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ABSTRACT

Earnings Responses to Social Security Contributions: Evidence from Older Workers in Canada*

This paper documents sharp bunching in third-party reported employment earnings at a basic exemption for social security contributions among older workers. Beginning in 2012, workers age 60-64 who were receiving a public pension were required to make social security contributions equal to 9.9 percent of their employment earnings above a basic exemption threshold of $3,500. Using administrative data on third-party reported earnings and a differences-in-bunching estimator we document sharp bunching at the $3,500 threshold. We argue that our results represent new evidence on the role of firms in mediating the earnings response to payroll taxes.

JEL Classification: H20, H24, H25, H31, H32, H55, J22, J23, J38

Keywords: social security contributions, sharp bunching, employment earnings

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1 Introduction

How do gross earnings respond to social security contributions (SSCs)? The answer to this question is relevant to both academics and policy makers. Academic research on the impact of SSCs on employment earnings has been used to learn about the incidence of payroll taxes (e.g. Saez et al. (2012a); Alvaredo et al. (2017)), labor supply adjustment frictions (Tazhitdinova (2015, 2020); Gudgeon and Trenkle (2024)), rent sharing (Saez et al. (2019)) and tax compliance (Kumler et al. (2020)). Additionally, policy makers are interested in understanding the responsiveness of earnings to payroll taxes to ensure that social security programs are adequately funded and to incentivize the labor supply of certain demographic groups. The evidence accumulated to date is mixed and suggests that the impact of SSCs on gross earnings depends on contextual factors like the size of the payroll tax, its salience and responses by employers.

In this paper, we revisit the question of the causal impact of SSCs on gross earnings using a large payroll tax reform in Canada that increased the nominal tax paid by workers over the age of 60 and their employers. Beginning in 2012, the Post-Retirement Benefits (hereafter, the PRB) provision required workers age 60-64 who were collecting a public pension to contribute 9.9 percent of employment earnings above a basic exemption amount of $3,500. The nominal SSC contribution was split equally between these older workers and their employers.[1] Prior to 2012, individuals age 60-64 who were receiving a public pension were exempt from SSC contributions. We use the discontinuous increase in the payroll tax rate faced by these older workers and a differences-in-bunching estimator to estimate the causal impact of SSCs on employment earnings.

Our differences-in-bunching estimator compares the fraction of workers age 60-64 who locate within $50 of the kink generated by the PRB reform before and after its introduction in 2012. Comparing the amount of bunching relative to the pre-reform period allows us to account for any baseline propensity to report employment earnings of $3,500 due to a round number bias or heaping of market earnings at a round number. Using administrative data on third-party (firm)

[1] While SSC contributions were mandatory for workers age 60-64 collecting a public pension, payroll taxes were voluntary for those over age 65. See Section 2 for additional details.

reported earnings, we document sharp bunching in the earnings distribution of workers age 60-64 after the adoption of the PRB reform. In particular, the bunching we document was not present before the PRB reform, appears immediately after the introduction of SSCs for older workers in 2012 and is concentrated within $10 of the $3,500 basic exemption amount. Our baseline estimates suggest that 57 percentage points more likely to receive employment earnings at the kink relative to the pre-PRB period. Furthermore, we document significant bunching responses among both older workers living in households with no self-employment income and those living in households who received self-employment income within the past three years, though our estimates are much larger for the latter group.

Our paper contributes to several active literatures. In contrast to the large literature documenting gross and taxable income responses to labor income taxes, relatively few papers study the gross (employment) earnings response to payroll taxes. The empirical evidence accumulated to date is mixed. For example, while Alvaredo et al. (2017) and Bozio et al. (2017) find no evidence of bunching a kinks in the payroll tax schedule in the U.K. and France, respectively, Tazhitdinova (2020) and Gudgeon and Trenkle (2024) document bunching generated by a discontinuous change both payroll and labor income taxes at a single income threshold in Germany. Saez et al. (2012a) exploit a discontinuous increase in payroll taxes faced by Greek workers that entered the labor market after 1993 and find no evidence of an earnings response on the extensive or intensive margins. On the other hand, Saez et al. (2019) find that employment of young workers increased following a large payroll tax cut in Sweden.

We contribute to this literature by studying a large (9.9 percentage point) increase to payroll taxes levied on the earnings of older workers, an understudied group. Studying the response to payroll taxes by this group contributes to this literature because older workers likely have a weaker labor market attachment than prime age individuals. To the extent that the labor supply of workers age 60-64 is more elastic than that of younger workers, we expect the implications for tax incidence and efficiency of our results to differ from prior work.[2] Furthermore, policy makers seeking to

[2] Alvaredo et al. (2017) show how bunching in the distributions of firm labor costs, gross earnings and net earnings can be used to infer the incidence of payroll taxes.

improve the financial sustainability of social security programs are interested in understanding how changing the financial incentives faced by older workers affects their labor supply choices (e.g. Gelber et al. (2020); Lalive et al. (2023)).

We also contribute to the literature documenting the role of firms and labor demand in mediating the gross earnings response to payroll taxes. Recently, Tazhitdinova (2020) and Gudgeon and Trenkle (2024) argue that the earnings response to the payroll and income tax changes caused by reforms German "mini-jobs" program depends on the willingness of firms to offer jobs that feature tax incentives. Moreover, Kumler et al. (2020) show that workers at smaller firms are more likely to under-report employment earnings than their peers in larger firms in the Mexican setting.[3] In Section 5 below, we show that the sharp bunching response to the PRB reform is stronger among workers living in households receiving self-employment income (i.e. either the worker themselves or their spouse). Arguably, individuals working in family firms face fewer barriers to adjust their earnings than individuals who don't work in family firms. Our results suggest that family firms are better able to facilitate worker preferences by allowing them to quickly adjust their earnings in response to the introduction of payroll taxes. This represents new evidence on the role of firms in mediating the gross response to payroll taxes and complements prior work.

Finally, we also contribute to the literature documenting bunching responses to payroll taxes and labor income taxes (le Maire and Schjerning, 2013; Bastani and Selin, 2014; Harju and Matikka, 2016; Paetzold, 2019; Gelber et al., 2020; Adam et al., 2021; Best, 2025).[4] Most papers in this literature find little or no bunching in the gross earnings distribution at kinks in the tax schedule and more significant bunching in the taxable income distribution (e.g.Paetzold (2019)).[5] The paper most closely related to ours is Gelber et al. (2020). They exploit a kink in the tax schedule faced by public pension recipients due to the Social Security Earnings Test (SSET) to estimate bunch-

[3] Kumler et al. (2020) also show that workers are more less likely to under report their earnings following a 1997 reform that tied future pension benefits to reported earnings.

[4] Zaresani (2020) find evidence of bunching in the distribution of gross earnings at a kink in the tax schedule generated by a Disability Insurance program in the province of Alberta in Canada. Lacroix and Michaud (2025) present estimates of the causal effect of a tax subsidy on the labor supply of older workers in the Canadian province of Quebec. Lavecchia (2024) shows that savings (and therefore capital income) responds to the introduction of a new tax-preferred savings account in Canada in 2009.

[5] Kleven et al. (2011) use audit data from Denmark and find that evasion is limited for third-party reported income.

ing in the gross earnings distribution, a (structural) labor supply elasticity and adjustment costs. Like Gelber et al. (2020), we also focus on older workers but our sample differs considerably form theirs. In particular, the kink in the budget set faced by older workers in our study is at $3,500, near the bottom of the earnings distribution. In contrast, median gross employment earnings of Canadian workers age 55-64 was $35,369 in 2006 and the SSET ranged from $12,000-$15,720 between 2005-2016 for those below the full retirement age.[6] Our paper complements Gelber et al. (2020) by studying workers lower in the income distribution, estimating the response to a change to payroll taxes rather than income taxes and by documenting the role of family firms (i.e. labor demand) in mediating the response of gross earnings to payroll taxes.

The remainder of this paper is organized as follows. In Section 2 we describe the features of the Canadian social security programs relevant to our study as well as the PRB reform. The administrative dataset and empirical methodology we use in the paper are introduced in Sections 3 and 4, respectively. Section 5 presents the main results and Section 6 offers concluding remarks.

2 Institutional Background

Canada's public pension system consists of three programs: (i) a contributory earnings-related social insurance program (the Canada Pension Plan (CPP)), (ii) a residency-based conditional cash transfer (Old Age Security (OAS)) and (iii) an additional conditional cash transfer for very low-income seniors (the Guaranteed Income Supplement (GIS)).[7] Since the focus of this paper is a 2012 reform to the CPP, we focus the discussion in this section on the CPP and the 2012 reform and leave additional details about Canada's retiremnt income system to Online Appendix A.

The CPP is funded by a payroll tax (henceforth referred to as premiums) paid by workers and employers. Between 2003-2018, CPP premiums were set at 9.9 percent of earnings split equally between employers and employees.[8] CPP premiums are levied on earnings above a basic

[6] For https://www.ssa.gov/oact/cola/rtea.html.

[7] Additionally, there are two GIS supplements available: (i) the GIS Spouse's Allowance for spouses of GIS recipients age 60-64 and (ii) the GIS Survivor's Allowance for the survivor's of deceased GIS recipients.

[8] Self employed workers are required to pay the entire 9.9 percent premium.

exemption set at $3,500 (unchanged since 2000) up to the so-called Yearly Maximum Pensionable Earnings (YMPE) which is set at the average industrial wage in Canada. Over the last two and a half decades, the YMPE increased with the average industrial wage from a nominal $34,100 in 2000 to $71,300 in 2025.[9]

The 2012 CPP reform we study increased the CPP premiums paid by older workers who were also receiving CPP benefits. Prior to the reform, workers over age 60 who elected to receive CPP benefits were exempt from paying premiums.[10] Starting in January 2012, the Government of Canada introduced the Post-Retirement Benefits (PRB) provision. This provision required individuals to pay CPP premiums if they were both working and collecting a CPP pension between the ages of 60-64. Importantly, employers of workers age 60-64 were also required to pay CPP premiums on earnings above $3,500 and below the YMPE. Additional premiums paid under the PRB provision increased the future benefits of affected workers. In particular, each dollar of additional premiums paid in year t increased CPP benefits by up to 2.5 cents starting year $t+1$.[11] While the PRB provision was mandatory for workers age 60-64 who collected a CPP pension, it was voluntary for those age 65-69.[12]

The introduction of the PRB reform introduced a (convex) kink to the budget set faced by CPP recipients over the age of 60 (particularly for those age 60-64). Earnings in excess of the basic exemption amount face an effective marginal tax rate that is 9.9 percent (split equally between workers and their employers) higher than earnings just below this threshold. While earnings below $3,500 only the tax filer's statutory marginal tax rate, earnings above the exemption threshold face the statutory marginal tax rate plus the CPP premium. In what follows, we estimate the bunching response to this kink among older workers receiving a CPP pension.

It is worth noting that two other reforms to the CPP were implemented around the same time

[9] See https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/payroll/payroll-deductions-contributions/canada-pension-plan-cpp/cpp-contribution-rates-maximums-exemptions.html.

[10] Consequently, earnings received after a worker began collecting benefits did not affect their average career earnings and, therefore, CPP benefits.

[11] The PRB provision shares similarities with the United States' Social Security Delayed Retirement Credit (DRC).

[12] In other words, individuals age 65-69 are able to continue working without paying premiums but doing so means their future CPP benefits do not increase.

as the introduction of the PRB provision. However, these other reforms did not have a differential impact on older workers or CPP recipients with earnings around the basic threshold of $3,500 so they should not affect our estimates of the effect of the PRB provision. From 2011 through 2016, the Government of Canada incrementally increased the absolute value of the adjustment factor for both early and late take-up of of CPP benefits. Before 2011, electing to receive the CPP early lowered the individual's monthly (resp. annual pension by 0.5 percent (resp. 6 percent) for each month before the individual's 65th birthday. Similarly, deferring a CPP pension led to benefits being adjusted upwards by 0.5 percent per month of deferral. By 2016, the monthly early and late adjustment factors increased from 0.5 percent to 0.6 percent and 0.7 percent, respectively. Since this reform affected all potential CPP recipients (not just those with earnings around $3,500), it should not affect our bunching estimates. Reassuringly, we find that our bunching estimates are quantitatively similar when the sample is all older tax filers or the sub-sample of tax filers receiving the CPP. This suggests that our estimates are not materially affected by selection into receiving the CPP early (or late).

Prior to 2012, electing to receive CPP benefits before age 65 required recipients to lower their earnings in the month before starting to receive a pension. This so-called "Work Cessation Test" was eliminated in 2012. As with the change to the early and adjustment factors, this reform did not differentially affect individuals around the $3,500 basic exemption threshold so it should not impact our bunching estimates.

Finally, $3,500 also happens to be the location of the earnings exemption for GIS recipients between the years 2008-2018 (inclusive). The GIS is a conditional cash transfer for very low-income seniors over age 65 that features a 50 percent claw-back rate for those whose net income (i.e. total income minus deductions) is above $3,500. This GIS claw-back also creates a kink in the budget set of tax filers but only affects those over the age of 65. Furthermore, the introduction of the PRB provision increased the marginal effective tax rate on employment earnings above $3,500 while the GIS claw-back rate increased the marginal effective tax rate on net income (i.e. total income minus deductions). Since our baseline analysis sample is workers age 60-64 who are not

eligible to receive the GIS, the presence of the GIS exemption should not affect our estimates. In heterogeneity analysis that expands the analysis sample to those age 60-70 we find that the presence of the GIS exemption does not substantially affect our estimates.[13]

3 Data

We use data from Statistics Canada's Longitudinal Administrative Databank (LAD). The LAD is a representative panel of 20 percent of Canadian tax filers. Each year since 1982, a random 20 percent of new tax filers are selected into the LAD and are followed over time until either death or until they otherwise stop filing a tax return (individual tax returns are linked over time using the tax filer's Social Insurance Number (SIN)). An observation in the LAD is a person-year. To protect the anonymity of individual tax filers, each observation in the data features a perturbation weight. This weight is a random variable drawn from a uniform distribution over the interval 0.8 to 1.2. Following the vetting guidelines established by Statistics Canada, all analysis uses this perturbation variable to weight observations.[14] Since the weight is a random variable with a mean of one, this weighting procedure does not affect the calculation of aggregate statistics like means or our regression/bunching estimates.

The LAD contains information on the sum of a tax filer's earnings from all employers in a tax (calendar) year based on T4 forms completed by employers; this form is similar to the W-2 form completed by employers in the United States. As mentioned earlier, one way in which our analysis differs from most other work in the literature is the focus we place on bunching of third-party reported T4 earnings at the basic exemption amount which, by definition, requires the cooperation of employers. Additionally, the LAD contains information on the receipt of social insurance (i.e. CPP benefits, OAS and GIS benefits, private pensions), self-employment status,

[13] In particular, we restrict sample to individuals age 60-70 who are ineligible for the GIS because their spouse's income is too high and who, therefore, are unaffected by incentives generated by the GIS. We also adopt a differences-in-bunching estimator that compares changes in the likelihood of locating exactly at the kink (i.e. sharp bunching) before and after the PRB provision. Differences in the propensity of locating exactly at the kink is attributed to the increased CPP premiums caused by the introduction of the PRB provision. See Sections 4 and 5 for additional details.

[14] See https://www150.statcan.gc.ca/n1/pub/12-585-x/12-585-x2023001-eng.htm.

industry of employment (2-digit NAICS code) and demographic characteristics (age, sex, marital status and immigration status).

While the most recent version of the LAD is an unbalanced panel of all tax filers spanning the years 1982-2022 (inclusive), our baseline analysis sample is the unbalanced panel of individuals age 60-64 with positive earnings during the 2005-2016 period. Restricting the sample to the years 2005-2016 allows us to examine bunching around the $3,500 threshold for several years before and after the introduction of the PRB provision. In an extension, we expand the sample to include all individuals age 60-70 with positive earnings because those over age 65 could have opted into making additional CPP premiums under the PRB provision. Below, we show that our estimates on the larger age 60-70 sample are of the same sign and pattern as the baseline estimates but are smaller in magnitude. This is not surprising since paying additional CPP premiums was optional for CPP benefit recipients over the age of 65.

Table 1 reports some means for the baseline sample. The average age of tax filers is 63.7 percent, 54.5 percent are male, 27.8 percent live in a household that received self-employment income in the past 3 years, 27.0 percent are immigrants and 84.7 percent of the sample is married or common law.[15] Since several papers in the literature find that labor supply responses to taxes are heterogeneous (Borjas, 2011; Chetty et al., 2011; Saez et al., 2012b; Bastani et al., 2020), we estimate bunching separately for different demographic groups of tax filers. Furthermore, 86.1 percent of our sample received CPP benefits. Finally, a significant minority of tax filers in our sample receive retirement income from sources other than the CPP, OAS and GIS. In particular, 42.9 percent of individuals age 60-64 in our sample receive income from a private (i.e. workplace) pension.[16]

[15]Our sample comprises 54.5 percent men because only include those with positive earnings. This restriction obviously does not affect the estimation below as kinks should not generate an extensive margin response.

[16]These accounts are known as Registered Pension Plans (RPPs) and they share many similarities with 401(k) retirement accounts in the United States.

4 Empirical Methodology

Our goal is to estimate the causal impact of the introduction of payroll taxes for older workers due to the PRB provision. This provision increases the payroll tax rate paid by older workers and their employers once earnings exceed the basic exemption of $3,500. Those whose earnings would otherwise be in a neighborhood above this level are incentivized to reduce their earnings due to the higher tax. If the distribution of earnings capacity (i.e. ability) is smoothly distributed in the population and there are no frictions associated with adjusting earnings, individuals will bunch exactly at the $3,500 threshold (Saez, 2010). The standard way to quantify the "excess mass" of individuals at the basic exemption amount is to use cross-sectional data and bunching estimators (Saez, 2010; Chetty et al., 2011; Kleven and Waseem, 2013).

Using cross-sectional data to quantify the causal effect of the PRB provision may lead to biased estimates for two reasons. The first is that the earnings threshold above which CPP premiums are levied – $3,500 – is a round number. Other papers have noted that earnings and taxable income have a tendency to bunch at round numbers even in the absence of tax incentives (e.g. Kleven and Waseem (2013)). Estimating bunching using cross-sectional data could lead to estimates that are biased upward if T4 employment earnings would heap at $3,500 in the absence of the introduction of the PRB provision. Additionally, the GIS income exemption is also located at $3,500 so bunching estimates using cross-sectional data could inflate the impact of the PRB provision if market earnings for older workers happen to heap at this level. Recall that our sample of age 60-64 workers that receive the CPP are ineligible for the GIS and the tax base for the CPP and GIS basic exemptions are different.

We address these concerns by adopting a differences-in-bunching estimator. This allows us to control for any baseline propensity for older workers receiving CPP benefits to heap at $3,500 either because of a round number bias or the GIS exemption. To operationalize this estimator, we first partition the annual T4 earnings distribution into bins of width δ. As a baseline we set $\delta = \$100$ but our estimates below are robust to other choices of δ. Let Z_{it} denote earnings bin i in year t. A tax filer is assigned to bin Z_{it} if their T4 earnings in year t, z_{it}, are in the interval

$[z_{it} - \frac{\delta}{2}, z_{it} + \frac{\delta}{2}]$. For each bin Z_{it} we then define p_{it} as the proportion of tax filers in our age 60-64 sample with T4 earnings in bin i in year t.

We then estimate the regression:

$$p_{it} = \alpha + \sum_m \gamma_m + \beta_1 \cdot Year_{2008}^{2011} + \beta_2 \cdot Year_{2012}^{2016} + \beta_3 \cdot Year_{2008}^{2011} \cdot \gamma_{3500} + \beta_4 \cdot Year_{2012}^{2016} \cdot \gamma_{3500} + u_{it} \quad (1)$$

where γ_m are T4 earnings bin fixed effects, $Year_{\underline{t}}^{\bar{t}}$ is a dummy variable equal to one for calendar years in the interval $[\underline{t}, \bar{t}]$ and γ_{3500} is a dummy variable equal to one for the $Z_{it} = \$3,500$ earnings bin (i.e. those with T4 earnings between \$3,450 and \$3,550). Unless otherwise specified, our regressions include those with earnings up to \$10,000 so $\gamma_m = \{100, 200, ..., 3500, ..., 9900, 10000\}$.[17] The coefficients β_1 (resp. β_2) measures the shift in the income distribution between 2008-2011 (resp. 2012-2016) relative to the omitted period of 2005-2007. Furthermore, the coefficient β_3 captures how the amount of sharp bunching (i.e. the proportion of tax filers in the $Z_{it} = \$3,500$ income bin) changes between 2008-2011 and the period 2005-2007. This coefficient will capture the extent to which the increase to the net income exemption for the GIS from \$500 to \$3,500 leads to sharp bunching in market earnings between 2008-2011.

The coefficient of interest, β_4, captures the change in sharp bunching after the introduction of the PRB reform in 2012 (relative to the omitted 2005-2007 period). This coefficient can be interpreted as the causal effect of the PRB reform if bunching of T4 earnings at \$3,500 due to (i) round number bias is constant over time and (ii) the GIS net income exemption is constant before and after 2012. Recall that our sample includes workers age 60-64 who are ineligible for the GIS so they are unaffected by incentives generated by this program.

[17] Any baseline propensity to bunch at \$3,500 will be captured by the γ_{3500} fixed effect. This fixed effect measures the proportion of age 60-64 tax filers who receive T4 earnings equal to \$3,500 in the 2005-2007 period.

5 Results

5.1 Graphical Results

We first present our results graphically before turning to the regression estimates from equation (1). Figure 1 shows histograms of the distribution of T4 earnings around the $3,500 threshold for the (pooled) years 2005-2007, 2008-2011 and 2012-2016. The first period corresponds to the period before the GIS income exemption was increased from $500 to $3,500. The second period (2008-2011) corresponds to the period where the GIS net income exemption was $3,500 but there were no CPP premiums faced by workers (and their employers) over age 60 receiving the CPP. The third period (2012-2016) corresponds to the period after the introduction of the PRB provision.

To highlight the extent of sharp bunching of T4 employment earnings precisely at $3,500, Figure 1 displays the proportion of tax filers in $100 intervals and focuses on $3,000 window around the $3,500 threshold. Specifically, the figure shows the proportion of individuals the following T4 earnings bins: $Z_{it} = \{500, 600, ..., 3400, 3500, 3600, ..., 6400, 6500\}$.

[Insert Figure 1 here]

Figure 1 also displays an estimate of the counterfactual earnings density. Following Chetty et al. (2011) and Kleven and Waseem (2013), we estimate the counterfactual density by fitting a polynomial to the distribution of T4 earnings between $500 and $6,500 using the following regression for each period $t = \{2005-2007, 2008-2011, 2012-2016\}$:

$$p_{it} = \sum_{q=1}^{7} \beta_q Z_{it}^q + \gamma_{3500} \cdot 1[Z_{it} = 3500] + \Gamma_i^{round} + \epsilon_{it} \tag{2}$$

Equation 2 specifies the counterfactual T4 earnings distribution as a function of a degree 7 polynomial with a dummy for the kink (i.e. the excluded region) and a vector Γ_i^{round} that includes dummy variables for each $500 round earnings level (i.e. $500, $1,000,...). Our estimate of the excess mass, b is equal to the ratio of the density at the kink and the counterfactual density. We estimate

this excess mass using the "bunch_count" command in Stata.[18]

A simple visual inspection of Figure 1 show that there is little to no bunching at the $3,500 earnings level both in the 2005-2007 and 2008-2011 periods. This suggests that bunching at $3,500 due to round number bias or due to market-level earnings responding to the GIS exemption is not quantitatively important. Our estimates of the excess mass for 2005-2007 and are 2.09 (s.e. 2.01) and 2.31 (s.e. 2.00), respectively. On the other hand, the bottom panel of Figure 1 shows significant bunching precisely at $3,500 is substantial; the estimated excess mass is 29.32 (s.e. 1.02), an order of magnitude larger than the estimated excess mass for the earlier periods. It is noteworthy that the bunching is observed only within $100 of the kink and that this bunching is in third-party reported T4 earnings. As we discuss below, this suggests a degree of cooperation by employers to allow earnings to adjust so precisely to the introduction of CPP payroll taxes (premiums). In Online Appendix Figure B3 and B4, we show that the sharp bunching is driven entirely by age 60-64 workers that are receiving CPP benefits (and who, therefore, face mandatory premiums). This supports our interpretation that our estimates below are driven by the causal effect of the program and not by bunching of market earnings.[19]

Figure 2 shows histograms of the T4 earnings distribution separately for each year between 2012 and 2016. The sharp bunching is evident immediately after the introduction of the PRB provision in 2012 though the estimated excess mass at the kink more than doubles within two years of the reform. The fact that T4 employment earnings appear to take 2-3 years to fully adjust to the PRB provision is similar to the adjustment periods found for older workers in other countries (e.g. Tazhitdinova (2020); Gelber et al. (2020); Gudgeon and Trenkle (2024)).

[18]Our estimates of the excess mass are similar with and without the dummies for round numbers. These estimates are available from the authors upon request.

[19]In order to avoid any possible bias due to selection into take up of CPP benefits between the ages of 60-64, we choose as our baseline sample all workers in this age range, regardless of whether they elected to receive a public pension.

5.2 Regression Results

Table 2 reports results from the estimation of equation (1). The coefficient estimates and standard errors reported in in column 1 correspond for our baseline sample of workers age 60-64 while column 2 corresponds to the expanded sample of all workers between the age of 60-70. The estimate of β_4 in column 1 is 0.573 and is statistically significant at the one percent level. This estimate suggests that the amount of sharp bunching at the CPP basic exemption kink is two orders of magnitude larger than the estimates for the 2005-2007 and 2008-2011 periods. Furthermore, this estimate is larger than most other prior papers that document bunching of employment earnings, especially among older workers (le Maire and Schjerning, 2013; Gelber et al., 2020; Kumler et al., 2020).

The PRB provision also allowed workers over the age of 65 to make additional CPP contributions on a voluntary basis. Column 2 of Table 2 estimates equation (1) on the expanded sample of all workers 60-70. The estimate of β_4 is 0.234 (s.e. 0.001) is slightly less than half the amount of the estimate in column 1. This is not surprising given that the additional CPP contributions are not mandatory for those over the age of 65 so the estimate in column 2 may be attenuated by those unaffected by the incentives generated by the PRB provision.

Table 3 reports estimates of equation (1) for individuals living in households with and without self-employment income.[20] Columns 1 and 3 report estimates for families where either the individual tax filer or their spouse received self-employment income in any of the past three years for the age 60-64 and 60-70 samples, respectively. Columns 2 and 4 report estimates for individuals living in households that do not receive self-employment income. The rationale for studying households with and without self-employment income separately is because the former face a higher nominal SSCs than the former. Recall that the PRB provision requires both older workers and their employers to make the nominal 4.95 percent contribution on earnings above $3,500. Consequently,

[20]Net self-employment income is the sum of net business income, net professional income, net commission income and net farming and fishing income from unincorporated businesses (i.e. sole proprietorship). The distinguishing feature of these firms is that self employment income net of expenses flows through to the personal tax returns of the sole owner.

self-employed individuals (i.e. sole proprietors) that pay wages to themselves or their spouse are unable to shift the burden of the payroll tax to those they are not related to.

The estimates in Table 3 suggest that the sharp bunching response to the CPP basic earnings exemption is much larger among older workers who receive self-employment income. In particular, the estimate of β_4 is 0.694 (s.e. 0.001) for individuals living in households with self-employment income and 0.258 (s.e. 0.002) for individuals living in households that don't receive self-employment income. These results provide new evidence on the role of firms in mediating the gross earnings response to payroll taxes. The bunching response to the PRB provision may be larger among individuals living households who receive self-employment income for at least two reasons. One reason is that these households face a larger increase in SSCs at the $3,500 threshold, as mentioned earlier. These households face a greater incentive to avoid the CPP payroll taxes because of the nominal payments faced by both sides of the employment relationship. Another reason why the bunching response to the PRB provision may be larger among households who receive self-employment income is that these workers face fewer barriers to adjust their earnings than individuals who don't work in family firms. Thus, our results suggest that family firms are better able to facilitate the preferences of workers they are related to by allowing them to quickly adjust their earnings in response to the introduction of SSCs due to the PRB provision.

A caveat to the interpretation of our estimates described above is that our data don't allow us to calculate how many of the older workers in columns 1 and 3 are receiving T4 earnings from a firm owned by their spouse (as opposed to a firm owned by an arms-length individual). One feature of our setting that supports our interpretation of the results is that self-employment income in the LAD is the business income (net of expenses) received by sole proprietors. Since sole proprietor firms in Canada are unincorporated, are run by a single individual and generally have few paid employees, they are likely to disproportionately include family-run firms (Innovation, Science and Economic Development Canada, 2020; Dewan, 2022). Furthermore, in Online Appendix Table B2, we show that sharp bunching due to the PRB reform is most pronounced among older workers in select industries where small family firms are over represented, including: administrative and

support, waste management and remediation services, educational services, health care and social assistance, accommodation and food services and construction.

6 Conclusion

This paper documents the causal impact of SSCs on third-party reported employment earnings. We exploit the 2012 imposition of payroll taxes on workers age 60-64 and their employers who receive public pension income in Canada. Using administrative data on third-party reported (gross) employment earnings and a differences-in-bunching estimator, we present evidence of sharp bunching precisely a kink in the budget set generated by payroll taxes. We show that the sharp bunching response to the 2012 reform we study was larger among individuals living in households receiving self-employment income, likely from family-run firms, than those living in households that do not receive self-employment income. We argue that this represents new evidence of the role of firms in mediating the earnings response to payroll taxes. In particular, we argue that individuals living in households with family-run firms face fewer barriers or costs associated with changing their earnings in response to financial incentives.

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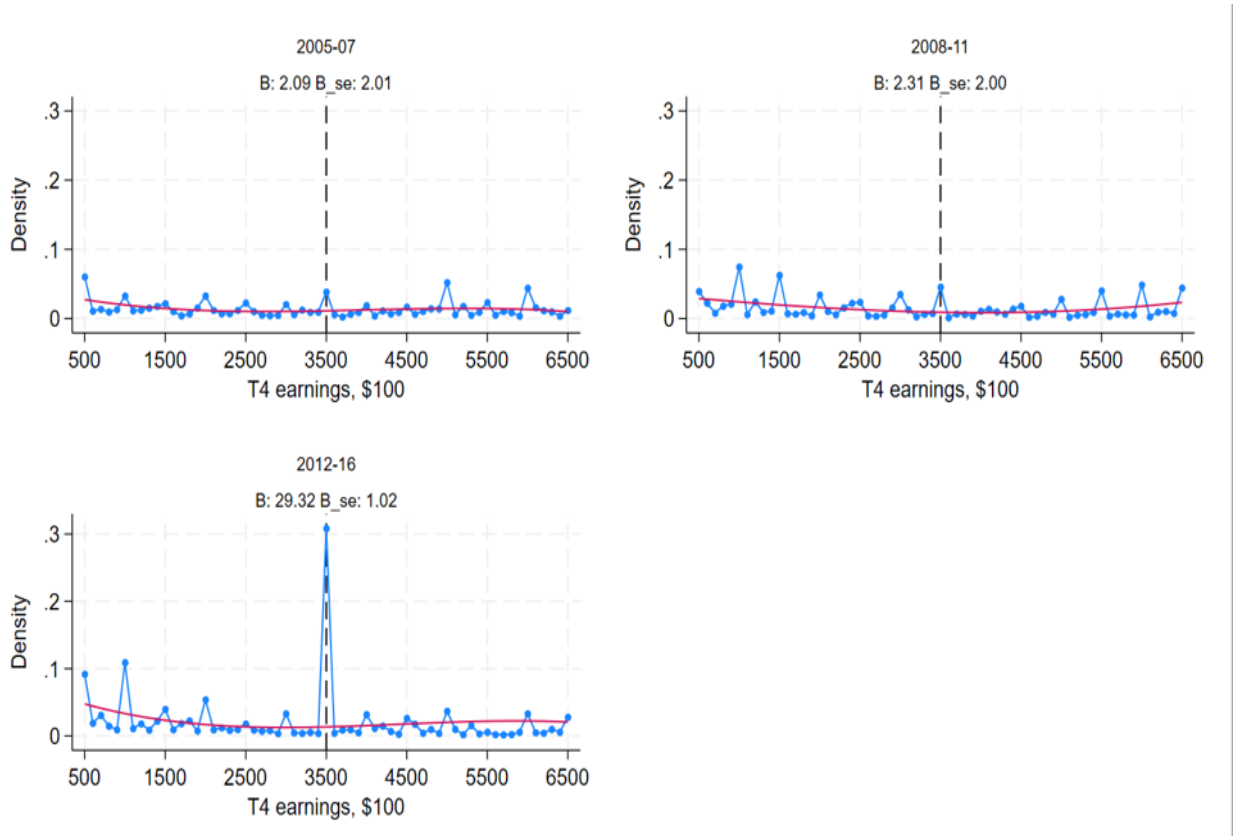
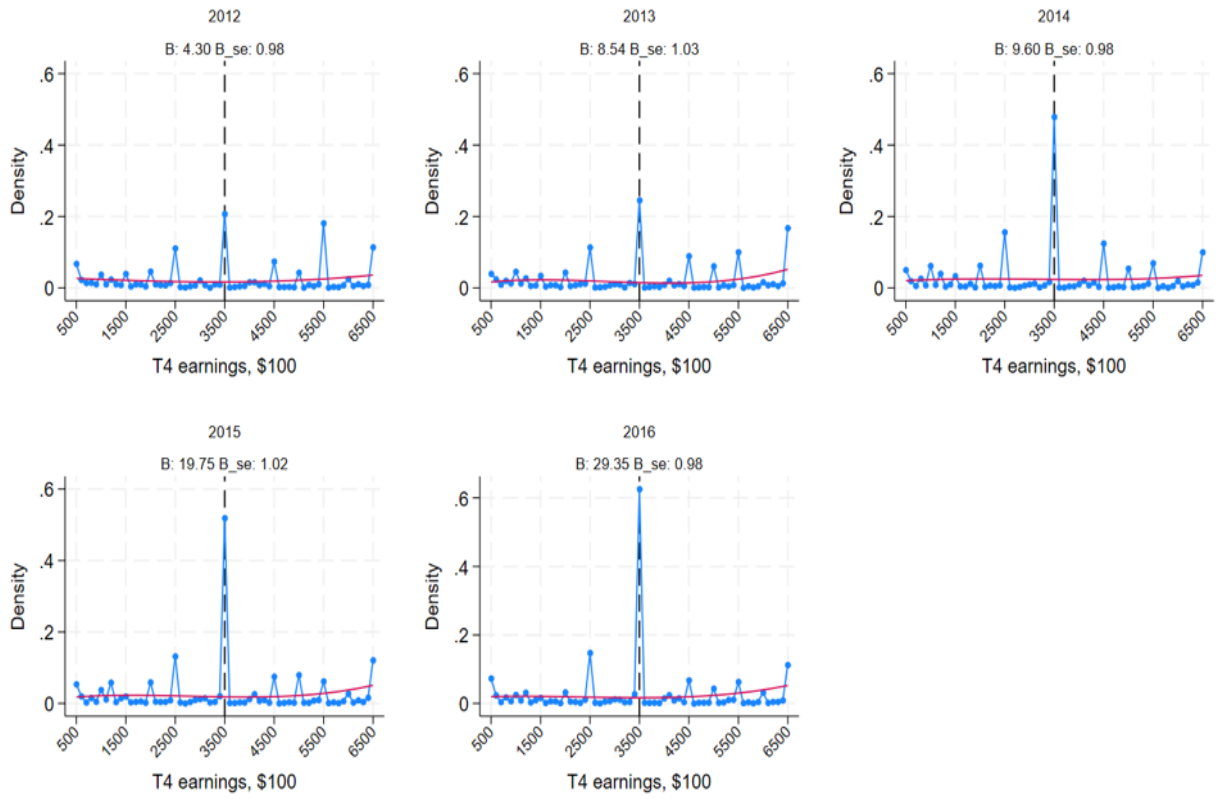
Figure 1: Earnings Histograms by Year: Age 60-64 Sample



Notes: The sample is tax filers from the LAD age 60-64 between 2005-2016 (inclusive) with positive employment (T4) earnings up to $6,500. The estimated of the excess mass relative to the average mass around the kink at the counterfactual (standard error) for the (i) 2005-2007, (ii) 2008-2011 and (iii) 2012-2016 periods are 2.09 (2.01), 2.31 (2.00) and 29.32 (1.02), respectively.

Figure 2: Earnings Histograms (2012-2016): Age 60-64 Sample



Notes: The sample is tax filers from the LAD age 60-64 between 2012-2016 (inclusive) with positive employment (T4) earnings up to $6,500. The estimated of the excess mass relative to the average mass around the kink at the counterfactual (standard error) for the (i) 2012, (ii) 2013, (iii) 2014, (iv) 2015 and (iii) 2016 years are 4.30 (0.98), 8.54 (1.03), 9.60 (0.98), 19.75 (1.02) and 29.35 (0.98), respectively.

Table 1: Summary Statistics

Variable	Male	Immigrant	Age	Married
Mean	0.545	0.270	63.7	0.847
(s.d.)	(0.491)	(0.102)	(0.091)	(0.412)
	% Private Pension	% Self-employed	% Receiving CPP	Emp. (T4) Earnings
Mean	0.429	0.278	0.861	64,643
(s.d.)	(0.232)	(0.113)	(0.129)	(94,822)

Notes: The sample is tax filers from the LAD age 60-64 between 2005-2016 (inclusive) with positive employment (T4) earnings. N = 6,219,400. % Self-employed refers to the fraction of individuals in the sample living in a household that received self-employment income in any of the three prior years.

Table 2: Differences-in-Bunching Estimates

Variable	(1) Age 60-64 Sample	(2) Age 60-70 Sample
$Year_{2008}^{2011}$	-0.000	-0.000
	(0.001)	(0.001)
$Year_{2012}^{2016}$	-0.000	-0.000
	(0.001)	(0.001)
$Year_{2008}^{2011} \cdot \gamma_0$	0.003	0.004
	(0.006)	(0.006)
$Year_{2012}^{2016} \cdot \gamma_0$	0.573**	0.234**
	(0.001)	(0.001)
Constant	0.019**	0.021**
	(0.001)	(0.002)

Notes: The sample in column 1 is tax filers from the LAD age 60-64 between 2005-2016 (inclusive) with earnings in the interval $(0, \$10,000]$ (N = 6,219,400). The sample in column 2 is tax filers from the LAD age 60-70 between 2005-2016 (inclusive) with earnings in the interval $(0, \$10,000]$ (N = 9,610,800). Heteroskedasticity robust standard errors are reported in parenthesis. $^{*}p < 0.5$; $^{**}p < 0.01$.

Table 3: Heterogeneity Analysis: Family Self-Employment Income

	(1)	(2)	(3)	(4)
	Age 60-64 Sample		Age 60-70 Sample	
Variable	Fam. S.E. Inc.	Fam. Wage-Earners	Fam. S.E. Inc.	Fam. Wage-Earners
$Year_{2008}^{2011}$	0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
$Year_{2012}^{2016}$	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
$Year_{2008}^{2011} \cdot \gamma_0$	0.004	0.003	0.003	0.004
	(0.007)	(0.007)	(0.006)	(0.006)
$Year_{2012}^{2016} \cdot \gamma_0$	0.694**	0.258**	0.323**	0.146**
	(0.001)	(0.002)	(0.001)	(0.001)
Constant	0.015**	0.021**	0.021**	0.022**
	(0.001)	(0.001)	(0.002)	(0.002)

Notes: The sample in columns 1 and 2 is tax filers from the LAD age 60-64 between 2005-2016 (inclusive) with earnings in the interval $(0, \$10,000]$ (N = 6,219,400). The sample in column 3 and 4 is tax filers from the LAD age 60-70 between 2005-2016 (inclusive) with earnings in the interval $(0, \$10,000]$ (N = 9,610,800). Heteroskedasticity robust standard errors are reported in parenthesis. $^{*}p < 0.5$; $^{**}p < 0.01$.

A Canada's Retirement Income System

This appendix section provides additional details about Canada's retirement income system. As described in the manuscript, Canada's public pension system is comprised of three programs: (i) the Canada Pension Plan (CPP), (ii) Old Age Security (OAS) and (iii) the Guranteed Income Supplement (GIS).

A.1 Canada Pension Plan (CPP)

The Canada Pension Plan (CPP) is a contributory social insurance program that was introduced in 1965. Between 1966 and 2019, the CPP replaced 25 percent of average career earnings up to the average industrial wage. Consequently, the replacement rate (i.e. benefits divided by average annual earnings) is characterized by a piece-wise linear function with a kink at the average industrial wage. Beginning in 2019, the Government of Canada announced an enhancement of the CPP that both increased the replacement rate from 25 percent to 33 percent and increased the earnings threshold below which earnings are insured. This enhancement is being financed by an increase in annual premiums, described below.

From its inception to 1998, the CPP operated with a "pay as you go" structure with annual contributions financing the benefits of current retirees. A 1998 reform to the CPP reduced benefits and increased annual contributions to improve the financial sustainability of the program and move from a "pay as you go structure" to one in which benefits are financed by current contributions and investment income.

The statutory incidence of CPP contributions falls on both employees and employers. Between 2003-2018 (the period covered by the analysis in the manuscript), annual CPP premiums were set at 9.9 percent of earnings above an exemption threshold of $3,500 and the so-called Yearly Maximum Pensionable Earnings (YMPE); the YMPE was set to the average industrial wage and was index to inflation. Nominally, both employees and employers were required to pay premiums equal to 4.95 percent of earnings in the aforementioned range. Between 2019-2023, annual premiums increased

from 9.9 percent to 9.9 to 11.9 percent and the earnings threshold below which earnings were insured increased from $68,500 to $73,200.

An individual's CPP benefits are based on their average career earnings and years of employment. CPP benefits replace 25 percent of average career earnings up to the YMPE. Consequently, the replacement rate drops discontinuously from 25 percent to zero for those whose average career earnings exceed the YMPE.[21] The normal retirement age at which individuals can receive CPP benefits is 65. However, individuals can opt to receive benefits from age 60 or delay benefits until age 70. Individuals that choose to receive benefits earlier than age 65 (resp. later than age 65) face an actuarial penalty (resp. increase to benefits). In 2015, close to 50 percent of adults age 60-64 elected to collect CPP benefits before age 65 (Statistics Canada, 2022).

One way to quantify the financial impact of the PRB provision we study is to compare the additional CPP premiums paid to the future increase to benefits from working for one year. Consider a hypothetical worker age 60-64 earning $30,000 per year who was eligible to receive the maximum CPP pension of $11,520 in 2011 (because their average career earnings were equal to or above the YMPE). To simplify the calculation, further ignore the impact of discounting and assume the CPP premiums paid by the worker's employer are not passed along in the form of lower wages. After the introduction of the PRB provision in 2012, the worker will have paid $1,311.75 ($0.0495 \times (30,000 - 3,500)$) in CPP premiums. Since the YMPE was $50,100 in 2012, the workers' future CPP pension by approximately $172 ($0.025 \times (30,000/50,100) \times 11,520$) per year starting in 2013.[22]

[21] Since benefits are based on average career earnings and there is a drop out provision that allows individuals to drop their lowest earning years, it is extremely difficult for workers to forecast the mapping between earnings in any one year and benefits in retirement unless their income is extremely stable (and is expected to remain stable until retirement).

[22] The PRB formula also includes adjustment factors that depend on the worker's age and the five year average of the YMPE ((Léonard, 2021)).

A.2 Old Age Security (OAS)

Old Age Security (OAS) is residency-based conditional cash transfer to Canadian citizens and residents over the age of 65. Individuals living in Canada who have resided in the country for at least 10 years since the age of 18 are eligible to receive the OAS. The residency requirement increases to 20 years for those not living in Canada after the age of 65. Monthly GIS payments are maximized for those who have lived in Canada for at least 40 years after the age of 18. The OAS is funded from general government revenues and benefits are distributed monthly.

In 2025, the maximum monthly GIS benefit is $734.90 CAD or about 11 percent of the average industrial wage. The OAS is a conditional cash transfer because benefits face a claw back rate that depends on the individual's age and income. For 2025, the clawback rate is 15 percent (resp. 14 percent) for those whose age is between 65-74 (resp. age 75+) and whose income is above $90,997.[23] A recipient's net income (from their tax return) in year $t-1$ is used to determine eligibility for the OAS in year t.

A.3 Guaranteed Income Supplement (GIS)

The Guaranteed Income Supplement (GIS) is a residency-based conditional cash transfer for low-income seniors that supplements the OAS. OAS recipients whose income is sufficiently low automatically receive the GIS. To contain costs and because the GIS is intended to support low-income seniors, recipients face a steep claw-back rate of that depends on their marital status. For example, unmarried individuals receive a maximum monthly benefit of $1,097.75 in 2025 and face a claw-back rate of 50 percent on income above an allowance of $5,000. As a result, GIS benefits are fully phased-out for unmarried seniors with income above $22,272. The maximum monthly GIS benefit for married individuals whose spouse is also receiving the GIS is 660.78 and benefits are fully phased out when a recipient's income exceeds $29,424.[24]

Before 2008, the earnings allowance above which the GIS claw-back rate began was very low,

[23] See https://www.canada.ca/en/services/benefits/publicpensions/old-age-security/payments.html.

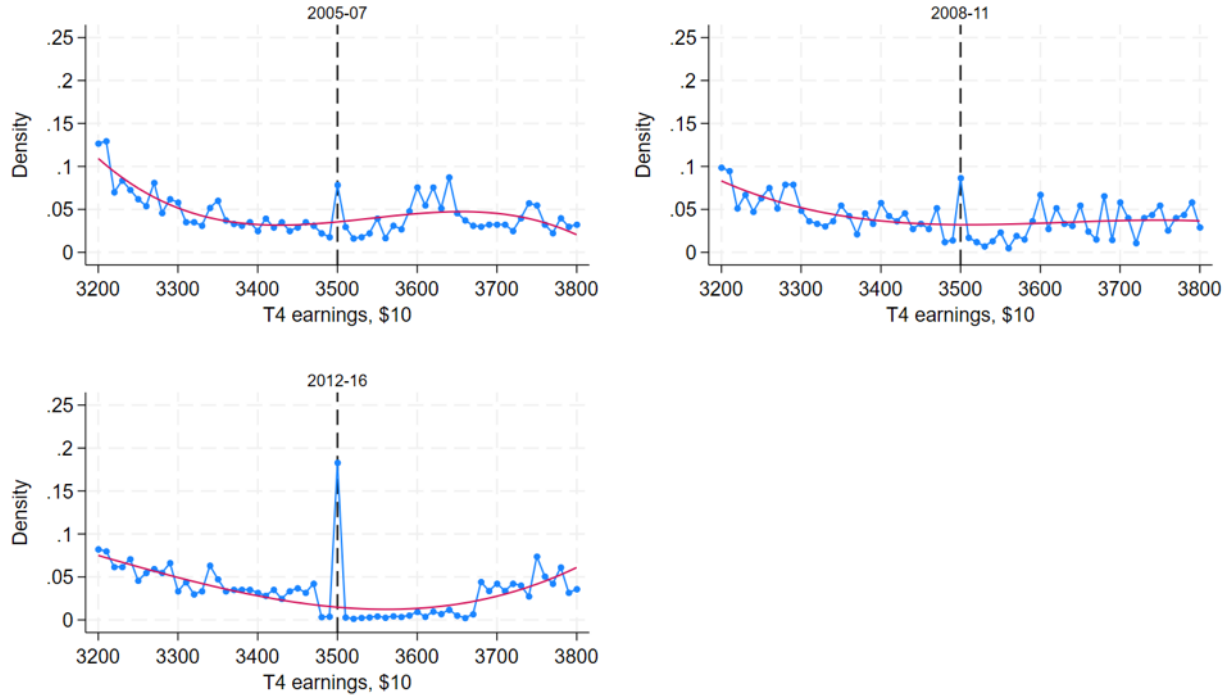
[24] See https://www.canada.ca/en/services/benefits/publicpensions/old-age-security/payments.html.

only $500 per year. In order to encourage labor market participation among seniors, this allowance has increased in recent years. Between 2008-2018, the allowance was a nominal $3,500 per years and since 2019 the allowance is $5,000. Since 2019, 50 percent of earnings between $5,000 and $10,000 can be deducted from an individual's net income.

B Appendix Figures & Tables

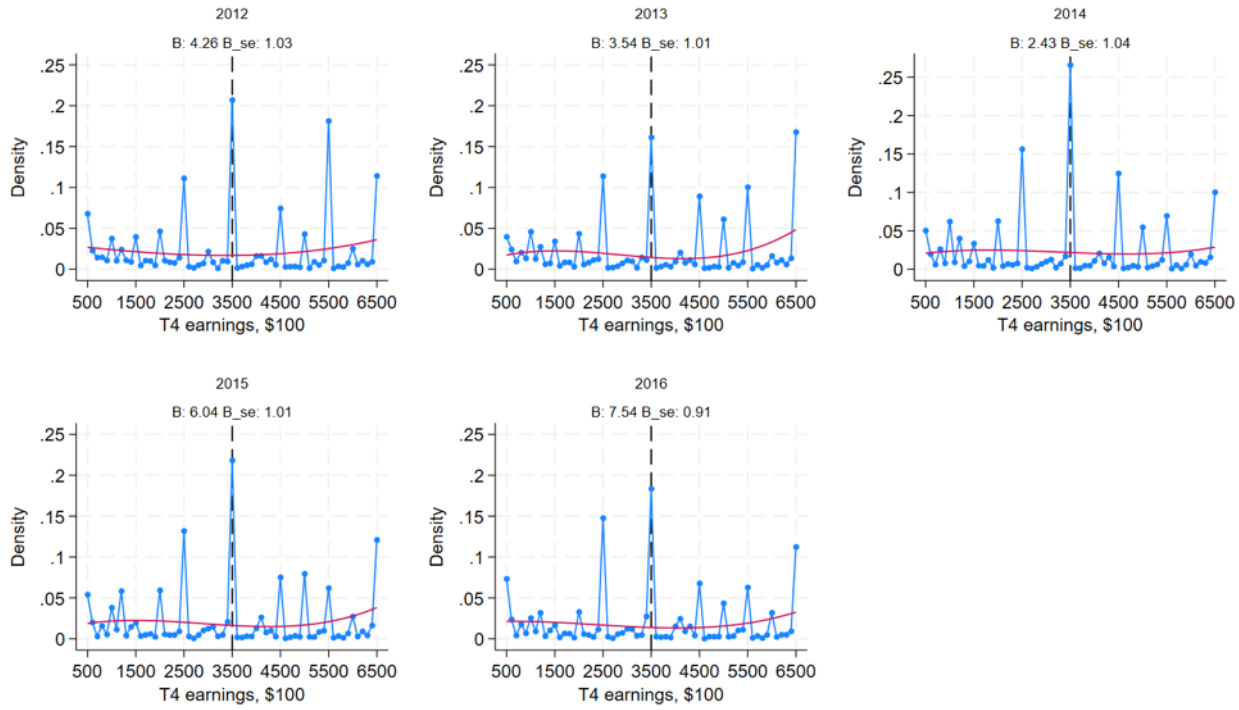
B.1 Appendix Figures

Figure B1: Earnings Histograms by Year: Age 60-70 Sample



Notes: The sample is tax filers from the LAD age 60-70 between 2005-2016 (inclusive) with positive employment (T4) earnings. The estimated of the excess mass relative to the average mass around the kink at the counterfactual (standard error) for the (i) 2005-2007, (ii) 2008-2011 and (iii) 2012-2016 periods are 2.21 (0.61), 2.63 (0.59) and 15.8 (0.63), respectively.

Figure B2: Earnings Histograms (2012-2016): Age 60-70 Sample



Notes: The sample is tax filers from the LAD age 60-64 between 2012-2016 (inclusive) with positive employment (T4) earnings up to $6,500.

Figure B3: Earnings Histograms by Year: Age 60-64 Sample of CPP Recipients

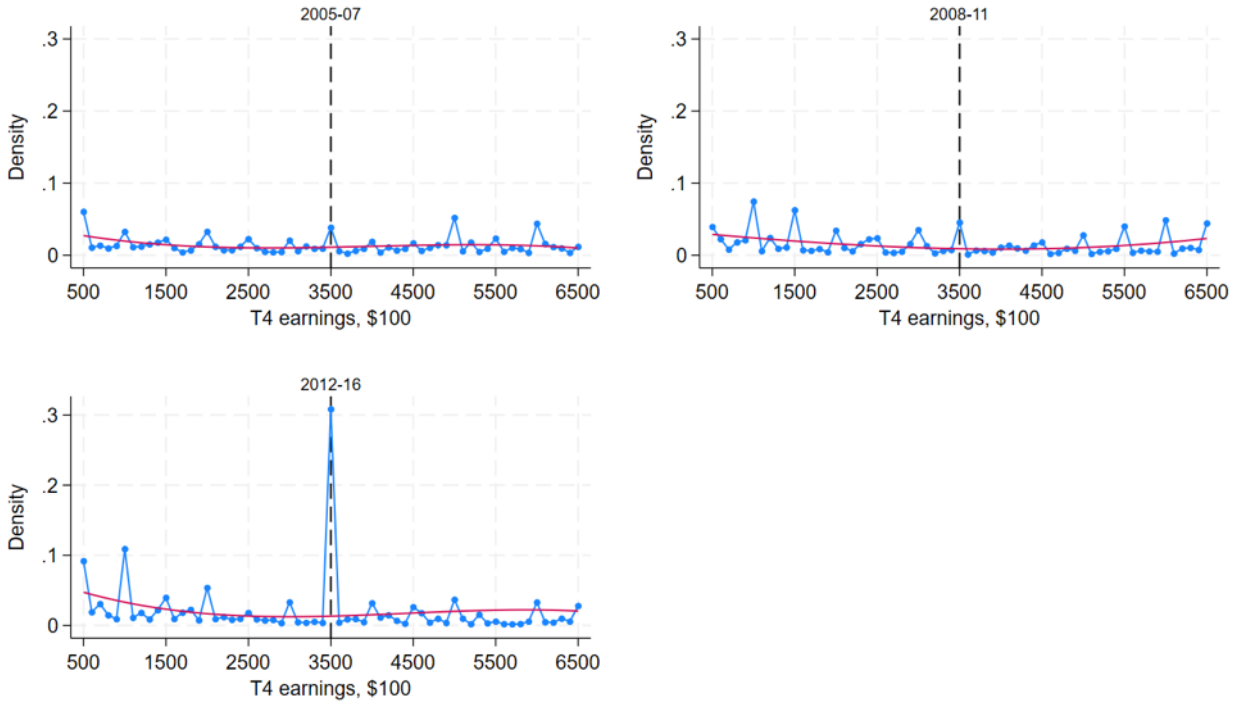
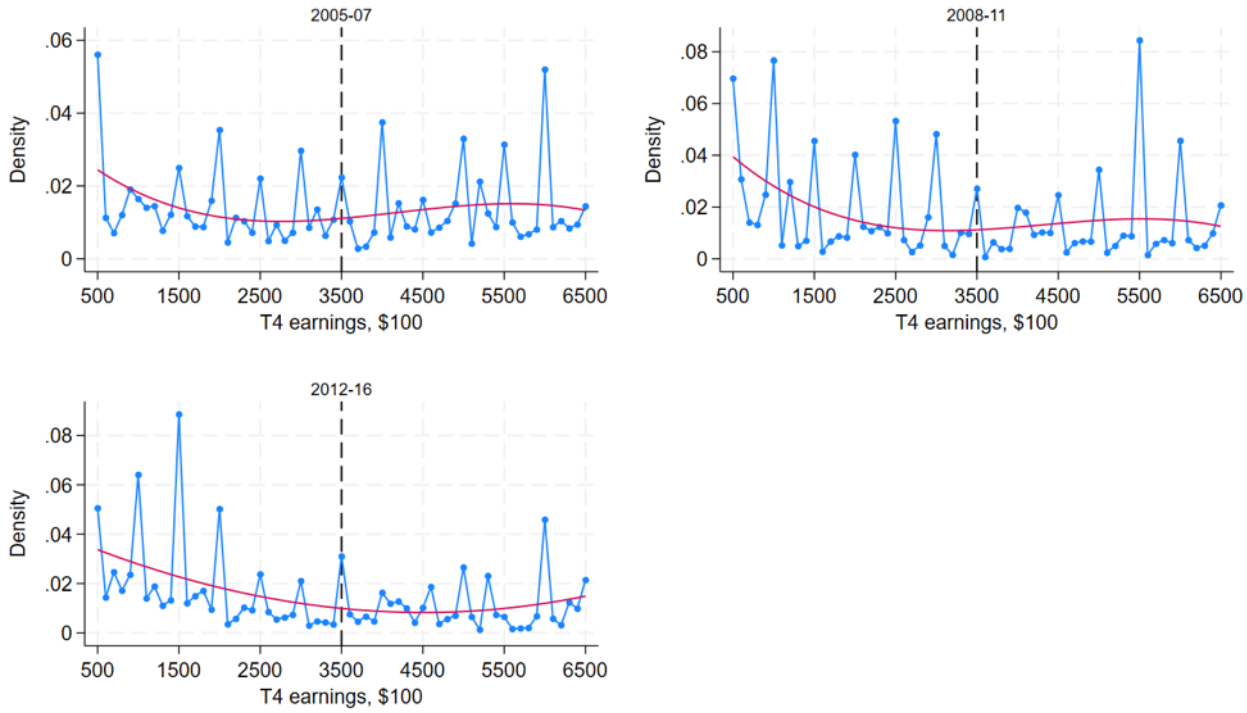


Figure B4: Earnings Histograms by Year: Age 60-64 Sample of Individuals Not Receiving CPP Benefits



B.2 Appendix Tables

Table B1: Heterogeneity Analysis: GIS Status

Variable	(1) GIS + Top-Up	(2) Some GIS	(3) GIS Ineligible
$Year_{2008}^{2011}$	-0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)
$Year_{2012}^{2016}$	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)
$Year_{2008}^{2011} \cdot \gamma_0$	0.004	0.002	0.003
	(0.007)	(0.006)	(0.006)
$Year_{2012}^{2016} \cdot \gamma_0$	0.005	0.114**	0.294**
	(0.007)	(0.001)	(0.001)
Constant	0.019**	0.024**	0.021**
	(0.002)	(0.002)	(0.002)

Notes: The sample is tax filers from the LAD age 60-70 between 2005-2016 (inclusive) with earnings in the interval $(0, \$10,000]$ (N = 9,610,800). Heteroskedasticity robust standard errors are reported in parenthesis. $^{*}p < 0.5$; $^{**}p < 0.01$.

Table B2: Heterogeneity Analysis: Industry of Employment

Variable	(1) Prim.	(2) Utilities	(3) Manftg.	(4) Retail	(5) Profess.	(6) Admin.	(7) Entmnt.	(8) Accom.	(9) Pub. Admi
$Year_{2008}^{2011} \cdot \gamma_0$	0.004	0.003	0.002	0.002	0.001	0.002	0.002	0.002	0.002
	(0.005)	(0.008)	(0.003)	(0.003)	(0.002)	(0.004)	(0.006)	(0.007)	(0.008)
$Year_{2012}^{2016} \cdot \gamma_0$	.242**	0.261**	0.101**	0.122**	0.401**	0.005	0.009	0.301**	0.020
	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.003)	(0.001)	(0.003)	(0.002)
Constant	0.022**	0.019**	0.020**	0.022**	0.028**	0.019**	0.022**	0.025**	0.023**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Notes: The sample is tax filers from the LAD age 60-70 between 2005-2016 (inclusive) with earnings in the interval $(0, \$10,000]$ (N = 9,610,800). Industries are defined using two-digit NAICS codes as follows: 11 (Primary) - Agriculture, Forestry, Fishing and Hunting; 21-23 (Utilities) - Mining and Oil and Gas Extraction, Utilities, Construction; 31-33 (Manufacturing) - Manufacturing; 41,44-45,48-49 (Retail) - Wholesale trade, Retail trade, Transportation and Warehousing; 51-55 (Professional) - Information and Cultural Industries, Finance and Insurance, Real Estate and Leasing, Professional, Scientific and Technical Services, Management of Companies and Enterprises; 56, 61-62 (Admin.) - Administration and Support; Waste Management and Remediation Services, Educational Services, Health Care and Social Assistance; 71 (Entertainment) - Arts, Entertainment and Recreation; 72, 81 (Accommodation) - Accommodation and Food Services, Other Services; 91 (Public Admin.) - Public Administration. Heteroskedasticity robust standard errors are reported in parenthesis. $^{*}p < 0.5$; $^{**}p < 0.01$.