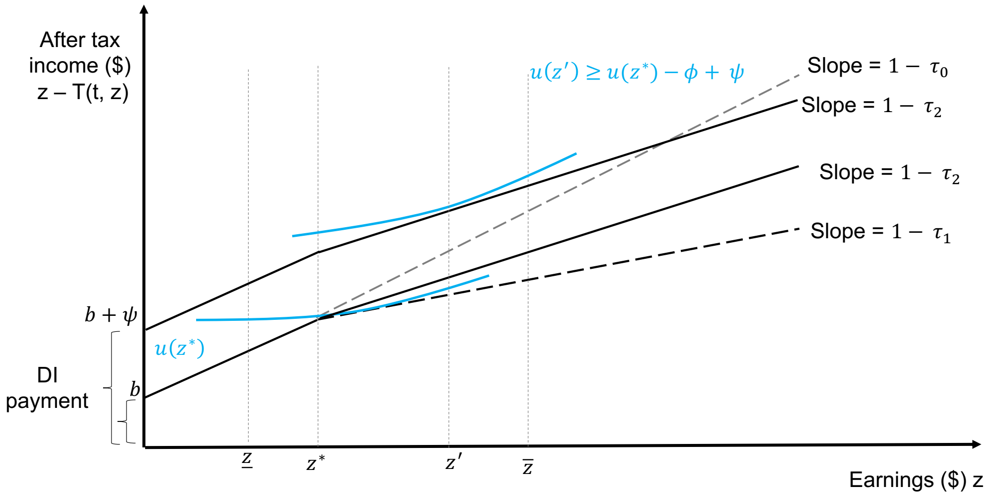
Note: This figure illustrates the change in the earnings around a kink at z^* where individuals face no adjustment cost when changing their earnings in response to a policy change, which decreased the marginal tax rate above the kink to τ_2 from τ_1. Individuals with earnings at z^* increase their earnings to z' to obtain higher utility.

(b) With adjustment cost



Note: This figure illustrates the change in the earnings around a kink at z^* where individuals face adjustment cost $\phi > 0$ when changing their earnings in response to a policy change which decreased the marginal tax rate above the kink to τ_2 from τ_1. Individuals with earnings in the range of $[\underline{z}, \bar{z}]$ do not increase their earnings since the increase in the utility is not larger than the adjustment cost. $\underline{z}$ and $\bar{z}$ are defined in (A.1).

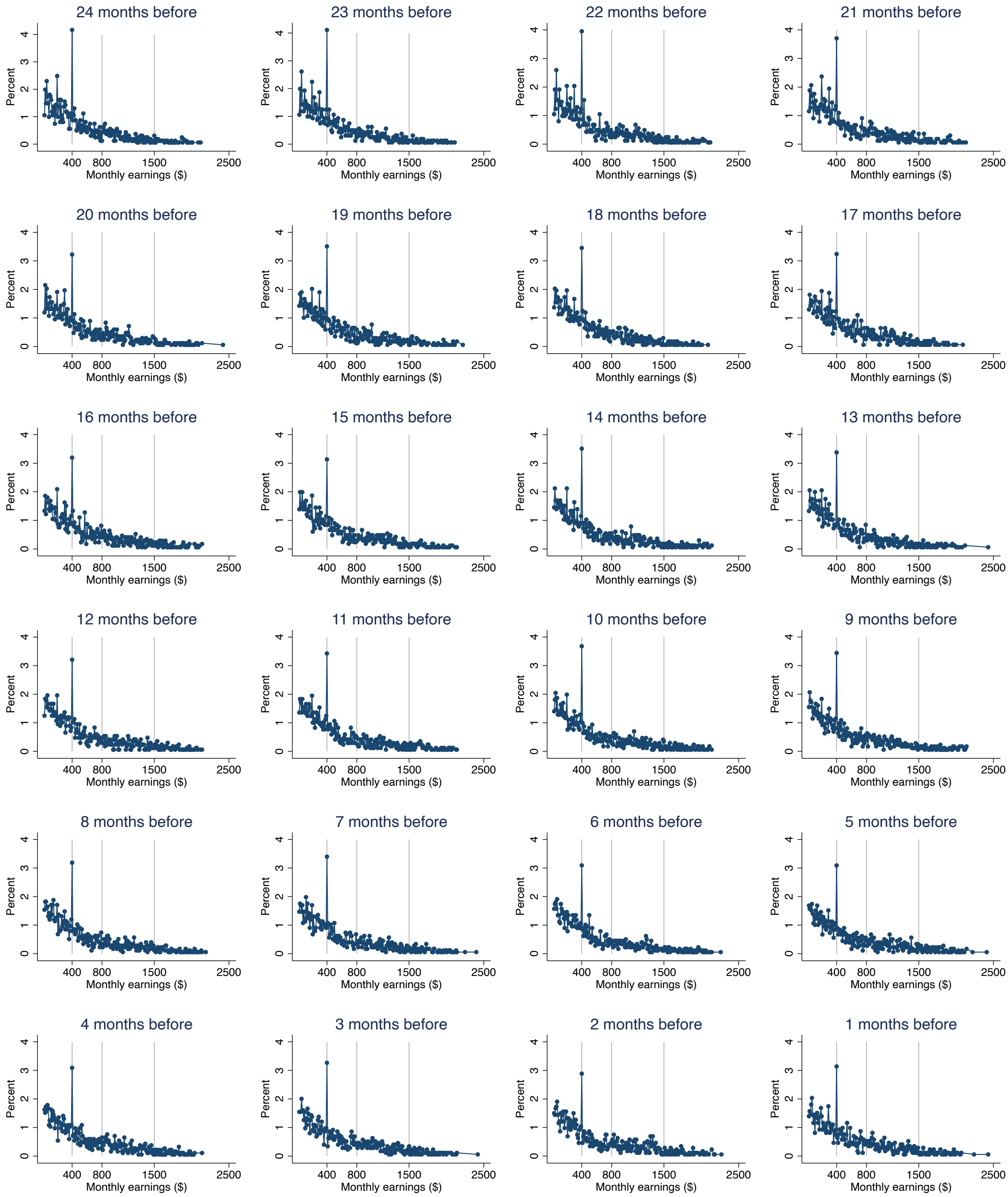
(c) With adjustment cost and increase in the payments



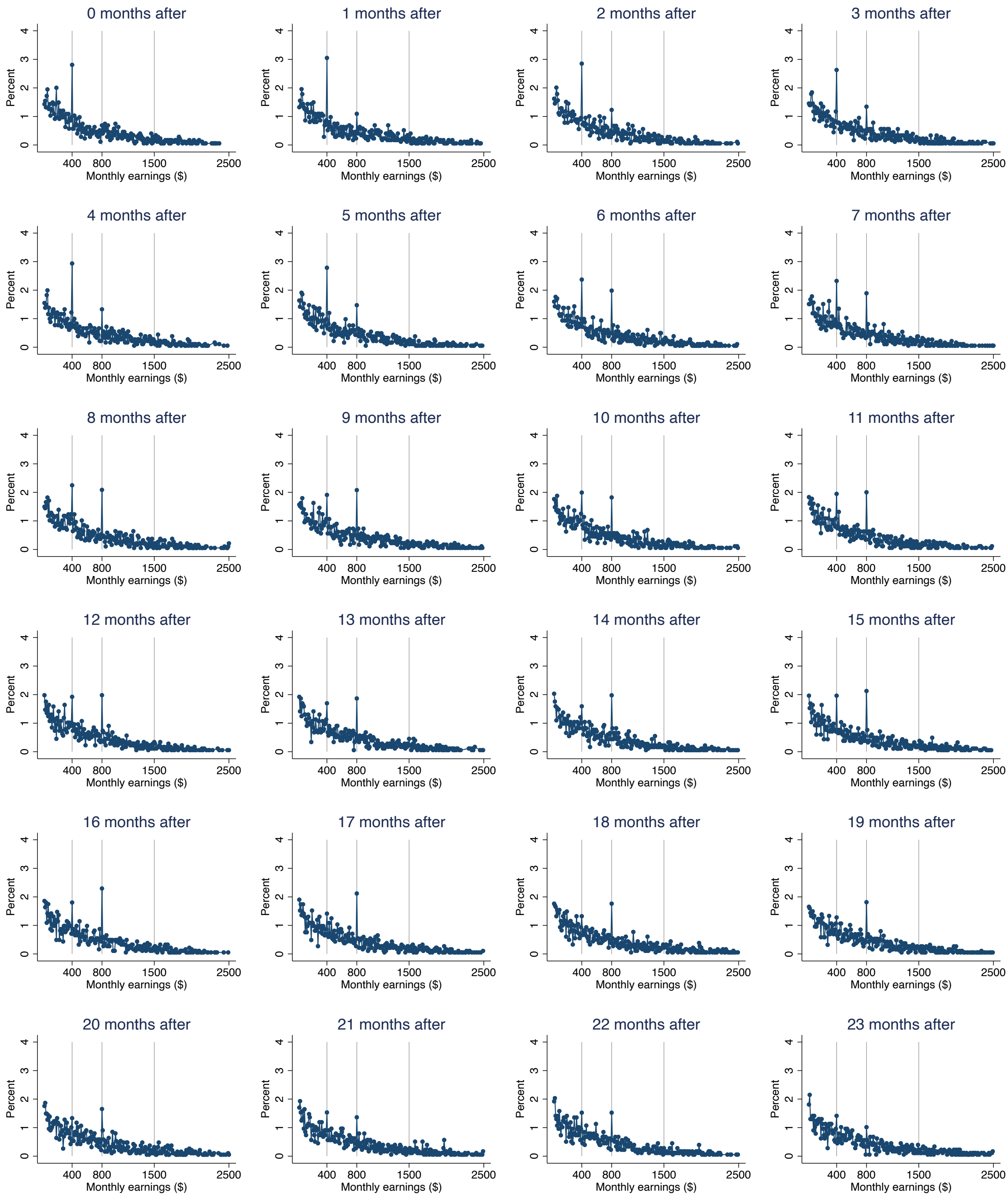
Note: This figure illustrates the change in the earnings around a kink at z^* where individuals face adjustment cost $\phi > 0$ when changing their earnings in response to a policy change which decreased the marginal tax rate above the kink to τ_2 from τ_1. If the policy change also increased the DI payments by ψ, then individuals with earnings in the range of $[\underline{z}, \bar{z}]$ increase their earnings since their utility gain is larger than adjustment cost. $\underline{z}$ and $\bar{z}$ are defined in (A.1).

Figure C.4: Dynamics of earnings distribution of young beneficiares

(a) Before policy change



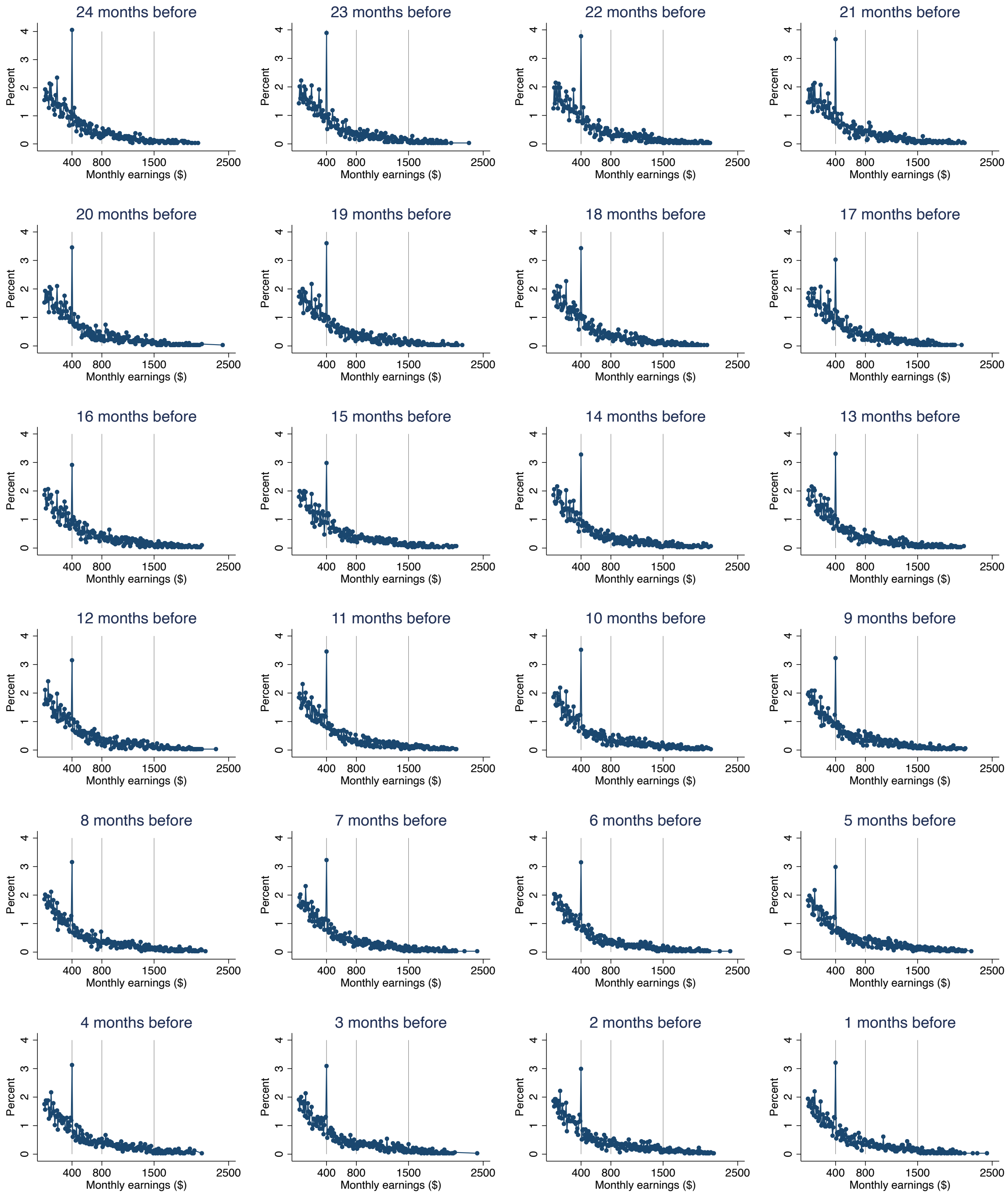
(b) After policy change



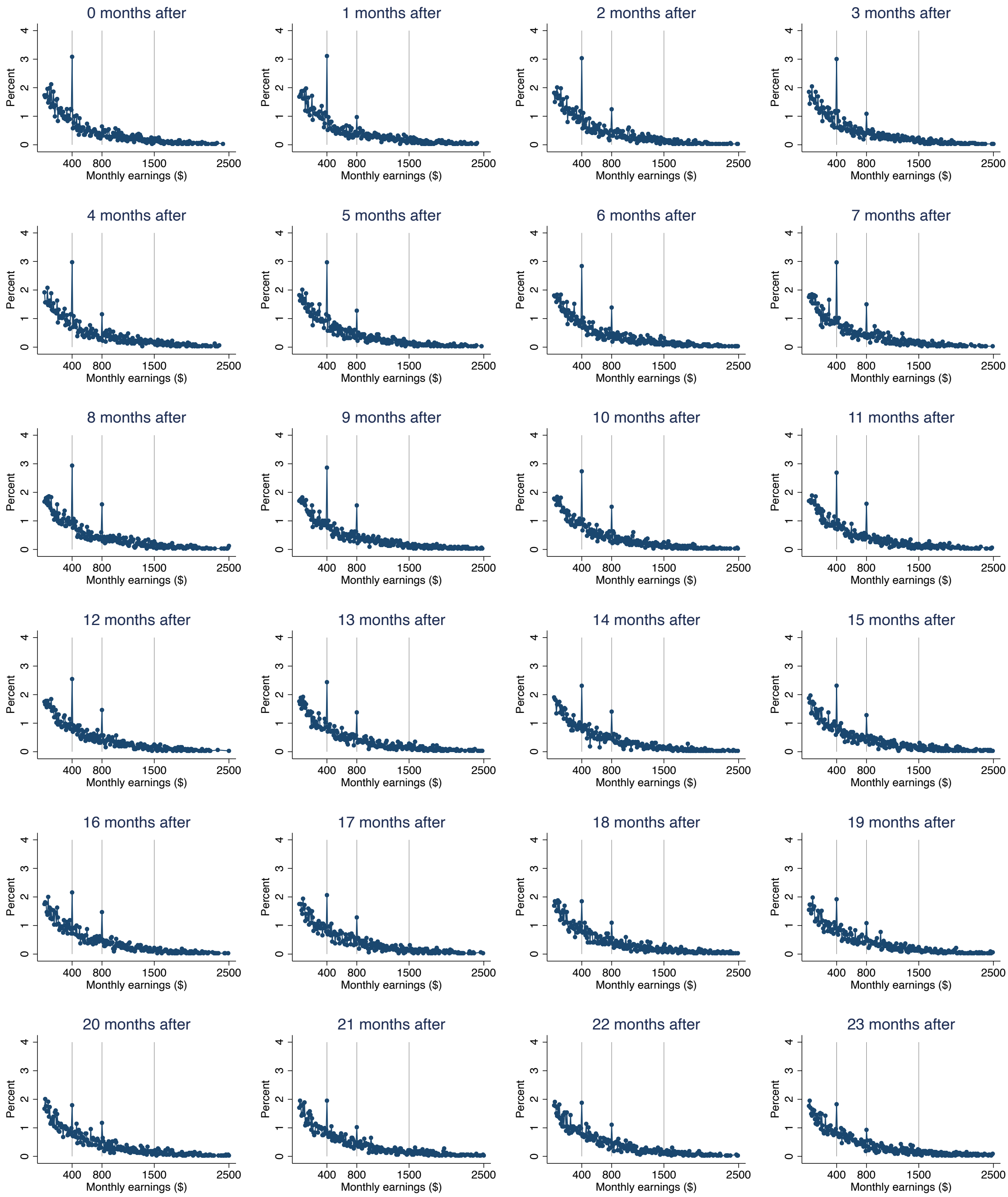
Note: This figure plots the distribution of the monthly earnings of 18–34-year-old beneficiaries in the study sample before and after the policy change. There is bunching at the exemption threshold every month before the policy change. The bunching gradually moves to the new threshold in months following the policy change, disappearing completely after two years. This is consistent with the estimates from the dynamic model presented in Figure 9.

Figure C.5: Dynamics of earnings distribution of beneficiares with Neurolgical disabilities

(a) Before policy change



(b) After policy change



Note: This figure plots the distribution of the monthly earnings of the beneficiaries with Neurological disabilities in the study sample before and after the policy change. There is bunching at the exemption threshold every month before the policy change. The bunching gradually moves to the new threshold in months following the policy change. However, even two years after the policy change, there is a considerable amount of bunching at the former threshold. This is consistent with the estimates from the dynamic model presented in Figure 9.