Three Papers on Retirement and Canada's Public Pension System

Three Papers on Retirement and Canada's Public Pension System

James Maxwell Stutely, Ph.D. Candidate
Department of Economics, McMaster University

A Thesis Submitted to the School of Graduate Studies in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy

McMaster University DOCTOR OF PHILOSOPHY (2022) Hamilton, Ontario (Economics)

TITLE:	Three Papers on Retirement and Canada's Public Pension System
AUTHOR:	James Maxwell Stutely B.A. Hons (Saint Mary's University) M.A. (McMaster University)
SUPERVISOR:	Professor Arthur Sweetman
SUPERVISORY COMMITTEE MEMBERS:	Professor Michael Veall Professor Adam Lavecchia
NUMBER OF PAGES:	145

Abstract

In three chapters, I focus on how, and which, policy parameters of Canada's public pension system affect seniors' labour supply decisions. First, I study seniors' labour supply responses to a series of reforms in 2012 and 2013 that incentivized many pensioners to extend their working lives; second, I assess how and whether receipt of public pension benefits affects seniors' retirement timing differentially for those with different past earnings at ages 50-53; and, finally, I investigate older immigrants' retirement and pension claiming decisions and how these decisions are impacted by permanent residency requirements for benefit eligibility. My analyses were carried out using income-tax and related panel data from the Longitudinal Administrative Databank (LAD), a 20% sample of taxpayers spanning the years 1982-2019 at the time of writing. In addition to detailed income-tax information, it contains information on receipt of non-taxable transfer income.

In Chapter 1, I examine retirement behaviour around Canada's normal retirement age (NRA), age 65, with respect to eligibility for Old Age Security (OAS) benefits, the OAS's low-income Guaranteed Income Supplement (GIS), and receipt of Canada Pension Plan (CPP) benefits. While marked retirement-age bunching occurs at the NRA, the economic motivations behind it are not well understood. I exploit a series of policy changes in 2012 to the CPP that increased the incentives to continue working beyond the NRA while in receipt of CPP benefits, as well as one in 2013 to the OAS program that permitted (actuarially generous) deferral of OAS benefits that incentivizes postponing retirement and take-up among those with high incomes. These reforms effectively "disentangle" the retirement and benefit take-up decisions and remove some economic factors that might cause retirement-age bunching at the NRA. However, using numerous causal empirical designs (e.g., a bunching design, a difference-in-differences

framework, and a regression-kink design), my results indicate that these policy changes elicited only modest labour supply effects, which suggests the continued importance of the NRA as a "norm" for retirement timing.

In Chapter 2, I examine heterogeneity in retirement-age bunching at the NRA and the extent to which public pension benefit receipt differentially affects seniors' labour supply decisions for those with different "career" earnings as measured at ages 50 to 53 (approximately the peak earnings years for a typical worker). First, I show that retirement-age bunching at the NRA is most pronounced among those in the middle- to upper-end of the career earnings distribution with those on the lower-end being more likely to retire much earlier than age 65. However, using a bunching design that measures the excess probability mass of employment exit at the NRA, I find that, among those who work up to the NRA, seniors with the lowest incomes have the highest retirement hazard. This indicates that some low-income seniors may be particularly vulnerable to NRA increases, which has been the standard mode of pension reforms of high-income countries, excluding Canada.

Second, using a simulated instrumental variables technique, I find that receipt of GIS benefits elicits particularly large effects among eligible and near-eligible seniors. In a difference-in-differences design, I exploit a 2011 policy change that topped up GIS benefits and raised its clawback rate for seniors with next to no private income. Comparing employment outcomes before and after this reform between those likely to be GIS-eligible to those who are not likely to be, I estimate that the reform reduced employment for the likely-eligible group.

Finally, in Chapter 3, I compare post-NRA labour supply and benefit claiming decisions between older immigrants and non-immigrants. I focus on the effect of permanent residency requirements for the OAS and the GIS benefit, which require at least ten years for eligibility for a

prorated/partial benefit and 40 years for a full OAS benefit. My results indicate significant heterogeneity by immigrants' age-at-arrival. While those who landed earlier in life are more likely than non-immigrants to continue working beyond the NRA, those who arrived later (especially after age 40), work less, with steeper labour supply declines at the NRA. I find that late age-at-arrival immigrants sharply reduce their labour supply after satisfying permanent residency requirements, while at the same time claiming the GIS benefit at a much higher rate than non-immigrants.

Acknowledgments

I would like first and foremost to thank Professor Arthur Sweetman, my Ph.D. supervisor, for being an excellent mentor, who leads by example. There are many aspects of Professor Sweetman's work ethic and efficacy that I will strive to emulate throughout my career. Most notably, he is extremely disciplined, detailed-oriented and commits to going above and beyond what is asked of him. I will continue to view Professor Sweetman as my role model and seek his advice as I begin my career as a Senior Economist with the Ontario Medical Association and beyond.

Professor Michael Veall, one of my committee members, provided me tremendous perspective about the publication process in academic journals. My discussions with Professor Veall were goal-oriented: in addition to always challenging me to prepare and submit my work to journals, he clearly set forth and weighed out my options about what and where to submit. He also went above and beyond in providing edits to and recommendations for my writing in preparation for submission. Professor Veall taught me invaluable lessons and skills in writing and the planning of research papers. I will continue to seek his advice and discernment throughout my career as I conduct economic policy-oriented research projects and strive to publish my work.

My other committee member, Professor Adam Lavecchia, challenged me to think on the cutting-edge of conceptual and methodological approaches in empirical microeconomics and public economics, and to highlight my work as it contributes to them. This has stimulated me to strive to contemplate and convey the key economic insights from any set of results, policy- or academic research-oriented, that I derive, and it will be a fundamental tool for me during my career as an economist.

Although not formally part of my thesis committee, I would also like to send a special thanks to Professor Emeritus Byron Spencer. I started my Ph.D. career at McMaster's RDC as a research assistant for Professor Spencer, who developed my skill set in analyzing large administrative data files. It was Professor Spencer who piqued my interest in pursuing my thesis topic. I was fortunate to have taken Population Economics with him in the Fall of 2016, his last semester teaching before his "retirement". His focus on issues related to aging was what influenced my research interests.

I would also like to send a special thanks to Peter Kitchen at McMaster's RDC for accommodating me as I (unusually) worked through two RDCs (also at the University of Ottawa's). He was always very swift to respond to my data, file transfer and vetting requests, which on some occasions saved me from a time-crunch.

Last but not least, I would like to thank my wife, Fei Yang, for her patience while I completed this thesis, and to my parents and the rest of my family in Nova Scotia and PEI for their continued support and encouragement. Love you guys very much.

Declaration of Academic Achievement

The material in this dissertation consists of my own research. I conducted all of the empirical analyses and the manuscript writing throughout 2018 to 2022.

Table of Contents

Chapter 3: Residency-Based Public Pensions and Immigrant Seniors' Employment

List of Tables

List of Figures

Introduction

In high-income countries, population aging is pushing policymakers to engineer reforms to encourage seniors to postpone retirement. Internationally, the most popular reforms have involved increasing the normal retirement age (NRA) for public pension eligibility, although some reforms have concentrated on improving work incentives at older ages. Unusually among high-income countries, Canada is not raising its NRA from age 65 and has instead pursued a set of policy changes to encourage extended working lives.[1] In this thesis, I seek to evaluate the impacts of these reforms and study seniors' labour supply decisions around the NRA age in three steps. In the first step, I evaluate how this set of policy of changes affected seniors' labour supply and public pension claiming decisions, using several causal research designs. Taxation and the public pension system present different workers with different incentives to extend their working lives beyond the NRA, depending in part on their career earnings, defined in this thesis as earnings at ages 50-53 when individuals are typically at their peak career earnings. I study, in the second step, the potential for heterogeneity across the career earnings distribution. Finally, in the third step, I compare post-NRA age labour supply outcomes between three population groups of seniors with potentially substantially different accumulations of retirement benefit entitlements and work histories: late age-at-arrival immigrants, immigrants who landed early in life, and non-immigrants.

My first paper asks, "How can government policy affect seniors' labour supply and public pension claiming decisions?" I start with an evaluation of the impacts of a series of public

[1] The Canadian government in 2013 initially proposed to gradually increase the NRA from age 65 to 67 but that proposal was withdrawn in 2016 several years before it had been intended to take effect. The NRA has since remained at 65 where it has been since 1966 at the inception of the Canada Pension Plan and the early 1970's, when the Old Age Security eligibility age was reduced from age 70 to 65.

pension reforms in 2012 to the Canada Pension Plan (CPP), the contributory, earnings-related component of the public pension system. These reforms took on two types: 1) making it easier for those ages 60-64 to earn employment income while drawing their CPP pension; and 2) making the deferral of CPP pension take-up potentially more attractive. I implement several empirical designs. In one strategy, I use a difference-in-differences approach that, similarly to Baker and Benjamin (1999a, 1999b), and Gruber (2000), exploits variation in the timing of the reforms across the CPP and the Quebec Pension Plan (QPP), a similar but distinct pension plan administered only in the province of Quebec, which implemented a similar set of reforms as the CPP, but with a two-year time lag. According to my difference-in-differences approach, the set of reforms had only modest effects on labour supply but increased the rate of early CPP take-up by more. In contrast, I detect no change in these outcomes at the NRA, which is consistent with an earlier literature that suggests that retirement-age bunching at NRAs is not motivated by financial incentives to work or retire, but is rather either a social/heuristic phenomenon (e.g., Behaghel and Blau, 2012; Seibold, 2021; Gruber, Kanninen, and Ravaska, 2021; Lalive, Magesan, and Staubli, 2021), or is a consequence of employers' and/or workplace pension plans (e.g., Deshpande, Fadlon, and Gray, 2021). However, I find that the duration of CPP deferral beyond the NRA increased for CPP participants relative to QPP participants not yet subject to a similar reform.

In another strategy, I implement a regression-kink design to study a 2013 that permitted deferral, with an actuarial generous adjustment, of Old Age Security (OAS) benefits, a non-contributory, tax-financed part of the income support system for those aged 65 and older. OAS features an income test that implicitly taxes back benefits when an individual's income exceeds a high-income threshold. This threshold causes a "kink" in the budget constraints for those subject to it and is, in theory, predicted to induce those individuals to reduce their labour supply to avoid the tax-back of their OAS. Indeed, I observe, in the pre-2013 years, a downward kink in the employment rate for those aged 65-69 whose income is at and just exceeds that threshold. However, after the 2013 deferral reform, I find that this employment rate kink flattens, and a downward kink in the OAS take-up rate develops. This suggests that, for high-income seniors just above the NRA, this reform increased employment and reduced OAS take-up.

I then ask, in my second paper, "How Do Public Pension Programs Differentially Affect Seniors' Labour Supply Across the Career Earnings Distribution?" In this paper, I examine impact heterogeneity of the OAS program and its low-income support component, the Guaranteed Income Supplement (GIS), on post-NRA labour supply across the career earnings distribution. My analysis involves tracking the same individuals' labour supply outcomes longitudinally from ages 50-75, and I define the career earnings distribution as deciles ranked based on their average employment earnings throughout ages 50-53. For those who had no employment income during those ages, I constructed an 11^{th} group of non-earners. My results indicate the changes in the GIS benefit have particularly large effects on seniors' employment. In addition, I uncover some evidence that the GIS benefit might cause some seniors on the margin of eligibility to reduce their labour supply to become eligible and receive it. I furthermore estimate that seniors on the low-end of the career earnings distribution have a higher rate of 'excess employment exit' at the NRA compared to high earners, which indicates that they may postpone their retirement until the NRA due to liquidity constraints. This means that some low-income seniors may be particularly vulnerable to increases in the NRA. Finally, I exploit a 2011 policy experiment that topped up the GIS benefit and substantially increased its tax-back rate for seniors with quite low incomes to measure employment effects of the GIS benefit. Using a difference-in-differences design, I find that this reform substantially reduced the employment probability for affected groups.

My final paper's topic is, "Residency-Based Income Support Systems and Senior Immigrants' Labour Supply." In this paper, I ask two questions: 1) how do senior immigrants' labour supply decisions differ from the native-born? and 2) if they do differ, how do the differences relate to their eligibility for income support benefits? To answer this, I compare post-age 50 labour supply and income support claiming decisions between immigrants and a non-immigrant group. I focus on the effects of permanent residency requirements for OAS and GIS benefits. My results indicate significant heterogeneity by immigrants' age-at-arrival. While those who landed earlier in life are more likely than non-immigrants to continue working beyond the NRA for income support eligibility, those who arrive later (especially after age 40), work less, with steeper labour supply declines after the NRA. I find that the late age-at-arrival group sharply reduces their labour supply after satisfying permanent residency requirements, while at the same time claiming GIS at much higher rate than non-immigrants.

Chapter 1

Employment and Claiming Effects of Earnings Tests on Public Pension Income: Implications of Retirement-Age Bunching

James Maxwell Stutely
Department of Economics, McMaster University

Abstract

I examine employment and public pension claiming decisions in response to two earnings tests that applied to two different age ranges. One applied to Canada's early eligibility-ages 60, the early retirement age (ERA), to 64; the other to those at and above age 65, Canada's normal retirement age (NRA). Using administrative income-tax data, I estimate their impacts by implementing both a difference-in-differences design that exploits a natural experiment whereby the timing of the elimination of the early eligibility-age earnings test was different across provinces, and a regression-kink design to study slope changes in the post-NRA populations' employment rate at the earnings test threshold. I find that while the early eligibility-age earnings test's elimination raised employment, it increased the probability of early claims by more. The post-NRA earnings test caused a downward kink in the employment rate at the threshold, but this was attenuated following a reform that permitted benefit deferral. Overall, while employment increased at the ERA, my results indicate the continued importance of the NRA retirement norm.

1. Introduction

Does eliminating employment conditions for retirement benefit eligibility affect seniors' employment decisions? Answering this is crucial for addressing efficiency and cost concerns in reforms that remove earnings tests on pension income to encourage extended working lives: if doing so elicits an increase in employment, then it increases efficiency and lowers program costs by increasing the number of contributors; if not, it results only in a mechanical increase in the level and number of benefit payouts (Gruber and Orszag, 2003; Song and Manchester, 2007). However, a number of papers uncover retirement-age "bunching" at statutory benefit-eligibility ages and advise that such changes in financial incentives to delay retirement do little to attenuate it (e.g., Behaghel and Blau, 2012; Seibold, 2021; Gruber, Kanninen, and Ravaska, 2022; Lalive, Magesan, and Staubli, forthcoming). I examine the employment effects of two separate earnings tests on public pension income applied to two different statutory benefit-eligibility ages: one at ages above Canada's normal retirement age (NRA), age 65; the other at ages above the early retirement age (ERA), age 60, but below the NRA. Using income-tax and related data, I evaluate their impacts using two empirical designs: 1) a panel difference-in-differences design that exploits a natural experiment in 2012 that eliminated an earnings test on retirement benefit receipt for workers aged 60-64 in Canada, excluding those from the province of Quebec who did not face this policy change until two years later; and, 2) a regression-kink design to measure changes in the employment rate for those aged 65-70 with incomes in the neighborhood of an earnings test cut-off, both before and after a reform that effectively eliminated that cut-off.

I focus on two earnings test reforms implemented across two separate components of Canada's public pension system. The first was to the Canada Pension Plan (CPP), which is the system's contributory, earnings-related component. Although commencement of early CPP benefits at age 60, the ERA, is penalized, many pensioners start at that age. In 2012, one reform to the CPP was the removal of the Work Cessation Test, an earnings test that restricted workers', ages 60-64, receipt of CPP retirement benefits to those who reduced their annual employment earnings to no more than the maximum monthly pension ($1,243.75 in 2022) for two consecutive months following take-up. Although this restriction was not 'strictly binding' in the sense that workers could return to work as usual after the two-month period, lifecycle models of labour supply suggest that older workers' employment decisions are particularly elastic at the extensive margin (e.g., Rogerson and Wallenius, 2013), and that most should make their retirement and pension claiming decisions jointly (e.g., Burtless, 1986; Blau, 2008; Haan and Prowse, 2014; Blundell, French, and Tetlow, 2016; Seibold, 2021). Along with several other CPP reforms in 2012, which reward working pensioners with additional contributory years, this policy change accommodates postponed retirement by financially disentangling that decision from the claiming decision. (A similar set of reforms to the U.S.'s OASDI program was analyzed by Duggan et al., (2021), but without the use of a natural experiment.) Only in the province of Quebec, which has a similar but separate Quebec Pension Plan (QPP), did the QPP-equivalent of the Work Cessation Test remain until two years later, in 2014, when it was eliminated. This allows me to investigate a unique setting in which older workers in the same country, but covered by different public pension plans, were temporarily subject to different financial incentives to postpone retirement and claiming. Such quasi-experimental variation has only previously been explored by Baker and Benjamin (1999a, 1999b), and Gruber (2000) who also exploited differences in CPP and QPP rules to study labour supply outcomes, with a very different focus from my paper.

I also examine a 2013 policy shift to the non-contributory, tax-financed Old Age Security (OAS) program, a residency-based demogrant available to those aged 65 and older. This reform also intended to encourage both postponed retirement and benefit deferral beyond Canada's NRA, age 65, for benefit eligibility. It permitted OAS deferral, with an actuarially generous reward of 7.2% per year. Since the OAS features an earnings test on high incomes (incomes at and above $81,761 in 2022), benefit deferral is particularly financially worthwhile for those with high income who intend to continue to work: it allows these workers to, in addition to receiving more OAS upon take-up, avoid having their OAS taxed-back, 15 cents on the dollar. In other words, conditional on OAS deferral, high income workers can flatten the "kink" in their budget constraint. As developed in Gelber, Jones, Sacks, and Song (2020), the presence of such a kink reduces seniors' labour supply on the extensive margin for those with incomes above it, since, in the presence of adjustment costs along the intensive margin, they can only avoid the income test by retiring. This generates the prediction that, before 2013, a downward kink the post-age 65 employment rate should be present at the OAS income test threshold, whereas, after 2013, the magnitude of that kink should be attenuated proportionately with the number of OAS deferrers. As an empirical analogue, I use a regression-kink design to evaluate changes in the slope of the post-age 65 employment rate between the pre- and post-2013 periods.

My empirical analyses use the Longitudinal Administrative Databank (LAD), a 20% representative panel of tax filers spanning (at the time of writing) the years 1982-2019, which, in addition to containing detailed income-tax information, is supplemented with information on non-taxable transfer payments. The timespan of the LAD's panel component allows me to construct earnings histories, which, as in Baker, Gruber, and Milligan (2003), I use to proxy for individuals' contributory earnings history in the CPP and QPP plans. To evaluate the 2012 CPP reforms, I employ a difference-in-differences design that assigns CPP and QPP participants as "treatment" and "control" groups, respectively. It measures the employment and claiming effects on those aged 60-64 after the removal of the Work Cessation Test at two periods: 1) between 2012 and 2014, when only CPP participants were no longer subject to the earnings test and had their deferral incentives enhanced; and 2) after 2014, when QPP participants were also no longer subject to the QPP-equivalent of the Work Cessation Test. I do not detect statistical support suggesting that the 2012 reforms elicited employment responses among CPP participants. Instead, like Gruber and Orszag (2003), and Song and Manchester (2007), I uncover some evidence that the probability of early CPP claims increased. On the other hand, I observe that the employment rate of QPP participants increased after 2014 relative to that of CPP participants, but with significant impact heterogeneity across non-Quebec provinces. In particular, older workers in Canada's most populous province, Ontario, were least responsive to the changes in 2012. In general, I observe that this reform coincides with a substantial attenuation of retirement-age bunching at the ERA, which suggests a role for changes in financial incentives in explaining this behaviour.

Another advantage of the LAD is its large sample size; it accommodates empirical designs, such as regression-kink estimators, that require the analysis of earnings data with quite granular bin-widths. This facilitates my analysis of the 2013 OAS deferral reform, which requires analyzing binned income local to the OAS earnings test threshold. As in Gelber, Jones, Sacks, and Song's (2020) analysis of seniors' employment responses to the U.S.'s Old Age, Survivor's, and Disability Insurance (OASDI) income test, I apply a regression-kink design that measures differences in the post-age 65 employment rate between those with income just above and just below the threshold. I implement two such designs, focusing separately on pre- and post-2013 observations, to examine the employment effects of the introduction of the OAS deferral option. My results show that a pre-2013 downward kink in the employment rate existed at the threshold, and attenuation of the kink during the post-2013. At the same time, a clear downward kink in the OAS claiming rate developed at the threshold. Taken together, my estimates suggest that the introduction of the OAS deferral option increased both the employment rate and probability of delaying OAS receipt for the post-NRA age population with relatively high incomes. However, this increase is only for a minority of seniors since the OAS threshold applies only to quite high earners. Accordingly, although the deferral option has a "local" effect on the employment rate at the kink, it does not produce a large "global" effect and does not reduce retirement-age bunching at the NRA.

This set of results relates and contributes to a literature that examines employment effects of changes in earnings test on pension income. My main contributions to it are in my use of a two causal designs: a natural experiment, which has only been done once before (i.e., Baker and Benjamin, 1999b), and a regression-kink design leveraged by high-quality, granular level earnings data, which has only been implemented in recent studies (e.g., Gelber et al., 2018; Gelber et al., 2020). Most of this literature focused on intensive margin effects, or, conditional on earning a positive amount, how much to earn, in the U.S. (e.g., Burtless and Moffitt, 1985; Friedberg, 1998, 2000; Song and Manchester, 2007; Gelber et al., 2013; Engelhardt and Kumar, 2009, 2014) and in Canada (Baker and Benjamin, 1999b; Baker, 2002). Some of these studies also employed bunching designs to examine seniors' labour supply around income test thresholds (Friedberg, 1998, 2000). These studies generally uncovered moderate substitution elasticities with respect to the earnings test, indicating that it causes some individuals to reduce earnings or switch from part- to full-time work. Numerous recent quasi-experimental studies of the removal of the U.S.'s Annual Earnings Test (AET) and its extensive margin effects (i.e., responses on the margin of whether to work or not) use difference-in-differences designs, that compare employment rates of those above the U.S.'s NRA to those below it, but detect little to no employment responses (e.g., Gruber and Orszag, 2003; Song, 2003; Song and Manchester, 2007; Haider and Loughran, 2008; Friedberg and Webb, 2009). However, using detailed administrative data and a more credible methodological approach that exploits earnings histories and predicted benefit eligibility to define treatment and control groups, recent papers by Gelber et al., (2018), Gelber et al., (2020), and Gelber et al., (2022) uncover sizeable employment effects after the removal of the AET.

My results also contribute to a literature that documents retirement-age bunching at statutory eligibility-ages for public pension receipt, and to papers that directly applied a bunching estimator to measure retirement-age elasticities (e.g., Brown, 2013; Manoli and Weber, 2016). For example, to those that find marked bunching at both the U.S.'s AET's ERA and NRA (e.g., Burtless and Moffitt, 1984; Behaghel and Blau, 2012; Seibold, 2021; Deshpande, Fadlon, and Gray, 2021) and in Canada (e.g., Baker and Benjamin, 1999a; Baker, 2002). Behaghel and Blau (2012), and Seibold (2021) argue that such bunching is a social/heuristic phenomenon. However, my results indicate that there is also an economic motivation, especially as it relates to the ERA in Canada, since bunching at the ERA fell after the 2012 CPP reform. On the other hand, I did not uncover economically significant changes in post-NRA employment, aside from those high-income earners whose incomes exceed the OAS earnings test. This reinforces the idea that the NRA still represents a retirement norm.

In what follows, I outline the key features of policy parameters of Canada's retirement income system, in section 2. In section 3, I outline my empirical framework, which includes my data and sample, research designs, and results. I then discuss policy implications, within the context of retirement-age bunching at the ERA and NRA, in section 4. Finally, I conclude in section 5.

2. Policy Parameters

Canada's retirement income system consists of three main pillars: 1) a two-part non-contributory, tax-financed Old Age Security (OAS) program for those over age 65 and its low-income support component, the Guaranteed Income Supplement (GIS), plus allowances for widows/widowers and spouses too young to be eligible but with an eligible partner; 2) a contributory, earnings-related public pension system, the Canada and Quebec Pension Plans (CPP and QPP); and 3) the tax treatment of employer-sponsored registered pension plans and personal retirement savings accounts. In addition, there are age-based tax credits and several provincial low-income supplement programs for those over age 65. Age 65 is Canada's normal retirement age (NRA) for public pension eligibility, which corresponds to the earliest at age which OAS and GIS can be claimed. It also represents the CPP's and QPP's standard claiming age for 'full' retirement benefits: CPP and QPP benefits can be commenced as early as age 60, Canada's early retirement age (ERA), but with a downward actuarial adjustment applied; if commenced after age 65, an upward actuarial adjustment is applied, with no actuarial advantage to CPP or QPP commencement after age 70. And, as shown in Figure 1, retirement-age "bunching" occurs at both the ERA and the NRA, suggesting that employment decisions are highly associated with these eligibility ages. Unlike most high-income countries, Canada is not increasing its NRA or ERA.

In this section, I focus on the key institutional features of the CPP and QPP plans, as well as the OAS program, since they are the focus of this paper.

2.1. Canada and Quebec Pension Plans

The contributory, earnings-related CPP is a social insurance program for retirees, which covers all workers in all of Canada except the province of Quebec. Workers in Quebec are covered by the similar but distinct QPP. In this paper, while I only consider CPP and QPP 'retirement benefits', it is noteworthy that these programs also feature a disability insurance component (Gruber, 2000; Milligan and Schirle, 2014), a survivor's component, a death benefit component, and the children's benefit (Employment and Social Development Canada, 2022).

CPP and QPP retirement benefits are a function of workers' contributory earnings history after age 18, or since the plan's inception in 1966. Eligibility for actuarially adjusted benefits begins at age 60, the early retirement age (ERA), but the "standard" age of take-up, for unadjusted benefits is age 65. There is a benefit penalty applied to early take-up between ages 60 and 64 and benefit compensation rewarded to deferred take-up between ages 65 and 70. No actuarial advantage is received with take-up beyond age 70. CPP and QPP retirement benefits replace at most 25% of average career earnings up to the average industrial wage at the time of retirement, which is known as the Year's Maximum Pensionable Earnings. This career averaging excludes a percentage (called the 'drop-out provision', now 17%) of the years since age 18 by dropping out the lower (including zero) contributory earnings years. Workers' and employers' contributions are deducted at source from employment income. Each side contributes 4.95% of employment income in excess of the Year's Basic Exemption amount of $3,500, up to the Year's Maximum Pensionable Earnings. The self-employed pay both the worker and employer portions.

In Table 1, I present a before and after picture of the key CPP and QPP policy parameters that were changed under the 2012 reform. In addition, I also outline the key differences in these parameters and changes across the CPP and QPP plans, which are later exploited for impact identification in my empirical section. I focus on the impact of the elimination of the Work Cessation Test, which, before 2012, restricted eligibility of CPP retirement benefits. It required workers reduced their employment income to no more than the maximum monthly CPP benefit ($1,243.75 in 2022) for two consecutive months following take-up. Of particular interest in Table 1 is differences in the timing of the removal of the Work Cessation Test across the two plans. It was eliminated two years later, in 2014, under the QPP plan.

However, a number of other changes to the rules also matter for this analysis and the interpretation of my results. A similar set of reforms to the U.S.'s OASDI program was analyzed by Duggan et al., (2021), but without the use of a natural experiment. For, for example, the CPP's and QPP's drop-out provision operates differently: while the CPP's excludes a percentage of low or zero contributory-earnings years from the benefit calculation, the QPP's only updates the benefit calculation if current year's contributory earnings are higher than in any previous years. This difference in rules favours QPP participants' work incentives relative to CPP participants. Second, the penalties and rewards on early and deferred retirement benefit claiming are higher under the CPP program that the QPP. Hence, at ages 60-64, CPP participants have a greater incentive to delay their pension compared to QPP participants. In addition, the Working Beneficiaries Provision was introduced in 2012. For working CPP and QPP claimants, earnings-based contributions are still made and go towards a 'post-retirement benefit' ('pension supplement' under the QPP; more details are in the Appendix). With no Work Cessation Test and the existence of the post-retirement benefit, the retirement and claiming decisions are effectively disentangled at ages 60-64.

To conceptualize the key policy parameters and show how retirement incentives differ between CPP and QPP participants, and to highlight how these reforms disentangle the retirement claiming decisions at the ages 60-64, I sketch a lifecycle model in which individuals' face a trade-off between higher consumption afforded through more labour supply and higher leisure enjoyed in retirement. Each individual chooses and optimal lifetime path that balances their respective consumption and leisure profiles.

I assume lifetime utility if a function of consumption *c* over remaining life years *T* and the utility of leisure during retirement is *T-R*. Individuals choose annual consumption *c*, pension claiming age *P* and retirement age *R* to maximize lifetime utility subject to a lifetime budget constraint and a minimum claiming age, the ERA, P^{ERA}, according to

$$\begin{aligned} max_{\{c,P,R\}}U \quad &= u(c)\cdot T + \theta\cdot(T-R) \\ &\text{s.t} \quad (1)\ cT \leq w(1-t)\cdot min\{R,P\} + w(1-\tau)\cdot 1\{R>P\}(R-P) + b(R,P)(T-P) \\ &\text{and } (2)\ P \geq P^{ERA}. \end{aligned}$$

The three terms on the right-hand-side of constraint (1) are after-tax income from labour earnings until retirement or claiming age, after-tax income from labour earnings for years between claiming age and retirement, and total public pension benefits. The second term captures an earnings test applied to pension income: labour earnings is lower after claiming than before (τ >> t). The implicit tax rate on pension income in this set-up, τ, is much different that that previously studied in Canada (e.g., Baker and Benjamin, 1999b), or earlier studies of the U.S.'s Annual Earnings Test. Here, τ reflects the pre-2012 Work Cessation Test that conditioned pension claiming on earnings to be below a threshold (i.e., the maximum monthly CPP or QPP retirement benefit); these other papers studied standard earnings tests, which tax-back earnings at the margin, causing a kinked budget constraint. In this model, individuals who retire prior to the ERA should claim benefits as early as possible. Otherwise, they should jointly retirement and claim benefits. This simple model therefor captures the empirical regularity of retirement bunching at the ERA and NRA.

This simple model outlines to predicted effects of removing the Work Cessation Test. Removing the Work Cessation Test, and hence τ, disentangles the retirement and claiming decisions is this system. This is so for two reasons. First, without the Work Cessation Test, CPP and QPP participants' retirement is not required for benefit receipt. And second, for working CPP and QPP claimants, the existence of the post-retirement benefit (pension supplement) means that the benefit function $b(R,P)$ continues to increase. Taken together, after 2012 (2014 for QPP participants), CPP participants no longer face a kink at the ERA in their lifetime budget constraint. Therefore, this model predicts that post-2012, one should observe an attenuation of retirement-age bunching at the ERA, which should be greater for CPP participants after 2012 relative to QPP participants, until their QPP-equivalent of the Work Cessation Test is eliminated.

2.2. Old Age Security

OAS is a demogrant paid to those aged 65 and older, subject to permanent residency requirements. Its benefits are taxable, inflation-adjusted (quarterly, since 1973; the benefit does not reduce if the cost of living decreases relative to last year's), and financed through general tax revenues. The 2022 maximum monthly benefit, \$642.25, is paid to those whose previous year's personal net income (total taxable income less non-contributory public pension benefits, claimed income tax and credits and deductions, and social security contributions and repayments) is at most \$79,845. For last year's net income exceeding that threshold, OAS recipients face a federal withholding tax on benefits of 15%, known as the recovery tax, such that benefits are completely exhausted for net income beyond \$133,141. Figure 2 presents the OAS benefit schedule as a function of net income.

Since 2013, OAS benefits can be deferred until age 70 with an actuarial adjusted increase of 0.6% per month (7.2% per year). The introduction of the OAS deferral option was intended to encourage high earners, with incomes at and above the OAS threshold, to postpone their retirement while deferring OAS. It changed work incentives for this group of workers because, during OAS deferral, workers effectively avoid paying the recovery tax. To highlight this reform's predicted effects, I use Rubin's (1974) potential outcomes framework to show how the presence of the OAS income test creates a corresponding kink in the OAS take-up rate and the employment rate. Given there are two states of the world, s = {0,1}, with 0 being a state with no OAS income test and 1 being the opposite. An empirical analogue to this set-up is the regression kink design (which is used in the next section), which compares the outcomes of those locating below the OAS threshold (s = 0) to those above it (s=1). Moreover, since working OAS deferrers effectively avoid the income test, my expectation is there will be attenuation in the size of the downward kink in the employment rate at the threshold. This motivates two regression-kink designs: one comparing those in state s = 0 to s = 1 in the pre-2013 period, and another such comparison for those in the post-2013 period.

These predictions come from the following. Related studies model income tests on pension income as a positive benefit reduction rate (BRR) for those earning above the threshold (Friedberg, 1998, 2000; Gelber et al., 2021). OAS claimants receive benefits $OAS_s(z)$ in state *s* as a function of their before-tax income *z*, and the pre-tax level of benefits received is denoted *b*. In either state, there is a linear proportional tax on earnings, $T(z) = \tau_0 z$. Hence, total before-tax and before-benefit resources are given by

$$z - T(z) + OAS_s(z) = (1 - \tau_0)z + OAS_s(z).$$

Without the threshold (s = 0), individuals face a flat BRR, $OAS_0(z) = b$, which is because the current level of OAS benefits would be independent of before-tax earnings. That is, the tax rate on before-tax and before-benefit resources amounts to τ_0. However, with the threshold (s = 1), the BRR becomes τ_b since the OAS income test taxes back benefits at the margin. The presence of the threshold at z^* induces two slop changes in the budget constraint according to

$$OAS_1(z) = \begin{cases} b, & \text{if } z \leq z^* \\ b - \tau_b(z - z^*), & \text{if } z^* < z \leq \overline{z}(b) \\ 0, & \text{if } \overline{z}(b) < z \end{cases}$$

The first slope change occurs at the threshold z^* and the second occurs at the point where OAS benefits are phased out. The slop change at z^* creates a convex kink in the budget set.

Why would this budget constraint kink cause a kink in the employment rate for those aged 65-70? The employment decision on the extensive margin is a function of the average net-of-benefit reduction rate, $ANBRR = 1 - \frac{(T(z) - OAS(z)) - (T(0) - OAS(0))}{z}$, which is the after-tax earnings that the individual keeps by staying employed at earnings level *z* rather than earning zero. The *ANBRR* is constant at $1 - \tau_0$ below the threshold z*, but changes to $1 - \tau_0 - \frac{\tau_b(\tilde{z}_0 - z^*)}{\tilde{z}_0}$ above z*. I show this graphically in Figure 3 for the case in which individuals face intensive margin adjustment costs, as in Zaresani (2020), and Gelber et al., (2021). For those with too steep an earnings adjustment cost, and therefore cannot bunch their earnings *z* and the threshold *z** (see the Appendix for more details about this bunching prediction), some will choose the zero earnings option, leading to a downward kink in the employment rate at *z**. However, choices change after 2013: now individuals earning above *z** can defer OAS, shift their budget constraint to match state s = 0, and not adjust their labour supply. Therefore, this model predicts an attenuation of a downward kink in the employment rate at z^*, and I empirically examine this prediction with a regression-kink design.

3. Empirical Framework

3.1. Data and Sample

I analyze Canada's Longitudinal Administrative Databank (LAD), a panel comprising 20% of tax filers that at the time of analysis spanned 1982-2019. It is topped up annually to remain nationally representative of tax filers at the 20% level. Once selected into the LAD, tax filers are followed longitudinally by a unique social insurance number identifier until they cease to file income tax. In addition to income tax-relevant information, the LAD features information on transfer income and demographic and geographic variables reported at the time of tax filing.

I select a sample of tax filers aged 50-75 during the years 1986 through 2019. I start the analysis in 1986 since it is the first year in which information on registered pension plan (RPP) contributions is observable in the LAD. I follow each individual longitudinally from age 50 to 75, or until the end of the data period, such that each individual must be observed to reach at least age 61, one year after Canada's early claiming age for C/QPP retirement benefits. Put differently, I select a sample of tax filers born between 1936 and 1958; those born in 1936 were 50 in 1986 and 75 in 2011; those born in 1944 were 50 in 1944 and 75 in 2019; and those born in 1958 were 50 in 2008 and 61 in 2019. I drop any late-age-arrival immigrants or any tax filers whose earliest age observed filing income tax was after 50. I also restrict my sample to "heads of the household": that is, in the case of married and common-law couples, I restrict the sample to the oldest of the two spouses. I do this to avoid the potential of confounding effects that may arise from receipt of the Allowances programs before the age of 65. These sample criteria were applied after taking a 5% sample from the LAD's registry file.

An indicator for having positive employment income is the key analysis variable of this paper, and I use information from both T4-earnings (i.e., salary income) and self-employment earnings to define it. My first set of empirical analyses involve comparing labour supply outcomes across CPP and QPP participants. A CPP (QPP) participant is defined as one who had employment income in Canada outside of Quebec (in Quebec) throughout ages 50-53. Some individuals switched status, for example from being a CPP to QPP participant, but these individuals are dropped from the sample (more on this below). I also consider other key indicator variables representing each sample units' retirement preparedness: an indicator for having at least one year of RPP contributions and/or filing a pension adjustment at ages 50-55; and an indicator for having any registered retirement savings plan (RRSP) contributions at ages 50-55. I also utilize demographic and geographic variables such as gender, marital status, the age difference between partners of a couple, and province of residence.

For my second set of empirical analyses, those that focus on the OAS income test threshold, I restrict the sample to those who were observed filing income tax at least once after the age of 66 (one year after the eligibility-age for OAS). For these analyses, I do not distinguish between CPP and QPP participants, but I use all of the other key regressors (measured at the time individuals were ages 50-53) to account for retirement preparedness.

3.2. Summary Statistics

I present summary statistics in Table 2, separately for the CPP and QPP samples (and the amalgam of the two), on the key outcome variables described above. I also show employment rates and CPP and QPP claiming rates for the age 60-64 population before and after 2012. In general, the means and proportions for the set of independent variables appear to be quite balanced across CPP and QPP participants. Some notable differences are that QPP participants are more likely to claim early, at the ERA, than are CPP participants. This might be explained by differences in the drop-out provision or actuarial adjustment factors across the two plans: QPP participants have a greater incentive to jointly postpone retirement and claim benefits at the ERA than do CPP participants (as described in Table 1). Table 2 also shows that, compared to pre-2013 years, the OAS claiming rate among the OAS-eligible, ages 65-70 population, fell after 2013. In addition, the post-2013 employment rate for that population is higher than the pre-2013 one, and, as expected, especially among the OAS-eligible population whose incomes render them subject to the OAS recovery tax.

3.3. Graphical Analysis

In the first part of my graphical analysis, I aim to provide evidence of how connected the employment and C/QPP claiming decisions are, and how the removal of the Work Cessation Test may have changed it. In Figure 4, I plot employment rates for those aged 60-64 centered around year of C/QPP take-up by birth cohort (those who claimed C/QPP benefits before 2012 and those who claimed after 2012), separately for CPP and QPP participants. For each cohort and group, there is a sharp dip in the employment rate from year 0 to 1 (year of take-up and one year after take-up), suggesting that most 60-64-year-olds exit employment upon claiming their pension. However, while still present, this dip in the employment rate to some extent smoothed out for the post-2012 CPP claimants, indicating an increase in the proportion of working pensioners.

To motivate my staggered difference-in-differences strategy below, I examine timeseries trends, over the 2002-2019 period, in employment and claiming rates, in Figure 5, separately for CPP and QPP participants. I show a separate timeseries for age groups 55-59, 60-64, and 65-69 to inspect whether employment and claiming for the age 60-64 group differentially changed relative to other ages who were not directly affected by the removal of the Work Cessation Test. The plot also provides reassurance for my difference-in-differences design since it indicates that the required parallel trends assumption (comparing CPP and QPP participants) holds. The figure shows minimal employment increases for CPP participants of the age 60-64 group after 2012, but relatively larger increases for QPP participants of that age group after 2014, when the QPP-equivalent of the Work Cessation Test was removed. In addition, after 2012, the rate of early claiming (at ages 60-64) increased for CPP participants relative to that of QPP participants, until after 2014.

My second set of graphical analyses focuses on labour supply for the age 65-70 population whose income is around the OAS income test threshold. I conduct this analysis separately for pre- and post-2013 observations to inspect for employment responses to the introduction of the OAS deferral option. I present in Figure 6 the employment rate for these two groups into income bins (of size $1,000 dollars); each dot represents a bin-specific employment rate. Of particular note, a dip in the employment occurs around the income threshold for pre-2013 observations, but it flattens out for those in year post-2013 years. Figure 7 suggests that this change in the employment rate is correlated with the option to defer OAS receipt. Specifically, it shows a downward kink in the OAS claiming rate at the income test threshold. Together, it appears that both the reform elicited both employment and claiming responses among the group subject to the recovery tax.

3.4. Difference-in-differences analysis of the Work Cessation Test

I set up a difference-in-differences design to first measure the initial impacts of the removal of the Work Cessation Test during the 2012-2014 period on the employment and claiming rates for CPP participants aged 60-64; I then measure the impacts for the post-2014 period, after the removal of the QPP-equivalent of the Work Cessation Test. In regression form, this is done by estimating the following equation

$$Y_{igt} = \alpha_0 + \mu_t + G_i + \beta_1(Post_1 \times G_i) + \beta_2(Post_2 \times G_i) + X_{it}^T + \epsilon_{igt} \quad (1)$$

In equation (1), *Y* is either an indicator for having positive employment income or having receipt of C/QPP retirement benefits for individual *i* in group (i.e., CPP or QPP participant) *g* in year *t*. I include in equation (1) a set of year fixed effects, μ_t, a CPP participant indicator, G_i, and a set of regressors X_{it}^T, which include indicators for having had, at ages 50-53, RPP contributions, RRSP contributions, and a prime-earnings measure. The *X* vector also contains dummies for being a female and being married. $Post_1$ and $Post_2$ and indicators equal to one for the years 2012-14 and post-2014. Of interest are the β_1 and β_2 parameters, which measure the difference-in-differences in employment/claiming rates for CPP to QPP participants during the 2012-14 and post-2014 periods. For a heterogeneity analysis across provinces, I estimate equation (1) with re-specifying the *G* indicator for being a CPP participant to a set of indicators equal to one for each province, excluding Quebec (the omitted group).

I present the output from equation (1) in Table 3. It suggests that, during the 2012-14 period, the employment rate of CPP participants who are between the ages of 60-64 did not change relative to that of QPP participants. On the other hand, after 2014, the employment rate of CPP participants decreased relative to QPP participants, indicating that the elimination of the QPP-equivalent of the Work Cessation Test had some effect on employment.

I also conduct robustness tests on equation (1). These include changing the years considered in the $Post_1$ and $Post_2$ indicators. I present the results in the Appendix. In general, however, they suggest no employment or claiming effects occurred in the pre-2012 years. In addition, as per Figure 5, the parallel trends assumption appears to hold for this analysis.

3.5. Regression-Kink Design at the OAS Threshold

Figures 6 and 7 provided graphical support that, at and above the OAS income test threshold, the introduction of the OAS deferral option increased the rate of employment and deferral. As described in section 2.2, I am to measure the difference in the employment and claiming rate between those who are subject to the recovery tax (s=1) to those who are not (s=0). To do this, I implement a regression-kink estimator with a local linear specification of the following form

$$\mathrm{Y}_{\mathrm{i,t}} = \pi + \mathrm{g}\left(\mathrm{Y}_{\mathrm{i,t-1}}\right) + \delta \mathrm{Y}_{\mathrm{i,t-1}} \mathrm{D}_{\mathrm{i,t-1}} + \mathrm{X}'_{\mathrm{i,t}}\zeta + \nu_{\mathrm{i,t}} \quad (2)$$

In equation (2), *Y* is either an indicator equal to one for being employed (i.e., having reported positive employment earnings), or an indicator equal to one for having claimed OAS benefits (i.e., having reported positive OAS income). The running variable, $Y_{i,t-1} \in [-b, b]$, where $Y_{i,t-1}$. denotes individual *i's* net income relative to the OAS income test threshold in year *t-1*; *g()* is a polynomial function (local linear); $X'_{i,t}$ is a vector of individual-specific observable characteristics; and $D_{i,t-1} = 1\{Y_{i,t-1} \geq OAS_t\}$ is an indicator function set to one for individuals with net income in the previous year exceeding the OAS income test threshold. One-year lagged net income and outcomes based on earnings and employment in the current year are used because the current year's OAS claw-back depends on last year's net income.

The parameter of interest δ measures the change in slope as a function of last year's net income relative to the threshold. Using a cross-sectional design for those with last year's net income localized around the threshold, those locating below the income test threshold are assigned as the control group and those locating above the threshold as the treatment group. The bandwidth, b, around the threshold is selected using the selection criteria outlined in Calonico, Cattaneo and Titiunik (2014) and Pei (2020). (See Appendix for details.) The required assumption to identify the parameter δ is that there be no "sorting" of the running variable around the OAS threshold kink. In other words, there should be no earnings bunching in lagged net income around that kink point. This assumption should hold since the OAS income test threshold changes each year with the consumer price index, and it is last year's income that stands as the running variable.

However, following the 2013 OAS deferral change workers aged 65-70 had the option to defer benefit receipt and avoid the earnings test. For workers who elected to defer benefits, the relevant kink at the OAS threshold vanishes. Therefore, the discontinuity in the employment rate would be expected to reduce in magnitude after 2013. As shown in Figure 6, that is indeed what happens for the age 65-70 population. In addition, Figure 7 shows pre- to post-reform differences in the probability of claiming OAS at the relevant threshold. Clearly for individuals aged 65 through 70 after 2013, a downward kink in the OAS claiming rate develops at the threshold. Accordingly, I estimate equation (2), separately, for pre- and post-2013 observations.

I present the results from equation (2) in Table 4. I estimate that the recovery tax threshold kink caused an upward shift in the retirement probability of 0.18. Compared to the pre-reform observations, the retirement of those with earnings above the threshold decreased by 9.9 percentage points. In terms of OAS claiming, before the deferral option, those with income above the OAS threshold increased the probability of claiming OAS by 2.32 percentage points. But the claiming rate fell above the threshold by approximately 7.0 percentage points after the introduction of the deferral option in 2013.

4. Retirement-Age Bunching and Policy Implications

My analyses detect some employment responses to the CPP and OAS earnings test reforms; but how much do they affect retirement-age bunching? Using a lifetime budget constraint, Figure 8 predicts why retirement-age might occur at the ERA and NRA; in line with this, as shown in Figure 1, bunching occurs at both the ERA and NRA – how much did the removal of these earnings tests affect these empirical moments? This is worthwhile to consider since policymakers must understand the relative importance of financial work incentives versus social/heuristic forces in influencing retirement decisions around these ages, since, as mentioned in the opening paragraph, focusing only on changing financial incentives can be costly if they do not function as intended.

I examine the extent to which ERA and NRA bunching changed from the pre- to post-reform years. This is done by estimating for individual *i* equations of the following form

$$y_i = \beta_0 + \beta_1 I(age_i \geq AGE) + \beta_2 (age_i - AGE) + \beta_3 (age_i - AGE) I(age_i \geq AGE) + \epsilon_i \quad (3)$$

The outcome in equation (3) is an indicator for individual *i* having positive employment income, and *AGE* represents either the ERA or the NRA. Of particular interest is the ratio β_1/β_0, which provides an estimate of the extent of excess employment exit occurring at the ERA or NRA. Similar estimators have been used in Brinch, Vestad, and Zweimuller (2015), and Fetter and Lockwood (2018). Equation (3) is estimated separately on the pre- and post-reform samples. Table 5 presents the results. While it shows sharp pre-reform ERA bunching, I find that this bunching dissipated in the post-reform years. On the other hand, my estimates suggest that NRA bunching is larger than ERA bunching and is just as present in the post-reform years as it was in pre-reform years, suggesting the continued importance of the NRA norm.

5. Conclusions

A common mode of contemporary reforms to encourage extended working lives is to eliminate earnings tests on pension income. While theoretically appealing, such reforms are not without problems. For example, if older workers do not in response increase their labour supply, these reforms mechanically increase the number and level of benefit payouts by relaxing eligibility restrictions. Retirement-age bunching at statutory eligibility ages for benefit receipt is an empirical regularity in which tends to be attributable to social norms/heuristics, and this raises policy concerns about the effectiveness of such financial reforms to incentivize delayed retirement. I use two causal research designs to measure the impacts of the elimination of two earnings tests and then study whether they had an effect on retirement-age bunching.

Using income-tax and related data, I first examine employment and claiming effects of the removal of the Work Cessation Test, which before 2012 required low to zero employment earnings among workers aged 60-64 to commence Canada Pension Plan (CPP) receipt. In a staggered difference-in-differences design, I exploit a natural experiment to measure its impacts. Namely, the Quebec Pension Plan (QPP), a similar but distinct public pension system in the province of Quebec, eliminated its version of the Work Cessation Test two years later, in 2014. I use this time lag to measure changes in CPP participants' employment and claiming outcomes relative to QPP participants'. My results indicate that this reform increased the employment rate of CPP participants but increased the early claiming rate by more. Overall, it attenuated retirement-age bunching at the early retirement age (ERA), age 60, when early CPP claiming can commence.

My second analysis focuses employment at and above Canada's normal retirement age (NRA), age 65, for receipt of Old Age Security (OAS) benefits. OAS features an earnings test on high income earners; those with earnings above the test's threshold are subject to a 15% benefit reduction on their OAS pension, causing a kink in their budget set. I examine, using a regression-kink design, the extent to which this earnings test impacts employment decisions among the post-NRA population of high earners. In addition, I exploit a 2013 policy change that introduced an actuarially generous OAS deferral option. In choosing to defer, those who would otherwise be subject to the earnings test can effectively avoid it. My results suggest that, before 2013, a downward kink in the post-NRA population's employment rate existed at the threshold, but it dissipated after 2013 when OAS deferral permitted. In addition, a post-2013 downward kink in the OAS claiming rate developed at the kink, suggesting that the deferral reform and employment among this group are closely connected. However, among the whole post-NRA population, retirement-age bunching at the NRA did not change, suggesting the continued importance of the NRA retirement norm.

References

Baker, Michael, and Dwayne Benjamin. 1999a. "Early Retirement Provisions and the Labor Force Behavior of Older Men: Evidence from Canada." *Journal of Labor Economics*, 17 (4)

Baker, Michael, and Dwayne Benjamin. 1999b. "How do retirement tests affect the labour supply of older men?" *Journal of Public Economics*, 71 (1): 27-51

Baker, Michael. 2002. "The Retirement Behavior of Married Couples: Evidence from the Spouse's Allowance." *Journal of Human Resources*, 37, 1-34

Baker, Michael, Jonathan Gruber, and Kevin Milligan. 2003. "The retirement incentive effects of Canada's Income Security programs." *Canadian Journal of Economics*, 36 (2), 261-90

Behaghel, Luc, and David Blau. 2012. "Framing Social Security Reform: Behavioral Responses to Changes in the Full Retirement Age." *American Economic Journal: Economic Policy*, 4 (4), 41-67

Blau, David. 2008. "Retirement and Consumption in a Life Cycle Model." *Journal of Labor Economics*, 26 (1)

Blundell, Richard, Eric French, and Gemma Tetlow. 2016. "Retirement Incentives and Labor Supply." *Handbook of the Economics of Population Aging*, Chapter 8, Vol. 1, 457-566

Brinch, Christian, Ola Vestad, and Josef Zweimuller. 2015. "Excess early retirement? Evidence from the Norwegian 2011 pension reform." Mimeo

Brown, Kristine. 2013. "The link between pensions and retirement timing: Lessons from California teachers." *Journal of Public Economics*, 98: 1-14

Burtless, Gary. 1986. "Social Security, Unanticipated Benefit Increases, and the Timing of Retirement." *The Review of Economic Studies*, 53 (5): 781-805

Burtless, Gary, and Robert Moffitt. 1985. "The Joint Choice of Retirement Age and Postretirement Hours of Work." *Journal of Labor Economics*, 3 (2)

Deshpande, Manasi, Itzik Fadlon, and Colin Gray. 2021. "How Sticky Is Retirement Behavior in the U.S.?" *The Review of Economics and Statistics*, 1-55

Duggan, Mark, Irena Dushi, Sookyo Jeong, and Gina Li. 2021. "The Effect of Changes in Social Security's Delayed Retirement Credit. Evidence from Administrative Data." *NBER Work Papers*, no. 28919, National Bureau of Economic Research, Inc.

Employment and Social Development Canada. 2022. "Public pensions", retrieved from https://www.canada.ca/en/services/benefits/publicpensions.html

Fetter, Daniel, and Lee Lockwood. 2018. "Government Old-Age Support and Labor Supply: Evidence from the Old Age Assistance Program." *American Economic Review*, 108 (8): 2174-2211

Friedberg, Leora. 1998. "The Social Security Earnings Test and Labor Supply of Older Men." *Tax Policy and the Economy*, 12

Friedberg, Leora. 2000. "The Labor Supply Effects of the Social Security Earnings Test." *The Review of Economics and Statistics*, 82 (1): 48-63

Gelber, Alexander, Damon Jones, and Daniel Sacks. 2020. "Estimating Adjustment Frictions Using Nonlinear Budget Sets: Method and Evidence from the Earnings Test." *American Economic Journal: Applied Economics*, 12 (1): 1-31

Gelber, Alexander, Damon Jones, Daniel Sacks, and Jae Song. 2022. "The Employment Effects of the Social Security Earnings Test." *Journal of Human Resources*, 57 (2): 341-371

Gruber, Jonathan. 2000. "Disability Insurance Benefits and Labor Supply." *Journal of Political Economy*, 108 (6)

Gruber, Jonathan, and Peter Orszag. 2003. "Does the social security earnings test affect labor supply and benefits receipt?" *National Tax Journal*, 56 (4)

Gruber, Jonathan, Ohto Kanninen, and Terhi Ravaska. 2022. "Relabeling, retirement and regret." *Journal of Public Economics*, vol 211

Haan, Peter, and Victoria Prowse. 2014. "Longevity, life-cycle behavior and pension reform." *Journal of Econometrics*, 178 (3): 582-601

Haider, Steven, and David Loughran. 2008. "The Effect of the Social Security Earnings Test on Male Labor Supply: New Evidence from Survey and Administrative Data." *Journal of Human Resources*, 43 (1): 67-87

Lalive, Rafael, Arvind Magesan, and Stefen Staubli. Forthcoming. "How Social Security Reform Affects Retirement and Pension Claiming." *American Economic Journal: Economic Policy*

Maestas, Nicole. 2010. "Back to Work Expectations and Realizations of Work after Retirement." *Journal of Human Resources*, 45 (3): 718-48

Manoli, Day, and Andrea Weber. 2016. "Nonparametric Evidence on the Effects of Financial Incentives on Retirement Decisions." *American Economic Journal: Economic Policy*, 8 (4): 160-82

Milligan, Kevin, and Tammy Schirle. 2014. "Push and Pull: Disability Insurance, Regional Labor Markets, and Benefit Generosity in Canada and the United States." *Journal of Labor Economics*, 37 (S2)

Rogerson, Richard, and Johanna Wallenius. 2013. "Nonconvexities, Retirement, and the Elasticity of Labor Supply." *American Economic Review*, 103 (4): 1445-62

Ruhm, Christopher. 1990. "Bridge Jobs and Partial Retirement." *Journal of Labor Economics*, 8 (4)

Saez, Emmanuel. 2010. "Do Taxpayers Bunch at Kink Points?" *American Economic Journal: Economic Policy*, 2 (3): 180-212

Seibold, Arthur. 2021. "Reference Points for Retirement Behavior: Evidence from German Pension Discontinuities." *American Economic Review*, 111 (4): 1126-65

Song, Jae, and Joyce Manchester. 2007. "New evidence on earnings and benefit claiming following changes in the retirement earnings test in 2000." *Journal of Public Economics*, 81 (3-4), 669-700

Appendix

- Canada Pension Plan Retirement Benefit Calculation, Key Features, and Post-Retirement Benefits

CPP retirement benefits are funded with a payroll tax applied to earnings above a nominally set basic exemption and are designed to replace 25 percent of career average earnings up to the average industrial wage – known as the years maximum pensionable earnings (YMPE).[2] Payroll contribution rates are currently set at 9.9 percent, split between the employer and worker. A simplified representation of the formula used to calculate monthly CPP retirement benefits is the product of three components according to

Monthly Benefit =

0.25 x (Average Earnings Ratio) x (Average YMPE) x (Adjustment factor) x (1/12).

The first component is individuals' average career pensionable earnings over their contributory period, earnings years since age 18, or since the CPP's 1966 inception, up to the month before CPP take-up the month before turning 70 or dies. The second component scales average career earnings to the prevailing YMPE, applying a five-year moving average of the YMPE including the year of CPP take-up. The third and final component applies a pension adjustment factor which adjusts the CPP benefit to the age of take-up. CPP take-up at age 65 results in an unadjusted CPP benefit, while take-up before (after) age 65 results in a downward (upward) adjustment factor of 0.6 (0.64) percent per month.

[2] Starting in 2019, with CPP Expansion, the CPP replacement rate is being gradually increased from 25 to 33.3 percent. This contribution rate, however, is set to contribute to what are known as CPP "Base" benefits. Starting in 2016 there is an additional 2 percent contribution rate on "Additional" benefits which are part of the recent CPP Expansion which seeks to gradually increase CPP replacement rates from 25 to 33 percent. See Baldwin (2020) for more details on this issue. The self-employed pay the full 9.9 percent.

Canada instituted in 2012 the inclusion of Post-Retirement Benefits.[3] The Post-Retirement Benefits provision is intended to give CPP beneficiaries the option to continue to work and make CPP contributions for actuarially neutral adjustments. After 2012 those who work and take-up early CPP retirement benefits are required to continue making payroll contributions until they retire or reach the age of 65, while those who continue to work and take-up CPP after 65 are given the option to make contributions to their Post-Retirement Benefit. For working CPP beneficiaries, each year of Post-Retirement Benefit contributions is payable in the following year, payable until the contributor's death, and the level of these benefits increase with price inflation. Employment and Social Development Canada (2017) estimates that in 2016-17 approximately 1.1 million CPP beneficiaries were receiving a Post-Retirement Benefit, totalling $341 million in payouts. To encourage deferred take-up, modifications to the CPP benefit formula stipulated decreases (increases) to the downward (upward) adjustment factor from 0.5 to 0.6 (0.5 to 0.64) percent per month.[4] And the drop-out provision was increased from 15 percent to 17 percent to allow more low earnings years to be excluded.[5]

Also, in 2012 the CPP Work Cessation Test was eliminated. The Work Cessation Test acted as an earnings test on prospective CPP pensioners aged 60-64; at that time CPP pensioners aged 65 and above were not subject to the work cessation test. Prior to 2012 the work cessation test stipulated that, to take-up CPP, individuals aged 60-64 must substantially reduce their labour earnings during the two consecutive months following initial take-up of CPP retirement

[3] See the following CBC (2012) news article for reference: https://www.cbc.ca/news/business/taxes/6-big-canada-pension-plan-changes-arrive-in-2012-1.1167450
[4] The decrease in the downward adjustment factor from 0.5 to 0.6 percent per month was phased in gradually from 2012 to 2016, while the increased upward adjustment factor was instated immediately in 2012.
[5] The drop-out provision was increased gradually, from 15 to 16 percent between 2012 and 2013, and from 16 to 17 percent between 2013 and 2014. At 15 percent, someone who takes up their CPP at age 65 after contributing each year from age 18 to 65can have seven of their low or zero earnings years dropped; at 17 percent, the same person can have eight years dropped.

benefits.[6] Beginning in January 2012 a 60-64-year-old could continue to work while taking up CPP – a policy shift that accommodates the increasingly gradual nature of retirement.

- More details on the Post-Retirement Benefit

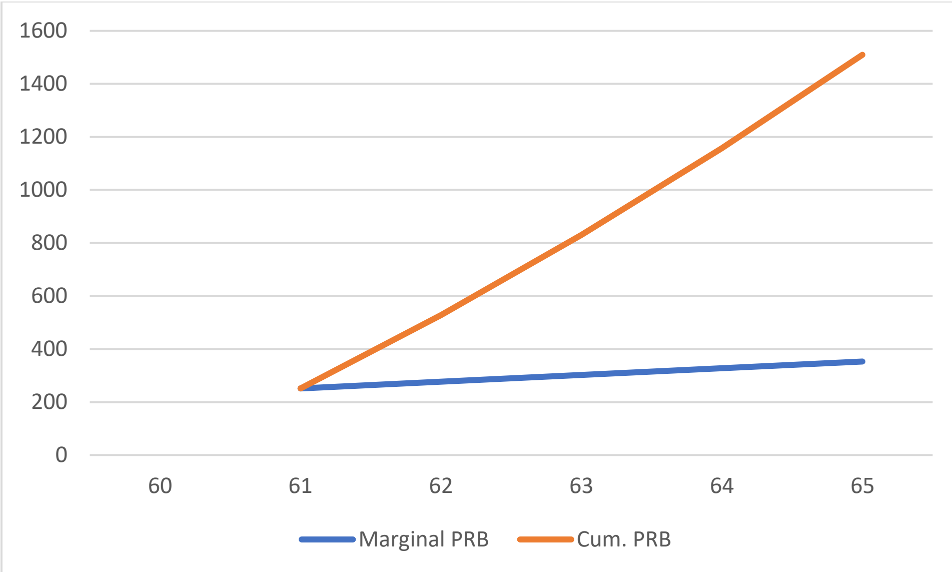
While post-retirement benefit contributions are voluntary for working age 65-70 pensioners, they are automatically enrolled into the post-retirement benefit program. Contributions end to it only if they file a notice to the Canada Revenue Agency (CRA). To re-start contributions they must file to the CRA.

The post-retirement benefit payout is a function of age and earnings. If you are 65, the maximum monthly CPP retirement benefit you can receive (in 2020) is $1,175.85; the maximum post-retirement benefit payout is 1/40th of the maximum CPP retirement benefit, or at most $29.40. The maximum annual post-retirement benefit is $352.75.

The post-retirement benefit faces actuarial adjustment factors, much like the CPP pension. Benefits are reduced by 7.2 percent per year on between 60-64 and increased by 8.4 percent per year between 65-70.

As an example, consider maximum CPP contributors (i.e., earning above the YMPE ($58,700)): In 2020, they make an annual CPP contribution of $2,898. If the contributor is 60 years old, still working, and collecting their CPP, their contributions will earn them the following adjusted post-retirement benefit schedule (indexed annually for life), starting at age 61:

[6] A further stipulation was that prospective pensioners must have labour earnings of at most the maximum CPP benefit for that year.



During this time their cumulative CPP contributions would amount to $14,490. In return for the contributions, their lifetime CPP pension will be $1,509.77 more each year, for life. Furthermore, if they live for 20 years past 65, to 85, they will receive approximately $30,195 in post-retirement benefit payouts, in addition to the payouts received during the 60-65 period.

For a 65-year-old contributor, the post-retirement benefit payout earns a return of about 13% per year, indexed for life. If they earned at least the YMPE in 2020 ($58,700) they would be entitled to a post-retirement benefit of $382.43 at age 66 (in 2021). That is

max PRB($352.75) +(0.07*12) =

$29.63 ($29.63+$352.75 = $382.43).

- Risk-return perspective

On their contribution of $2,898, they earn a return of $352.80/$2,898 = 13.19%).

- Bunching at Kink Points with Fixed Costs of Intensive Margin Adjustments

The bunching predictions of this paper are based on the neoclassical model of labor supply as outlined in Saez (2010). For a given individual i, utility is a function of after-tax income (consumption), c_i, and before-tax income (cost of effort), z_i. In this framework, utility depends positively on c_i and negatively on z_i. Then according to the utility function, the cost of effort varies with n which is assumed to be drawn from a smooth distribution.

Absent a convex kink at the earnings exemption, z^* , we assume a linear tax-schedule, $T(z) = t \cdot z$ with a smooth, baseline, earnings distribution, $h_0(z)$. The earnings exemption creates a convex kink at z^*: a discrete increase in the marginal increase in the tax rate from t to $t + \Delta t$, giving the following kinked tax-function: $T(z) = t \cdot z + \Delta t \cdot (z - z^*) \cdot I(z > z^*)$, where $I(\cdot)$ is an indicator function. Under the linear tax-schedule, absent the convex kink, an individual with ability $n^* + \Delta n^*$ would locate in earnings bin $z^* + \Delta z^*$.

With the imposition of a kinked tax-function, all workers who earned in the interval $(z^*, z^* + \Delta z^*)$ who were tangent to $T(z) = t \cdot z$ move to the kink point, z^*[7]. The behaviour causes the excess bunching mass observed at z^*, which is completely offset by a missing mass on (z^*, ∞). No hole is created in the distribution because some of those located above the marginal buncher, $z^* + \Delta z^*$, shift earnings to fill up the hole.

Assume individuals incur adjustment costs associated with adjusting earnings. The adjustment costs are captured in this model as dis-utility, $\phi(\alpha)$, and its impact is portrayed in

[7] Implicitly assumed by Saez (2010) that there is a homogenous preference parameter; this has been disputed by Blomquivst and Newey (2017).

Figure 2C for an individual with earnings z* in the range (z', z''). For individuals earning z', utility for re-locating to z* is given by

$$u(c, z^*; \alpha) = u(c, z'; \alpha) + \phi, z' < z^*$$

and for those earning z''

$$u(c, z^*; \alpha) = u(c, z''; \alpha) + \phi, z'' > z^*.$$

If the utility gain from re-locating earnings to z* is not sufficiently large to offset ϕ, then individuals do not re-locate to z*.

- Using Fixed Costs of Earnings Adjustment to explain the Kink in the Employment Rate at the OAS income test threshold

Consider an individual who has a zero-earnings option *b*, a level of benefits they can receive without working. For an individual with initial earnings z'' to re-locate earnings to z*, the OAS threshold, they must incur an adjustment cost of $\phi = u(c, z^*; \alpha) - u(c, z''; \alpha)$. At the margin, as portrayed in Figure 3C, some individuals within the range (z*, z'') do not re-locate to z* because the adjustment cost of doing so outweighs the utility gain. However, some individuals choose the zero-earnings option (they retire) because the utility that they receive from benefits *b* alone outweighs the utility they would receive from re-locating to z* minus the adjustment cost as well as the utility they would receive from keeping earnings at z'' with tax rate t_1.

- Regression-Kink Design

For a binary treatment indicator $D = 1\{X \geq 0\}$ where X is a normalized policy cutoff, RD and RK designs estimate, under smoothness assumptions (Hahn, Todd, and Van der Klaauw, 2001; Lee, 2008),

$$lim_{x \to 0^+} E[Y : X = x] - lim_{x \to 0^-} E[Y : X = x]$$

to identify the treatment effect, $\tau := E[Y_1 - Y_0 : X = 0]$, with Y_1 and Y_0 being potential outcomes. Econometricians estimate this equation using polynomial regression, separately for $lim_{x \to 0^+} E[Y : X = x]$ and $lim_{x \to 0^-} E[Y : X = x]$, solving a minimization problem using observations above, denoted by superscript +, the policy cutoff. These estimators are usually biased in finite samples, leading to an econometric literature (Hahn, Todd, and Van der Klaauw, 2001; Imbens and Kalyanaraman, 2012; Calonico, Cattaneo and Titiunik, 2014b) on asymptotic approximations for the bias and variance.

Calonico, Cattaneo and Titiunik (2014b) derive the asymptotic mean squared error (AMSE) for a *p*th order local polynomial as a function of bandwidth as

$$AMSE_{\hat{\tau}_p}(h) = h^{2p+2} B_p^2 + \frac{1}{nh} V_p$$

where *B* (approximate squared bias) and *V (*approximate variance) are unknown. The approximations of *B* and *V* depend on the *(p+1)* derivative of $E[Y : X = x]$ and the conditional variance, $Var[Y : X = x]$, on both sides of the policy cut-off, respectively (as well as the density of X at the cut-off for the variance approximation).

The AMSE equation is used to select the optimal bandwidth for an ad-hoc polynomial order p – this is done by solving $h_{opt}(p) := argmin_h\{AMSE_{\hat{\tau}_p}(h)\}$. This has been done previously in Imbens and Kalyanaraman (2012) for local linear estimation (*p = 1)* and more recently in Calonico, Cattaneo and Titiunik (2014b, hereafter CCT) to extend the optimal bandwidth selector to alternative polynomial orders.

This paper employs the CCT optimal bandwidth selector and follows the order selection approach developed in Fan and Gijbels (1996) and Pei, Lee, Card and Weber (2020). This method compares, after selecting an optimal bandwidth such as in CCT, the resulting $AM\hat{S}E_{\hat{\tau}_p}$ over a pool of candidate polynomial orders *p.* Formally, this paper selects *p* from the set *Ω* based on

$$\hat{p} := argmin_{p\in\Omega}\, AM\hat{S}E_{\hat{\tau}_p}\left(\hat{h}\,(p)\right)$$

To estimate the algorithm in Equation 3a, this paper employs the *rdmse* STATA package (Pei, 2020).

Appendix References

Calonico, S., Cattaneo, M., and Titiunik, R. (2014a) "Robust Data-Driven Inference in the Regression-Discontinuity Design." *Stata Journal*, 14(4): 909–946.

Calonico, S., Cattaneo, M., and Titiunik, R. (2014b) "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs." *Econometrica*, 82(6): 2295–2326.

Calonico, S, Cattaneo, M., Titiunik, R. (2015) "Optimal Data-Driven Regression Discontinuity Plots." *Journal of the American Statistical Association*, 110(512): 1753–1769

Card, D, Lee, D., Pei, Z., and Weber, A. (2020) "Local Polynomial Order Regression Discontinuity Designs", *NBER Working Paper* No. 27424

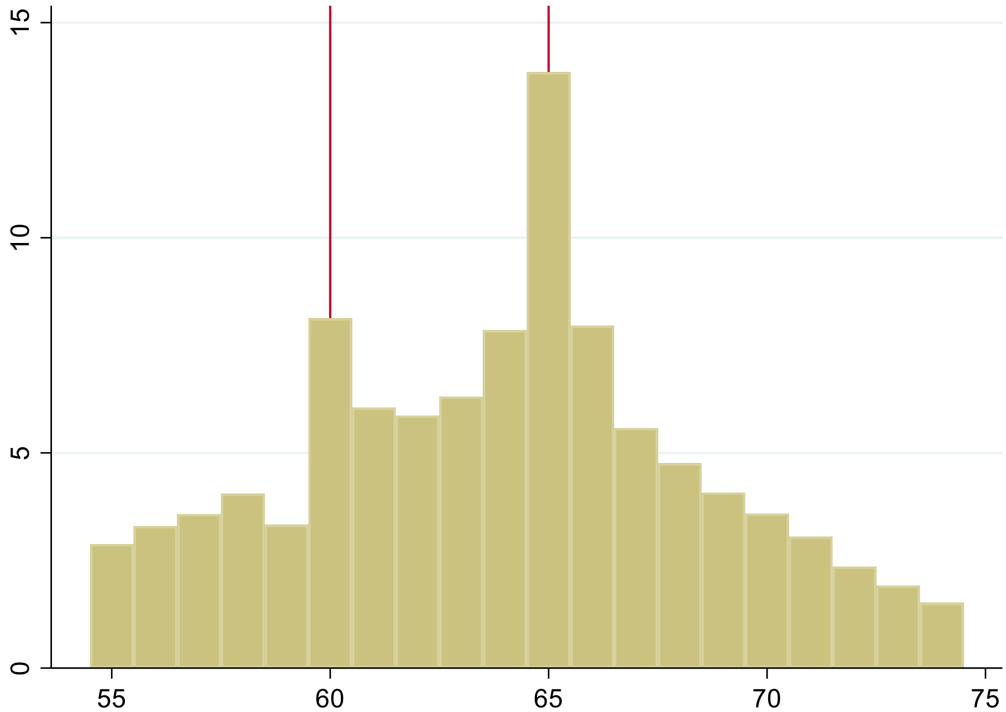
Card, D., Lee, D., Pei, Z., and Weber, A. (2012) "Nonlinear Policy Rules and the Identification and Estimation of Causal Effects in a Generalized Regression Kink Design." *NBER Working Paper* 18564.

Milligan, K., (2021), "Canadian Tax and Credit Simulator," retrieved from https://sites.google.com/view/kevin-milligan/home/ctacs

Stock, J., and Wise, D. (1990), "Pensions, the Option Value of Work, and Retirement," *Econometrica*, Vol. 58, No. 5, pp. 1151-1180

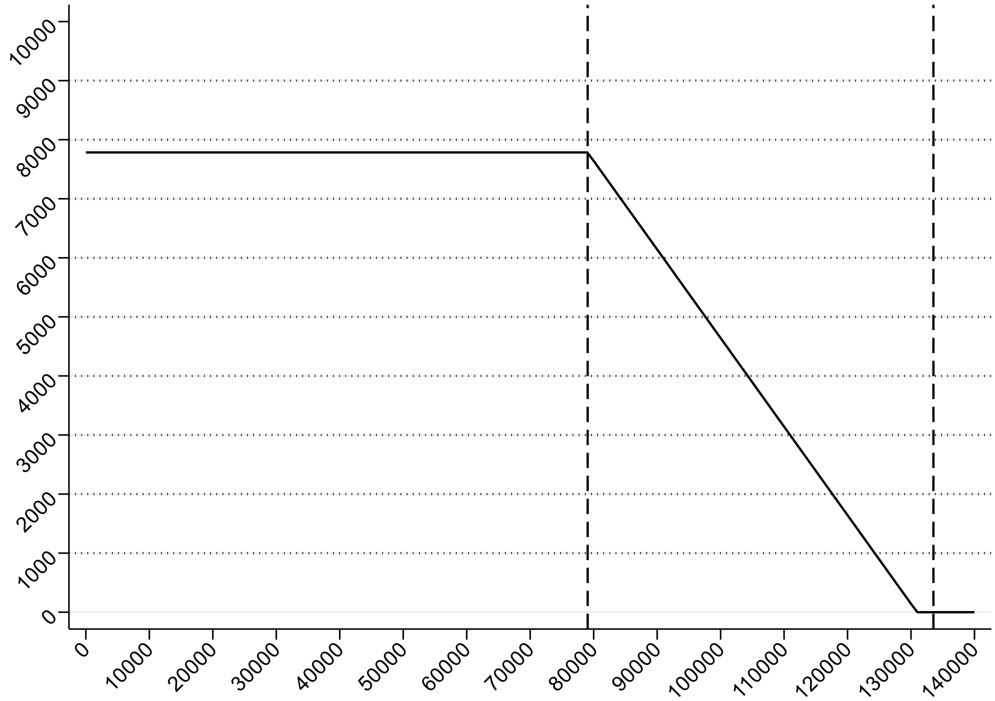
Figures and Tables

Figure 1: Retirement-Age Distribution



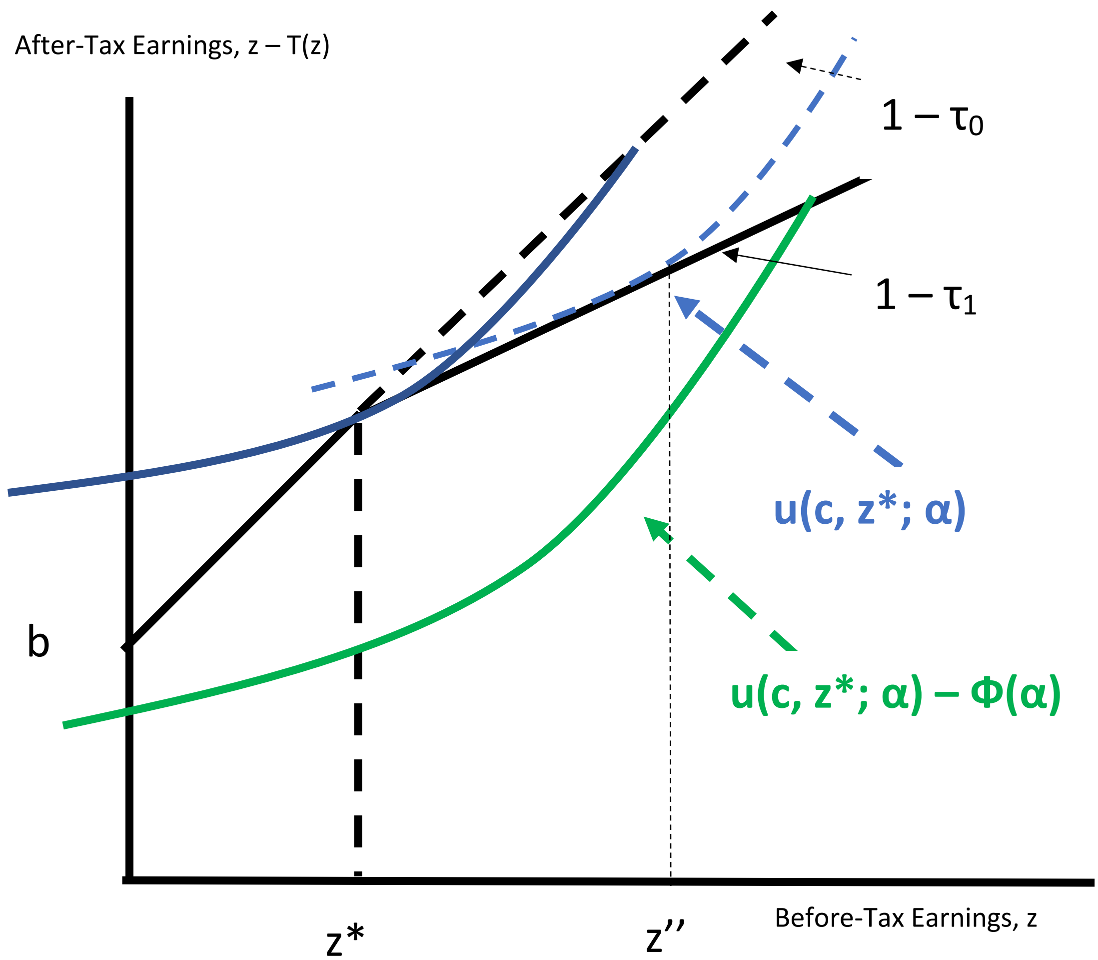
Notes: Authors' calculations based on the LAD. The sample used are those that survive and are observed filing income tax beyond age 66. Retirement-Age reflects the age at which I observe an individual to have their first two-year string of zero employment income (the sum of T4-earnings + self-employment income) conditional on having at least one year of positive employment income before that age.

Figure 2: Old Age Security Benefit Schedule



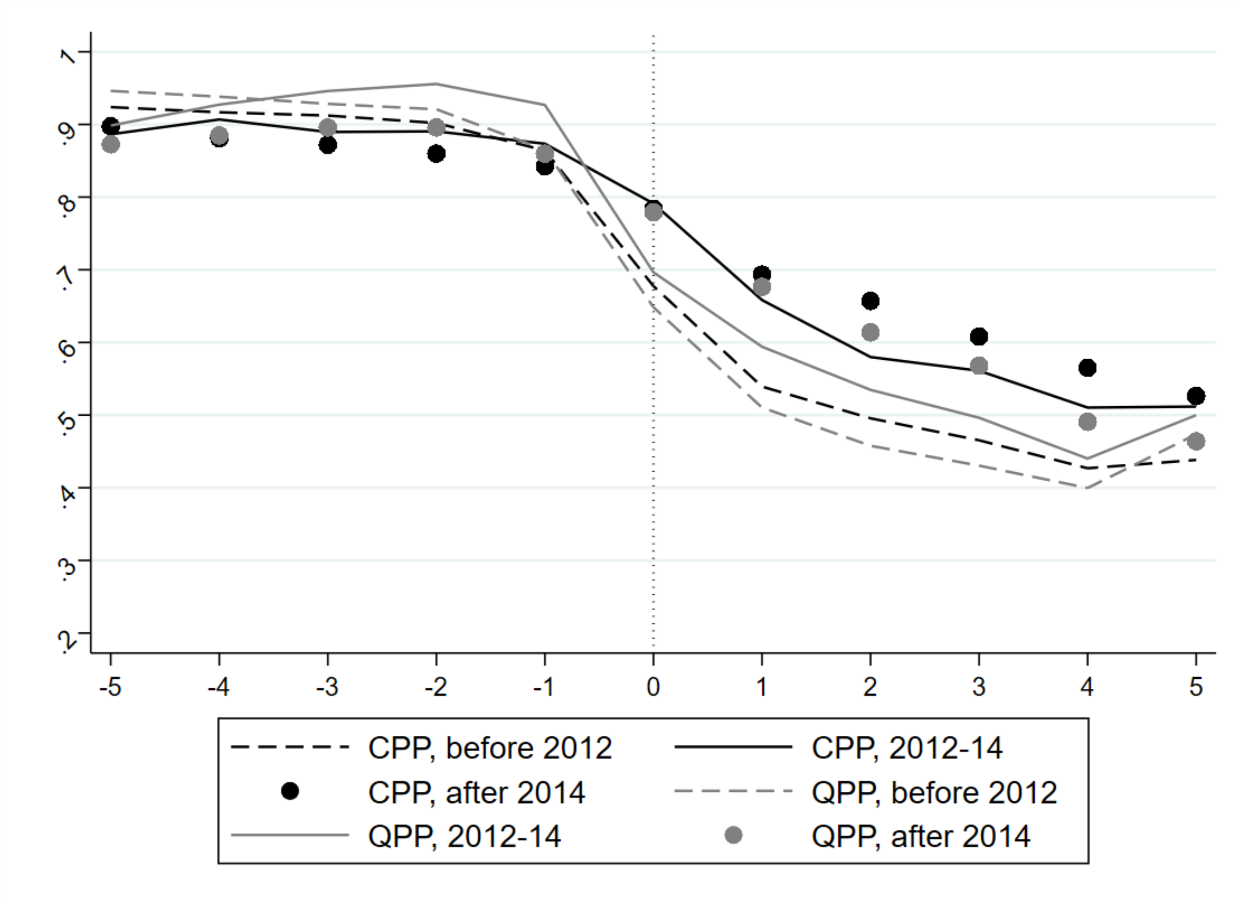
Notes: Author's calculations using current OAS parameters from Government of Canada, https://www.canada.ca/en/services/benefits/publicpensions/cpp/old-age-security/payments.html . The plot reflects the annual OAS benefit schedule as function of net income using 2022 parameters.

Figure 3: Zero-Earnings Response with Fixed Costs of Intensive Margin Adjustment



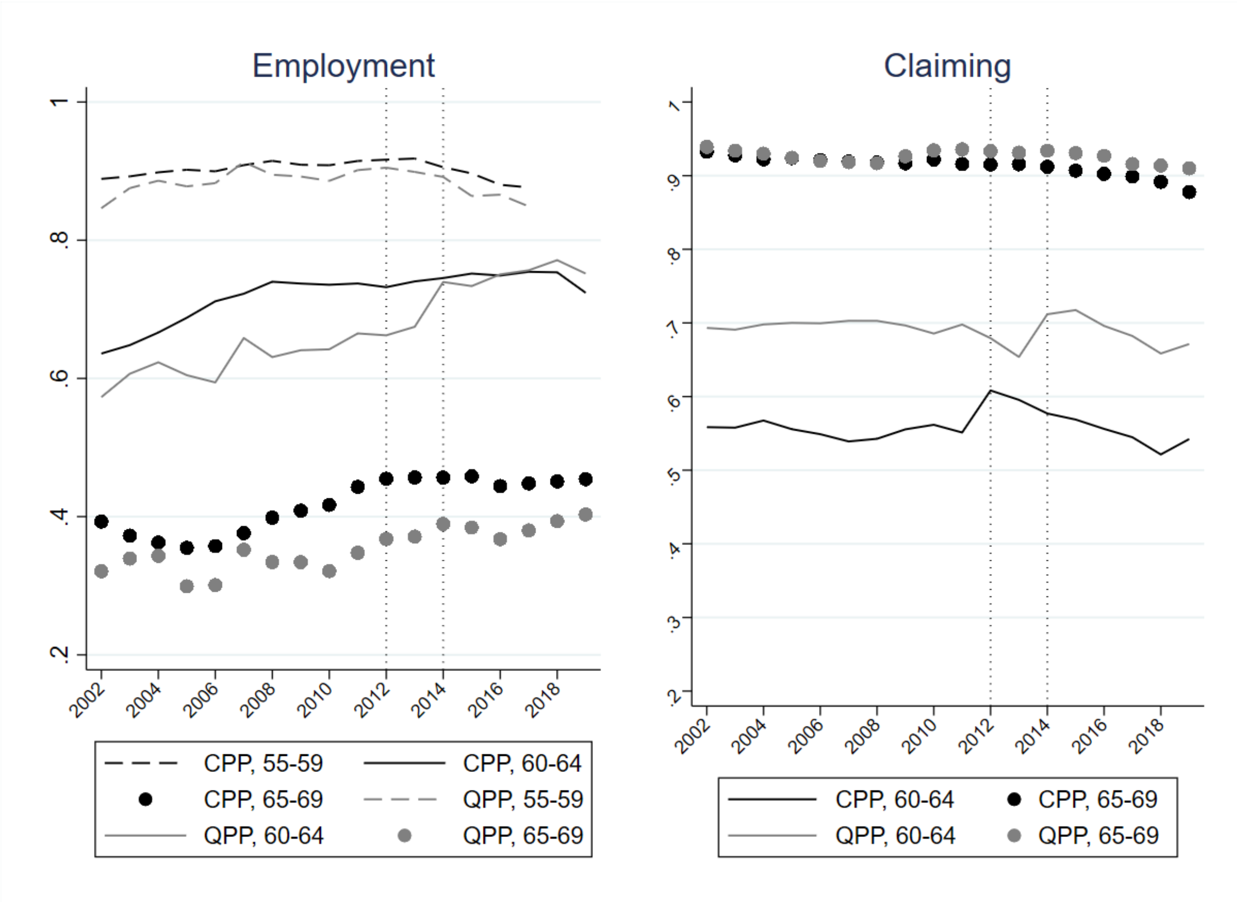
Notes: Produced by the Author based on Gelber et al.'s (2020) model. Consider an individual who has a zero-earnings option *b*, a level of benefits they can receive without working. For an individual with initial earnings z'' to re-locate earnings to z*, the OAS threshold, they must incur an adjustment cost of ϕ = u(c, z*; α) – u(c, z''; α). At the margin, some individuals within the range (z*, z'') do not re-locate to z* because the adjustment cost of doing so outweighs the utility gain. However, some individuals choose the zero-earnings option (they retire) because the utility that they receive from benefits *b* alone outweighs the utility they would receive from re-locating to z* minus the adjustment cost as well as the utility they would receive from keeping earnings at z'' with tax rate t_1.

Figure 4: Employment Rate Centered Around Year of C/QPP Take-up



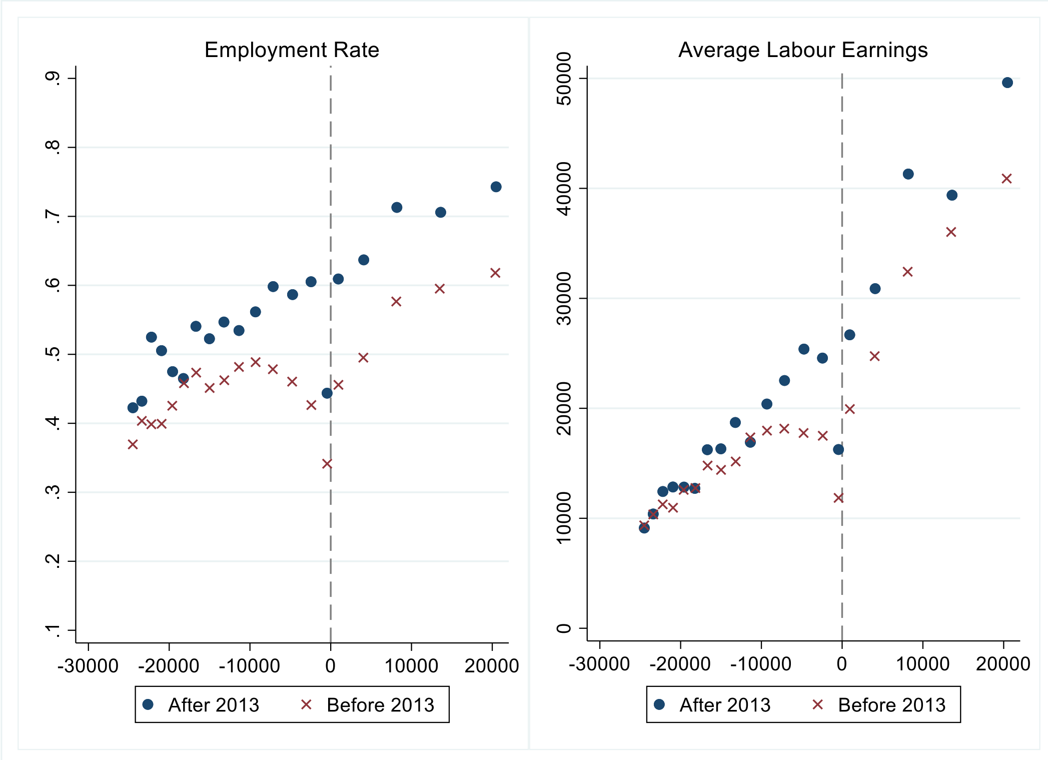
Notes: Author's calculations based on the Longitudinal Administrative Databank. This plot reflects employment rates for the age 60-64 population. On the x-axis, 0 represents the year of C/QPP take-up.

Figure 5: Employment and Claiming Rate Timeseries



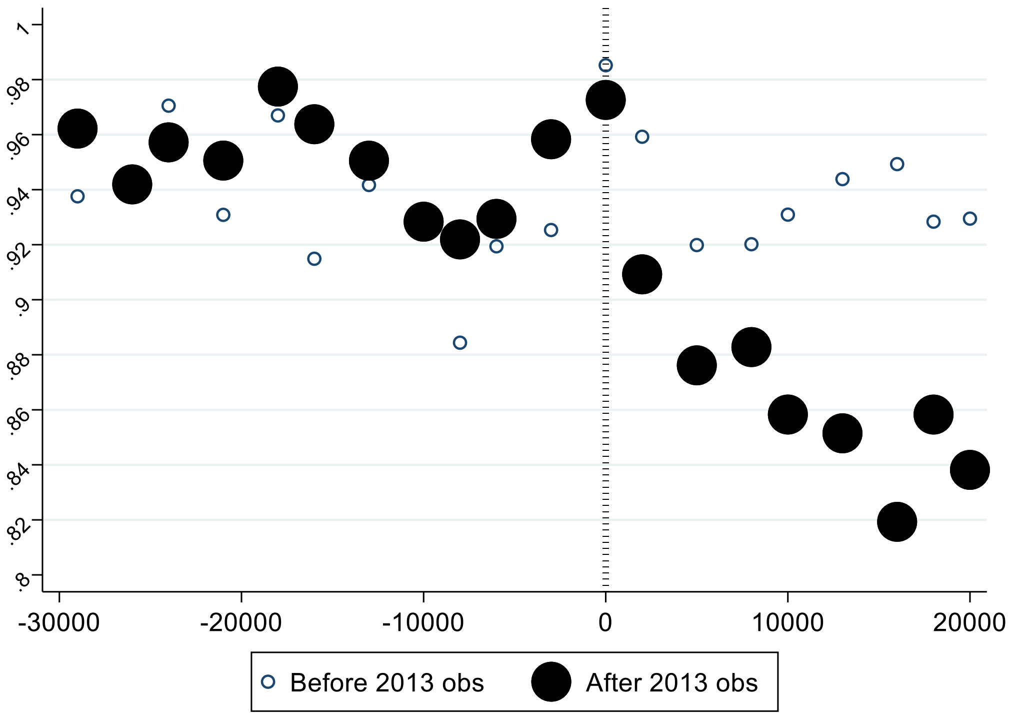
Notes: Author's calculations based on the Longitudinal Administrative Databank. These plots present unconditional means (proportion employed/claiming C/QPP benefits).

Figure 6: Post-NRA Labour Supply with Net Income Centered around the OAS Threshold



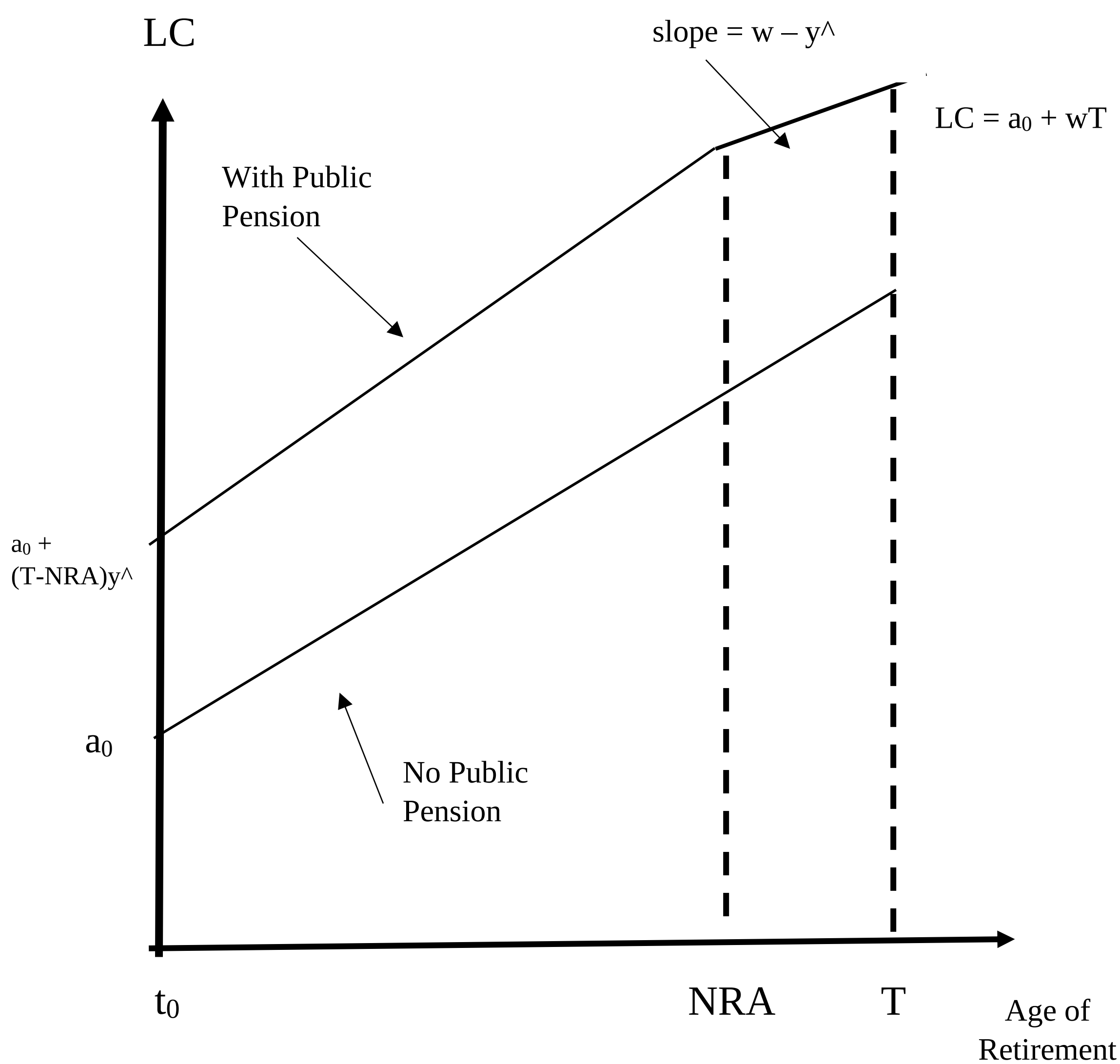
Notes: Author's calculations using the Longitudinal Administrative Databank. The post-NRA population represents those ages 65-70. This plot was produced using Stepner's (2011) binscatter Stata command. The dots present mean employment rates by binned net income of size $1,000.

Figure 7: Post-NRA OAS Claiming Rate with Net Income Centered around the OAS Threshold



Notes: Author's calculations based on the Longitudinal Administrative Databank. This plot was produced using Stepner's (2021) binscatter Stata command. The dots present the mean OAS claiming rate by binned net income of size $1,000.

Figure 8: Lifetime Budget Constraint with Retirement-Age Bunching



Notes: Diagram produced by the Author. The figure shows that one's private return to extending their working life beyond the NRA, but not before, is reduced. Hence, the presence of public pension benefits introduces a convex kink in the lifetime budget constraint at the NRA. For those whose retirement age is before the NRA, an additional working year increases total lifetime consumption by their earnings, *w*. In contrast, for those whose retirement age is after the NRA, extending their working life for one more year increases total lifetime consumption by the excess of earnings over the benefit level, max{0, w – y}. The program therefore impose an implicit marginal tax on earnings after the NRA, with tax rate t = min{1, y^/w}.

Table 1: CPP and QPP Policy Parameters Before and After 2012

	Canada Pension Plan	Quebec Pension Plan
Policy Parameters		
	Pre-2012 Rules	
Work Cessation Test	Reduce earnings to no more than the maximum monthly benefit ($986.67 in 2012) for two consecutive months after early (ages 60-64) CPP commencement	Similar earnings test
Change	Removed in 2012	Removed in 2014
Drop-Out Provision	In calculation average career earnings, 15% of low (zero) earnings years are ignored. For those who claimed CPP at age 65, this meant 7 low/zero years were dropped from their benefit calculation	Career earnings years are added to the QPP benefit calculation only if they result in an increase in average pension payments
Change	Increased to 7.5 years (16%) in 2012; again to 8 years (17%) in 2014	No change
Adjustment Factors	Penalty applied to early CPP take-up (ages 60-64) of 0.50% per month. Rewards to deferred CPP (ages 65-65) were also 0.50% per month	Similar adjustment factors
Change	Penalties and rewards gradually increased to 0.60% and 0.70% per month starting in 2012	Increased two years later, in 2014, and by less than the CPP's
Early Retirement Age	CPP can be commenced as early as age 60 with monthly penalties applied before age 65	The same early retirement age
Change	No change	No change
Normal Retirement Age	Unadjusted CPP benefits can be commenced at age 65, with rewards applied to take-up between ages 65 and 70. No actuarial advantage to take-up after 70	The same normal retirement age
Change	No change	No change

Notes: Produced by the author based on a report by the Office of the Superintendent of Financial Institutions (2018).

Table 2: Sample Summary Statistics

	CPP	QPP	Total
Whole Sample			
Count and Percent of Sample	72.93%	27.07%	1,285,025
Female	0.48 (0.50)	0.46 (0.50)	0.48 (0.50)
Married	0.78 (0.41)	0.73 (0.44)	0.77 (0.42)
Died	0.07 (0.26)	0.07 (0.26)	0.07 (0.26)
Ever Lost from File	0.07 (0.25)	0.04 (0.19)	0.06 (0.24)
Year of Birth	1948.87 (6.43)	1948.99 (6.34)	1948.90 (6.40)
C/QPP at age 60	0.35 (0.48)	0.45 (0.50)	0.37 (0.48)
C/QPP at age 65	0.95 (0.48)	0.95 (0.48)	0.95 (0.48)
Self-employed, ages 50-53	0.16 (0.37)	0.13 (0.33)	0.15 (0.36)
Mean Employment Income, ages 50-53	64200.38 (112903.29)	54875.50 (87362.98)	61675.82 (106674.17)
RPP Contributions, ages 50-53	0.62 (0.48)	0.64 (0.48)	0.63 (0.48)
RRSP Contributions, ages 50-53	0.67 (0.47)	0.66 (0.47)	0.66 (0.47)
Sample of Survivors beyond NRA			964,354
OAS Ineligible	0.044 (0.205)	0.022 (0.147)	0.038 (0.192)
Subject to OAS recovery tax	0.108 (0.310)	0.055 (0.229)	0.094 (0.292)

Notes: Author’s calculations based on the Longitudinal Administrative Databank. Cells reflect means and proportions with standard deviations in parentheses. The counts represent cross-sectional units.

Table 3: DiD Estimates

	1 No controls	2 Demographic controls	3 Prime-Earnings Controls	4 All Controls	5 Heterogeneity by Province
β_1	-0.004	-0.007	-0.008	-0.009	
	(-0.55)	(-1.04)	(-1.09)	(-1.23)	
β_2	-0.020***	-0.022***	-0.023***	-0.022***	
	(-4.35)	(-4.91)	(-4.95)	(-4.95)	
β NFLD					0.102***
					(4.55)
β PEI					0.073*
					(1.96)
β NS					0.050**
					(2.65)
β NB					0.041*
					(2.05)
β ON					-0.018*
					(-2.27)
β SAS					-0.025
					(-1.47)
β MAN					0.018
					(1.02)
β ALB					-0.027*
					(-2.37)
β BC					-0.002
Constant	0.624***	0.562***	0.556***	0.573***	0.586***
	(235.58)	(86.76)	(84.96)	(75.73)	(77.31)
N	234680	234680	234680	234680	234680
adj. R-sq	0.009	0.034	0.035	0.038	0.040

Notes: Author's calculations based on the Longitudinal Administrative Databank. The results in column 3 are based on regressions with fixed characteristics at ages 50-53: prime-earnings employment income, RPP indicator, RRSP indicator, having had self-employment income. In each specification, Quebec is the omitted group. T statistics are in parentheses; * p < 5%. ** p < 1%, *** p < 0.1%.

Table 4: Regression-Kink Estimator at the OAS Earnings Test Threshold

Effect of OAS Threshold	Employment	OAS claim
Pre-2013 Observations	-0.176***	0.0232
	(-5.23)	(1.34)
Post-2013 Observations	-0.035	-0.088***
	(1.21)	(-4.35)
N	9641	9641
Adjusted R2	0.035	0.082

Notes: Author's calculations based on the Longitudinal Administrative Databank. Cells present coefficient estimates of δ from equation (2), and t-statistics are in parentheses. * p < 5%. ** p < 1%, *** p < 0.1%.

Table 5: Estimates of Retirement-Age Bunching at the ERA and NRA

	ERA		NRA	
	Pre-Reform	Post-Reform	Pre-Reform	Post-Reform
B_1	-0.09***	-0.03	-0.15***	-0.13***
	(-34.75)	(-1.51)	(-34.75)	(-29.10)
B_0	0.64***	0.66***	0.65***	0.66***
	(243.69)	(249.75)	(243.69)	(245.83)
B_1/B_0	-0.14***	-0.05	-0.23***	-0.20***
	(-32.12)	(1.02)	(-31.56)	(-34.31)
N	117,103	96,915	117,103	96,915
adj. R^2	0.327	0.307	0.291	0.303

Notes: Author's calculations based on the Longitudinal Administrative Databank. Regressions were ran using an indicator for having positive employment; hence, a negative coefficient from the B_1/B_0 implies that the employment rate is lower than would be predicted in the absence of an ERA or NRA kink in the lifetime budget constraint. Cells present coefficient estimates from equation (3) with t-statistics in parentheses. * p < 5%. ** p < 1%, *** p < 0.1%.

Chapter 2

How do Public Pensions Differentially Affect Seniors' Employment Decisions across the Earnings Distribution?

James Maxwell Stutely
Department of Economics, McMaster University

Abstract:

I study how crossing the eligibility-age threshold for Canada's Old Age Security (OAS) program and its low-income support component, the Guaranteed Income Supplement (GIS), differentially affects seniors' employment decisions across the distribution of earnings. Earnings are represented by average earnings for ages 50-53, commonly close to the peak earning period. Using a panel of income tax filers and an instrumental variables technique, I find that crossing the age-65 eligibility threshold is associated with steep reductions in employment participation, which are somewhat larger for those who receive larger GIS payments, consistent with a disincentive effect from the 50% GIS clawback. The estimated hazard rate of employment exit also appears to increase for those with lower past earnings and hence likely higher GIS eligibility. I also study a policy experiment that, in 2011 without prior announcement, topped up GIS benefits and increased its clawback rate to 75% for only the lowest earners with no non-OAS income. Using a difference-in-differences design that compares changes in pre- to post-2011 employment rates between a treatment and control group of those in the bottom- and top-end of the peak earnings distribution, I observe that the GIS top-up provision reduces employment for those likely to receive it.

1. Introduction

Do public pension programs differentially affect post-age 65 employment decisions across the distribution of past earnings? I study differential employment exit outcomes at a public pension eligibility-age threshold between seniors with lower versus higher average past earnings Past earnings is defined to be average earnings at ages 50 to 53, when workers are near the peak of the typical age-earnings profile. Answering this is crucial for addressing equity issues in public pension reforms that aim to encourage extended working lives. Older workers do not all face the same opportunities to extend their careers, and the associated incentives are highly correlated with their past earnings. I focus on employment exit as a function of eligibility for low-income support Guaranteed Income Supplement (GIS) benefits. The GIS features a 50% clawback rate (and in some special cases more) on benefits for workers with next to no accumulated private retirement income and contributory, earning-related public pension entitlements.

Using Canadian income-tax and related data, I address three angles: 1) I estimate how public pension receipt differentially affects employment-age profiles across the peak earnings distribution, 2) using hazard regressions, I study variation in the extent to which crossing the age-65 eligibility threshold affects employment exit hazards across the peak earnings distribution; and 3) exploiting a policy experiment that mostly affected only seniors on the bottom of the peak earning distribution by strengthening an earnings test while topping-up GIS payments, I explore whether low-income seniors' post-reform employment decisions changed relative to an unaffected group of higher earners.

I study the incentive effects of the Old Age Security (OAS) pension, an income tested, income support program for Canadian residents over age 65 and the GIS. The latter income support program is targeted towards low-income seniors. OAS and the GIS represented the majority of Canada's total transfer expenses in 2021 (Department of Finance Canada, 2021), with virtually all of those aged 65 older receiving some OAS, and approximately 30% percent receiving GIS income (Office of the Superintendent of Financial Institutions, 2022).

Those receiving OAS benefits in 2022 face a claw-back rate of 15% on each additional dollar of (their prior year) net income above $81,761; benefits are completely taxed back for net income above $134,253. On the other hand, those receiving the GIS face a claw-back rate of 50% on each dollar of income earned exceeding $5,000. In spite of the high claw-back rates (especially for GIS), seniors with very low incomes during their working years who receive OAS and GIS face very high income replacement rates during retirement (often exceeding 100%). Those with higher incomes, both during their working years and in retirement, face significantly lower income replacement rates. This variation in tax-back rates and income replacement across the earnings distribution forms the basis of my empirical analysis.

My analysis uses the Longitudinal Administrative Databank (LAD), a 20% representative panel of tax filers spanning the years 1982-2019. In addition to containing detailed income-tax information, the LAD is supplemented with information on non-taxable transfer payments, including the GIS. The LAD's sample size and panel timespan is very large, which allows the construction of peak earnings histories, which as noted in this paper is captured by tax filers' average earnings at ages 50-53. Ranking tax filers into deciles based on their position in the peak earnings distribution, I first investigate how employment decisions across deciles vary after crossing the age-65 eligibility threshold.

Second, I implement an approach akin to Gruber and Coile's (2007), and Fetter and Lockwood's (2018) simulated instruments strategy whereby OAS and GIS payments in levels and probability of receipt are instrumented by predicted (based on lagged net income) OAS and

GIS eligibility. I find that an increase in OAS and GIS payments reduces the employment probability for those in the bottom half of the peak earnings distribution by small but statistically significant amounts. The estimated effects on those in the upper half are also negative but somewhat smaller in magnitude and not statistically significant. That is, those in the lower peak earnings decile present somewhat larger employment effects associated with crossing the age-65 threshold, and this is consistent with the 50% clawback on GIS benefits. A similar set of results was found in Neumark and Power's (2005) study of the U.S.'s Supplementary Social Insurance program (SSI – similar, but not identical, to Canada's GIS). These results indicate the relative importance of the GIS, compared to OAS, in affecting seniors' employment decisions.

I next implement a bunching design to study differential employment exit patterns at age 65 across peak earnings deciles. The key intuition behind this model comes from a lifecycle model of labour supply: such a model predicts that employment exit spikes should be sharpest among those with the highest retirement income replacement rates (i.e., highest among those in the bottom peak earnings deciles) who face the biggest labour supply disincentives. I observe somewhat higher employment exit hazards at the age-65 eligibility threshold among those in the bottom deciles, which may reflect incentive effects from the GIS or that most of the risk-set among this group had already exited employment before reaching age 65.

Finally, I exploit a 2011 policy experiment that changed the employment incentives for seniors with very low incomes. This reform "topped-up" GIS benefits for those with little private income or pension income while also substantially increasing the GIS clawback rate from 50% to 75% on topped-up benefits. This reform increased the average participation tax rate for those over age 65, thereby reducing the incentive for seniors to be employed. I estimate the impact of this reform on employment for low-income workers using a difference-in-differences design that uses higher income workers as a counterfactual because they are unaffected by the 2011 policy. My results suggest that the trends in employment rates across seniors with different levels of income is stable during the years leading up to the 2011 reform, supporting the plausibility of the parallel trends assumption in this setting. I also find that the employment rates of affected seniors fall slightly compared to the comparison group after the implementation of the reform. Thus, the GIS top-up provision appears to reduce employment for seniors in the bottom decile of the earnings distribution, but the magnitude of the effect is small.

Although unusual in empirical studies, in this paper I implement three distinct empirical strategies, with each estimating separate parameters, to address various policy-relevant angles. First, an instrumental variables strategy is used to identify seniors' employment elasticity as a function of OAS and GIS receipt across the peak earnings distribution, which could not be recovered due to simultaneity bias using benchmark OLS regressions. Heterogeneity in this parameter across the peak earnings distribution informs us better about how changes in public pension benefit schedules, a one percentage change in benefit levels, differentially affect post-age 65 employment decisions based on past earnings.

I then use a bunching design to estimate differential "excess" employment exit, measured as the difference in observed to predicted employment exit under an assumed smooth counterfactual employment-exit age profile, across the peak earnings distribution at the age-65 eligibility threshold. This estimates a different parameter, the employment exit hazard, and focuses on a different sub-population of seniors: those who had not yet left employment by age 65. Instead of informing us about heterogeneity in the impacts of changes to the benefit schedule across the earnings distribution, it is used to study the extent to which employment exit decisions are sensitive to statutory eligibility ages, either because seniors with different past earnings levels postpone employment exit until cross the eligibility-age threshold or because of social norms in retirement timing.

Lastly, a difference-in-differences strategy that exploits the 2011 GIS top-up change that altered employment incentives for seniors mostly near the bottom of the peak earnings distribution is implemented to provide under weaker assumptions causal evidence on the effects of changes in public pension rules (i.e., the 2011 GIS top-up introduction altered both the GIS claw-back rate and the benefit level for the lowest income seniors). Assigning treatment status to those in the bottom earnings deciles, and control status to those in the top, a pre- to post-2011 difference-in-differences estimator provides quasi-experimental evidence on the employment effects of a targeted policy change that altered eligibility rules.

This paper is organized as follows. In section, I highlight some of the related literature. I then outline the key institutional features of the OAS program and the GIS, as well as their incentive effects on seniors' employment decisions. The data, sample of analysis, descriptive statistics, and empirical framework are outlined in section 4. I conclude in section 5.

1. Related Research

This set of results contributes to several strands of literature. In particular, it relates closely to a literature examining the labour supply effects of Social Security programs for seniors in the U.S. (e.g., Diamond and Gruber, 1999; Feldstein and Liebman, 2002; Krueger and Meyer, 2002; Coile, 2015), public pension programs in Canada (Baker and Benjamin, 1999a), and work attempting to disentangle the labour supply effects of retirement income suport programs due to income transfer effects versus changes in marginal incentives to work (e.g., Burtless and Moffitt, 1985; Baker and Benjamin, 1999b; Friedberg, 2000; French, 2005; Gelber, Isen, and Song, 2016; Gelber, Jones, and Sacks, 2017; Fetter and Lockwood, 2018, Gelber, Jones, and Sacks, 2020). Of these papers, only Fetter and Lockwood (2018), and Gelber, Jones, and Sacks (2020) model heterogeneity in the impacts of retirement public pension programs on seniors' labour supply decisions by income group. Unlike in these studies, I exploit the LAD's long panel to additionally construct "treatment" and "control" groups based on actual earnings histories, rather than proxies for earnings history in the cross-sectional data.

I also make contributions to the literature documenting stark retirement-age bunching at the NRA (e.g., Burtless and Moffitt, 1984; Behaghel and Blau, 2012; Seibold, 2021; Deshpande, Fadlon, and Gray, 2021), and the literature that directly applies a bunching estimator to measure retirement elasticities (e.g., Brown, 2013; Manoli and Weber, 2016). Specifically, Behaghel and Blau (2012), and Seibold (2021) suggest that this bunching is a social/heuristic phenomenon, and my results provide mixed evidence in relation to that. However, unlike these papers, I am able to use high-quality, panel data to study retirement bunching behaviour across the career earnings distribution, which I argue allows for a closer consideration of economic motivations behind retirement bunching because of the heterogeneity in opportunities and incentives to bunch at the NRA.

2. Institutional Background

Canada's retirement income system consists of three pillars: 1) a two-part income support program, financed by general tax revenues, called Old Age Security (OAS) for those over age 65 and a supplemented called Guaranteed Income Supplement (GIS) for those with low incomes; 2) a contributory, earnings related public pension system, the Canada and Quebec Pension Plans (CPP and QPP or C/QPP); and 3) preferential tax treatment for certain employer-sponsored registered pension plans and personal retirement savings vehicles. In addition, there are age-based tax credits and several provincial low-income supplement programs for those over age 65.

Age 65 is Canada's eligibility-age threshold for OAS, the GIS, and the receipt of full C/QPP retirement benefits. C/QPP retirement benefits can commence as early as age 60, but there is a downward actuarial adjustment. There is an upward actuarial adjustment for the receipt of C/QPP benefits between ages 65-70, with no actuarial advantage to C/QPP commencement after age 70. Unlike most high-income countries, there are no plans to increase NRA beyond age 65.

In this paper, I focus on the main components of the OAS and GIS programs. OAS is a residency-based individual pension for those aged 65. Benefits are taxable, inflation-adjusted (quarterly, since 1973), and financed through general tax revenues. The 2022 maximum monthly benefit, $642.25, is paid to those whose previous year's personal net income (total taxable income less non-contributory public pension benefits, claimed income tax and credits and deductions, and social security contributions and repayments) is at most $81,761. For net income exceeding that threshold, OAS recipients face a federal recovery tax on benefits of 15%. Since 2013, OAS benefits can be deferred until age 70 with an actuarial adjusted increase of 0.6% per month (7.2% per year). In addition, since 2013, OAS automatic enrollment is available for eligible seniors aged 65. OAS benefits are included in the calculation of taxable income.

Within the OAS program is the family-income tested (based on, if married, own and spouse's combined net income) GIS benefit for low-income singles and couples. Eligibility for full requires receipt of OAS benefits and, for single individuals in 2022, a net income of $20,208 or less and, for couples, a net income of $25,728 or less if each spouse receives OAS and $46,656 if only one receives OAS. GIS benefits are subject to a 50% tax-back on net income, excluding OAS, in excess of a $5,000 earnings exemption. Maximum monthly GIS benefits in 2022 are $1,219.68, and this amount is adjusted quarterly for inflation. Unlike OAS benefits, GIS benefits are considered non-taxable. In 2008, the GIS earnings exemption was increased from $500 to $3,500 of (non-self-employment) employment income. This increase also applied to the widows/widowers/spousal allowances program, which is subject to a 75% tax-back rate. Although not within the timeframe of this paper, beginning in 2020, the earnings exemption was raised to $5,000 for employment and self-employment income. In addition, 50 percent of the next $10,000 of employment or self-employment income is also exempt. There is no actuarial advantage to deferring GIS benefits.

Since 2011, GIS eligible seniors with extremely low family market incomes (i.e. $2,000 for unmarried individuals and $4,000 for couples) receive an annual GIS top-up of $600 for single seniors and $840 for couples. The top-up was increased to $947 in 2016. The tax-back rate on these top-up benefits is 25%, meaning GIS recipients who receive the top-up are subject to a 50%+25%=75% tax-back rate on private income. These top-up benefits are completely phased out when annual private income exceeds $4,400 for singles and $7,360 combined for couples.

2.1. Old Age Security and the Guaranteed Income Supplement

The non-contributory public pension system expands the set of consumption-leisure opportunities of potential claimants by paying them OAS benefits, and potentially GIS, for each period of retirement after crossing the age-65 eligibility threshold. Both OAS and GIS elicit an income effect that tends to induce retirement and, for those who have not retired by the NRA, a substitution effect, stemming from the federal recovery tax on OAS benefits and the claw-back on the GIS, which also tend to induce retirement.

As predicted in simple versions of the lifecycle model of labour supply and consumption, a worker's private return per each year of an extended working life beyond the NRA is reduced because of the tax back provisions in OAS and GIS. Hence, the presence of OAS and the GIS introduces a convex kink in one's lifetime budget constraint at the NRA. For those whose retirement age is before the NRA, an additional working year increases total lifetime consumption by their earnings*;* in contrast, for those whose retirement age is after the NRA, an extended working life increases total lifetime consumption by the excess of earnings over the OAS benefit level net of the recovery tax, or, if they are GIS recipients, the excess of earnings over the OAS benefit and GIS level net of the GIS clawback. These two programs therefore impose an implicit marginal tax on earnings after the NRA, which is higher for GIS recipients (i.e., low-income seniors), since the GIS clawback is substantially larger than the OAS recovery tax.

Another prediction, in line with the developments summarized in Saez (2011), and Kleven (2016), is that a bunching of retirements should occur at the convex kink at the NRA, since the kink attracts more workers than nearby allocations on the lifetime budget constraint. Of particular note, and as developed in Laitner and Silverman (2012), the retirement bunching should be sharpest for groups facing the highest effective marginal tax rate (EMTR) after they become eligible for the OAS/GIS. I proxy for EMTRs using deciles of the earnings distribution. Because of the features of the OAS and GIS, those facing the highest EMTRs are those with earnings sin the bottom decile of the (permanent) earnings distribution.

3. Empirical Framework

3.1.Data and Sample

To investigate how public pension programs affect seniors' labour supply decisions, I analyze Canada's Longitudinal Administrative Databank (LAD) for the period 1982-2019. The LAD is a panel comprising 20% of tax filers. It is topped up annually to remain nationally representative at the 20% level. Once selected into the LAD, tax filers are followed longitudinally until they cease to file a tax return. In addition to information on taxable income, its components and tax liabilities, the LAD contains information on transfer income and a set of demographic and geographic characteristics (such as age, gender, immigration status, marital status, and province of residence). It also contains a spousal identifier to link tax-filing spouses in each year to construct spousal income- and tax-related variables.

Using the LAD registry file, I select a 5% sample of tax filers aged 50-75 during the years 1986 through 2019. A 5% sample is selected to safeguard against residual disclosure and protect tax filers' anonymity. I start the analysis in 1986 since it is the first year in which registered pension plan (RPP) contributions are observable in the LAD. I follow each individual longitudinally from age 50 to 75, until they die or emigrate, or until the end of the data period, such that each individual must be observed to reach at least age 61, one year after Canada's early claiming age for C/QPP retirement benefits. Put differently, I select a sample of tax filers born between 1936 and 1958; those born in 1936 were 50 in 1986 and 75 in 2011; those born in 1944 were 50 in 1994 and 75 in 2019; and those born in 1958 were 50 in 2008 and 61 in 2019. I drop any late-age-arrival immigrants or other tax filers whose earliest age observed filing income tax was after 50.

An indicator for having positive employment income (including self-employment income) is the key dependent variable in my analysis. Most of my empirical analysis involves comparing labour supply outcomes across the career earnings distribution. I define the career earnings distribution as, for each individual, the sum of employment income at ages 50-53, which are then ranked into deciles. For those who had zero employment income over ages 50-53, I construct an 11th group of "non-earners". I also consider other key indicator variables representing each sample units' retirement preparedness: an indicator for having at least one year of RPP contributions and/or filing a pension adjustment between ages 50-55; and an indicator for having any registered retirement savings plan (RRSP) contributions at ages 50-55. I also include demographic and geographic variables as covariates, including binary variables for gender, marital status and the age difference between partners of a couple, and province of residence.

3.2. Summary Statistics

I present panel descriptive statistics for my sample in Panel A of Table 1. In total, my analysis sample consists of 67,980 cross-sectional units, of which 8,411 (12.4%) comprise the "non-earnings" group (i.e., the 11^{th} group). While just over half of the sample is female, the non-earnings group is 73% female and the top-earnings group (i.e., the 10^{th} decile) is only 18% female. Those in the upper deciles are more likely to be married than those in the lower deciles and the 11^{th} group of non-earners. Non-earners, and the lowest earnings deciles, are most likely to be observed with a year of non-tax-filing or to have died between ages 53 and 75.

I next show summary statistics on income by source at ages 50-53 in Panel B of Table 1. Of note, the non-earnings group, and the lowest career earnings deciles, are less likely than the upper earnings deciles to have participated in a RPP plan (identified by having either positive RPP contributions or filing a pension adjustment which indicates pension plan contributions by an employer) or made RRSP contributions, which provides indication of retirement-preparedness differentials across the peak earnings distribution. I also present summary statistics for the sample at age 65 in Panel C. Clearly, the upper-half of the career earnings distribution is much more likely to have some positive employment income at age 65 compared to those bottom-half deciles and the non-earnings group. They are also much more likely to have some RPP and RRSP income. On the other hand, the bottom-half and the non-earnings group are more likely to receive GIS income, measured in terms of net GIS income (i.e., net of GIS clawback). Of particular note in Panel C are the measure of 'income composition' and 'income replacement' variables. Income composition is the ratio of public pension income (C/QPP + OAS + GIS) at age 65/66 to employment income at age 65/66, and income replacement is the ratio of public pension income at age 65/66 to average total income over ages 50-53, for each decile. It shows that public pension income comprises a particularly large proportion of both the non-earnings group and the lowest deciles' income at age 65/66.

3.3. Age Profiles of Employment and Income Replacement

Across the peak earnings distribution, how are employment decisions at the age-65 eligibility threshold differentially associated with the receipt of public pension payments? To graphically explore this question, I plot in Figures 1 and 2 age profiles of employment probabilities and income replacement rates, by decile. First, Figure 1 presents the proportion of individuals in each earnings group with positive employment income at ages 50-75. Among all earnings groups, except for the 10th decile (the highest career earnings group), the proportion employed dips at age 65. Also, the income replacement rate spikes at age 65, as shown in Figure 2, which plots average income replacement ratios at each age, separately for each decile The relationship between these two age profiles is explored further below using a regression framework.

3.4. Effect of OAS and GIS payments on Employment-Age Profiles

I exploit two sources of variation to examine the employment effects of OAS and GIS. The first is age, since OAS and GIS are only available to those over age 65 (with Allowances recipients being exceptions to this). The second is variation in income in the years leading up to the NIA. Combining these two sources, I analyze whether there are differential changes in the employment-age profile after crossing the threshold, after accounting for potential age-specific effects common across the peak earnings distribution at age 65.

In my main specifications, I estimate for individual i in decile d (plus the 11th group of non-earners) equations of the following form

$$y_{i,a,d,b} = \beta_d + \delta_{b,a} + \sum_{a \neq 64} \gamma_a \times \log(\text{post} - \text{age 65 benefits})_i + \Lambda^T x_{i,a} + \epsilon_{i,a,d,b} \quad (1).$$

In equation (1), the outcome variable y represents either a dummy for having positive employment income or the natural logarithm of real (in 2022 dollars) employment income. Included on the right-hand-side is a set of decile fixed effects, β_d, an interaction of birth cohort and age fixed effects, $\delta_{b,a}$, to allow for fixed differences in employment for each age and birth cohort, as observed in Schirle (2008) and Milligan and Schirle (2019). I also include a set of observable characteristics, $x_{i,a}$. Since the variation I exploit is differences in effective marginal tax rates across deciles, I cluster the standard errors at the earnings decile level. Equation (1) is estimated on a sample of individuals ages 55 and over. Of particular interest is the variable $log(\text{post} - \text{age 65 benefits})_i$, which is the log of OAS and GIS benefits for individual i, which is constructed using net income information from the LAD and the OAS and GIS benefit schedule.

I present the estimated γ_a coefficients from equation (1) in Table 2. In columns 1 and 2 the independent variable of interest is the log of OAS and GIS benefits, respectively. There is no evidence of OAS receipt being associated with reduced employment: indeed, some of the coefficients are positive suggesting that either more OAS benefits is associated with increased employment for upper deciles or a result of spurious correlation since some of those in the upper deciles may be above the OAS phase-out region

Coefficients on the GIS regressions suggest that receipt of the GIS benefit could have a larger effect on employment than OAS. At the 0.1% level of statistical significance, a 1%

increase in GIS benefits is associated with a reduction in the employment probability for the non-earners group and the 1st earnings decile by 0.05 and 0.04 percentage points. I also observe that receipt of the GIS benefit affects, at least at the 5% level of statistical significance, is associated with an increase in employment probability in the upper deciles, with coefficients of slightly lower magnitudes. Inclusion of the birth cohort and age fixed effects interaction term do not greatly affect these results. However, there is potentially simultaneity bias (since income determines an individuals' net OAS and GIS benefit) in these estimates, which is addressed below.

My benchmark OLS regression analysis of post-age 65 employment status on receipt in levels of OAS and GIS benefits is subject to simultaneity bias since the key regressor, log OAS and GIS benefits, is endogenous in the sense that being employed or not affects net income and hence OAS and GIS eligibility. To overcome this, an instrumental variables approach is adopted. Namely, I run a two-stage least squares regression whereby in the first stage log OAS and GIS benefits is regressed on simulated OAS and GIS receipt as a function of one-year lagged net income, and then their predicted values are used as regressors in regressions of post-age 65 employment status.

I argue that simulated OAS and GIS receipt is a relevant instrument, and these variables can be credibly excluded from the regression of interest for the following reasons. First, simulated OAS and GIS receipt is clearly correlated with current OAS and GIS receipt because they are both a function of one-year lagged net income. Moreover, I assume that using past earnings with a one-year lag ensures that unobservables affecting lagged earnings are not correlated with the error term in the current period. This assumption is supported by the fact that changes in current-year employment status does not affect simulated benefits since they are already determined by past earnings. Simulating current year's OAS and GIS receipt also effectively simulates seniors' current year's effective marginal and average participation tax rates (EMR and ATR), which result from OAS recovery tax and, if eligible, GIS claw-back. Suitability of the exclusion restriction holds because one's employment status in the current period is only affected by simulated benefits through their affect on the current period's OAS and GIS benefit schedule, and hence the current period's EMR and ATR.

I report the results from the instrumental variables (IV) strategy in column 3. The coefficients and their statistical significance for deciles 1 to 4 do not change from the OLS case. In contrast, the estimated effect of the GIS benefit on employment for the upper half of the earnings distribution is not statistically different than zero under the IV strategy, although this is largely because the standard errors are higher for these deciles. That some previously higher earning individuals have such reduced earnings that they are now eligible for GIS is consistent with the findings for the U.S. SSI program by Neumark and Powers (2005).

3.5. Employment Exit Hazards

Based on lifecycle model predictions, bunching in employment exit should occur at the age-65 eligibility threshold. Furthermore, the bunching should vary across individuals with different replacement rates. To test this prediction, I first plot empirical histograms in Figure 3, which show the retirement age distribution for each earnings decile. Despite having much lower income replacement rates from public pension benefits, a higher percentage of those in the middle of the career earnings distribution leave employment at age 65 compared to those in the bottom deciles and the non-earners group. On the other hand, those in the upper deciles are most likely to be in the OAS phase-out region and hence some of this larger spike may be attributable to the OAS recovery tax. While this result may appear to go against standard lifecycle models, note that we have ignored private/employer pension plans and the like, and such plans may impose employment conditions on receipt.

I also take a second approach to measuring employment exit hazards. I do this by estimating the following model by decile

$$y_i = \beta_0 + \beta_1 I(age_i \geq 65) + \beta_2(age_i - 65) + \beta_3(age_i - 65)I(age_i \geq 65) + \epsilon_i \quad (2).$$

In equation (2), the outcome *y* is an indicator equal to one if individual *i* is observed to have zero employment income in the current period, conditional on having had positive employment in the previous period. The purpose of equation (2) is to estimate the hazard of employment exit age 65; similar models have been estimated in Brinch, Vestad, and Zweimuller (2015) for Norway, and Fetter and Lockwood (2018) for the U.S., but in neither were the estimates conducted separately by position on the peak earnings distribution. In this specification, the "excess" employment exit hazard is defined as the estimate of β_1/β_0. (Note that the hazard is the percentage of exits of those who have not yet exited as opposed to Figure 3 which displays the percentage of exits of the entire group.) A negative value of β_1/β_0 indicates that observed employment exit at age 65 is less than what is predicted at that age, whereas a value greater than zero indicates that there is excess employment exit occurring at age 65.

I display the results from equation (2) in Table 3. In contrast to the finding in Figure 3, estimates of the hazards β_1/β_0 by peak earning group suggest a "fanning-out" effect in the sharpness of the employment exit hazard, which is higher for the non-earners and the bottom deciles and lower for the upper deciles. In other words, conditional on working until age 65, those groups with the lowest peak earnings are most likely to leave employment at age 65.

These results may be driven by at least three factors. First, they results might suggest an economic motivation to employment exit at the eligibility threshold, and it supports a liquidity constraints explanation of employment exit, whereby those with the lowest peak earnings histories and retirement resources are most likely to postpone retirement until age 65 since they cannot afford to retire sooner. Second, they may also capture that most of the "risk-set" of low-earnings deciles have already exited employment before age 65. Finally, they may indicate that facing new higher effective marginal tax rates after crossing the age-65 eligibility threshold hastens retirement.

3.6. Policy Experiment

For my last empirical test, I exploit exogenous variation arising from the 2011 policy change that topped-up the GIS benefit and increased its clawback rate to measure its effect on low-income seniors' employment probabilities. Specifically, as described in section 2, this policy change, without prior notice, increased both the GIS benefit and clawback rate on topped-up benefits for very low earning seniors with very low private income. I use a difference-in-differences (DiD) approach in which sets the peak earnings deciles 2-10 as a "control" group, and the combined non-earners group and the 1st earnings decile as a "treatment" group. Accordingly, I estimate equations, for individual *i* in period *t*, of the following form

$$y_{i,t} = \alpha_0 + \beta_1 \times Post_t + \beta_2 \times Treat_i + \gamma \times (Post_t \times Treat_i) + \beta_X \times X_{i,t} + \epsilon_{i,t} \quad (3).$$

In equation (3), *y* is an indicator equal to one if individual *i* in period *t* has positive employment income, *Post* is an indicator equal to one for post-2011 observations, and *Treat* is an indicator equal to one if individual *i* is in the non-earnings group. The coefficient of interest is γ, which measures the difference-in-differences in employment probabilities from before to after 2011 for the non-earnings group compared to the other earnings groups.

The usual assumption to be met for equation (3) to be valid is that of “parallel trends”. That is, trends in seniors’ employment would be parallel in the absence of the policy change. This is not testable; it is an assumption. However, support for this assumption can be obtained by observing whether, before the policy change, the difference in the time series of the outcome variable between the treatment and control groups is parallel. I plot in Figure 4, by year, employment profiles for each of the 11 earnings groups. Reassuringly, differences in pre-2011 employment timeseries appear to be quite parallel across earnings groups. Then there is a sizeable dip in 2011 in employment probabilities for the non-earnings group and the 1st decile group, suggesting that this policy change reduced employment for the “affected” groups. I also run falsification tests to assess under an auxiliary assumption that, if the observed trends are not parallel prior to the policy change, then the unobserved counterfactual trends after the policy change are not parallel. My analysis is robust to these tests.

I plot the results from equation (3) in Figure 5, plotting a separate DiD estimate for each year after 2011 (i.e., a series of difference-in-differences estimates). My results suggest that initially, in 2011, the difference-in-differences in the employment probability for the treatment group was about 2 percentage points higher than that for the control group. However, and as expected, it changed to between 3 and 4 percentage points lower after 2012 and remained so until 2018. These results indicate that increases in the GIS benefit reduce seniors’ labour supply. However, caution is needed in interpreting these results due to potential confounders. Specifically, beginning in 2012, incentives to work beyond the NRA increased due to a number of C/QPP policy shifts, and these policy shifts were mainly only beneficial to seniors with higher incomes.

For falsification tests, I re-estimate equation (3) numerous times, using a different control group for each estimate (i.e., for each career earnings decile 2 through 10). The set of results for this analysis is left for the Appendix. In general, the results in Figure 5 are robust.

4. Conclusions

Most high-income countries are reforming their public pension systems to encourage extended seniors' working lives. However, the set of opportunities and incentives for seniors to do so varies substantially across their past earnings distribution. In this paper, I investigate the employment effects of Canada's Old Age Security (OAS) program and its low-income support component, the Guaranteed Income Supplement (GIS). I use a large, administrative data set of tax returns, allowing me to construct earnings histories, where I focus on ages 50 to 53 as these are common peak earnings years Looking at how OAS and the GIS benefit affect seniors' employment across these past earnings deciles allows me to examine heterogeneity in the impacts of public pension programs on employment decisions compared to what has been documented in the literature.

My results indicate that the GIS benefit induces modest reductions in seniors' employment after crossing the age-65 eligibility threshold, attributable to its high clawback rate of 50% and generous payments for low-income seniors. Furthermore, seniors on the low-end of the past earnings distribution have a higher employment exit spike in their employment exit hazard at age 65 compared to higher earners, which may be attributable to GIS incentive effects or that the "risk-set" of lower-earners is sparse by age 65. Since lower-income individuals will more likely be GIS-eligible, this is consistent with the possibility that the work disincentives within GIS induce employment exit, or that low-earners postpone their retirement until reaching age-eligibility for GIS since they cannot afford to do so earlier. Finally, I exploit a 2011 policy experiment that topped up the GIS benefit and substantially increased its tax-back rate for seniors' with quite low incomes to measure employment effects of the GIS benefit. Using a difference-in-differences design, I find that this reform modestly reduced the employment probability for affected low-income groups. Overall, these results suggest that seniors' employment exit decisions vary across the distribution of past earnings, but the extent to which these decisions are affected by changes in public pension provisions appears to be modest.

References:

Baker, Michael, and Dwayne Benjamin. 1999a. “Early Retirement Provisions and the Labor Force Behavior of Older Men: Evidence from Canada.” *Journal of Labor Economics,* 17 (4): 724-56.

Baker, Michael, and Dwayne Benjamin. 1999b. “How do Retirement Tests Affect the Labor Supply of Older Men?” *Journal of Public Economics,* 71: 27-51

Behaghel, Luc, and David Blau. 2012. “Framing Social Security Reform: Behavioral Responses to Changes in the Full Retirement Age.” *American Economic Journal: Economic Policy,* 4 (4): 41-67

Brown, Kristine. 2013. “The Link between Pensions and Retirement Timing: Lessons from California Teachers.” *Journal of Public Economics,* 98: 1-14

Burtless, Gary, and Robert Moffitt. “1985. “The Joint Choice of Retirement Age and Postretirement Hours of Work.” *Journal of Labor Economics*, 3 (2): 209-36

Coile, Courtney, and Jonathan Gruber. 2007. “Future Social Security Entitlements and the Retirement Decision.” *Review of Economics and Statistics,* 89 (2): 234-46

Coile, Courtney. 2015. “Economic Determinants of Workers’ Retirement Decisions.” *Journal of Economic Surveys,* 29 (4): 830-53

Deshpande, Manasi, Itzik Fadlon, and Colin Gray. 2021. “How Sticky Is Retirement Behavior in the U.S.?” *The Review of Economics and Statistics,* 1-55

Department of Finance Canada. 2021. “Annual Financial Report of the Government of Canada Fiscal Year 2020-2021,” retrieved from https://www.canada.ca/en/department-finance/services/publications/annual/2021.html

Diamond, Peter, and Jonathan Gruber. 1999. “Social Security and Retirement in the United States.” In *Social Security and Retirement around the World,* edited by Jonathan Gruber and David A. Wise, 437-73. Chicago: University of Chicago Press

Feldstein, Martin, and Jeffrey Liebman. 2002. “Social Security.” In *Handbook of Public Economics,* Vol. 4, edited by Alan J. Auerbach and Martin Feldstein, 2245-324. Amsterdam: Elsevier

Fetter, Daniel, and Lee Lockwood. 2018. “Government Old-Age Support and Labor Supply: Evidence from the Old Age Assistance Program.” *American Economic Review,* 108 (8): 2174-2211

French, Eric. 2005. “The Effects of Health, Wealth, and Wages on Labor Supply and Retirement Behaviour.” *Review of Economic Studies*, 72 (2): 395-427

Friedberg, Leora. 1999. “The Effect of Old Age Assistance on Retirement.” *Journal of Public Economics*, 71 (2): 213-31

Friedberg, Leora. 2000. “The Labor Supply Effects of the Social Security Earnings Test.” *Review of Economics and Statistics,* 82 (1): 48-63

Gelber, Alexander, Damon Jones, and Daniel Sacks. 2020. “Estimating Adjustment Frictions Using Nonlinear Budget Sets: Method and Evidence from the Earnings Test.” *American Economic Journal: Applied Economics,* 12 (1): 1-31

Gelber, Alexander, Damon Jones, Daniel Sacks, and Jae Song. 2022. “The Employment Effects of the Social Security Earnings Test.” *Journal of Human Resources*, 57 (2): 341-371

Kleven, Henrik. 2016. “Bunching.” *Annual Review of Economics*, Vol. 8: 435-65

Kreuger, Alan, and Bruce Meyer. 2002. “Labor Supply Effects of Social Insurance.” In *Handbook of Public Economics*, Vol. 4, edited by Alan J. Auerbach and Martin Feldstein, 2327-92, Amsterdam: Elsevier.

Laitner, John, and Dan Silverman. 2012. “Consumption, Retirement and Social Security: Evaluating the Efficiency of Reform that Encourages Longer Careers.” *Journal of Public Economics,* 96 (7-8): 615-34

Lumsdaine, Robin, James Stock, and David Wise. 1996. “Why Are Retirement Rates So High at Age 65?” Chapter in *Advances in the Economics of Aging*, the National Bureau of Economic Research, 61-82

Manoli, Day, and Andrea Weber. 2016. “Nonparametric Evidence on the Effects of Financial Incentives on Retirement Decisions.” *American Economic Journal: Economic Policy,* 8 (4): 160-82

Milligan, Kevin, and Tammy Schirle. 2019. “Retirement Incentives and Canada’s Social Security Programs.” In *Social Security Around the World: Reforms and Retirement Incentives*, edited by Courtney Coile and Axel Borsch-Supan, NBER Book Series. University of Chicago Press.

Neumark, David, and Elizabeth Powers. 2005 “Welfare for the Elderly: The Effects of SSI on Pre-Retirement Labor Supply.” *Journal of Public Economics*, 78 (1-2): 51-80

Office of the Superintendent of Financial Institutions. 2022. “Actuarial Report (17th) supplementing the Actuarial Report on the Old Age Security Program as at 31 December 2018,” retrieved from https://www.osfi-bsif.gc.ca/Eng/oca-bac/ar-ra/oas-psv/Pages/oas17.aspx

Poterba, James, Steven Venti, and David Wise. 2011. “The Composition and Drawdown of Wealth in Retirement.” *Journal of Economic Perspectives*, 25 (4): 95-118

Saez, Emmanuel. 2010. “Do Taxpayers Bunch at Kink Points?” *American Economic Journal: Economic Policy*, 2 (3): 180-212

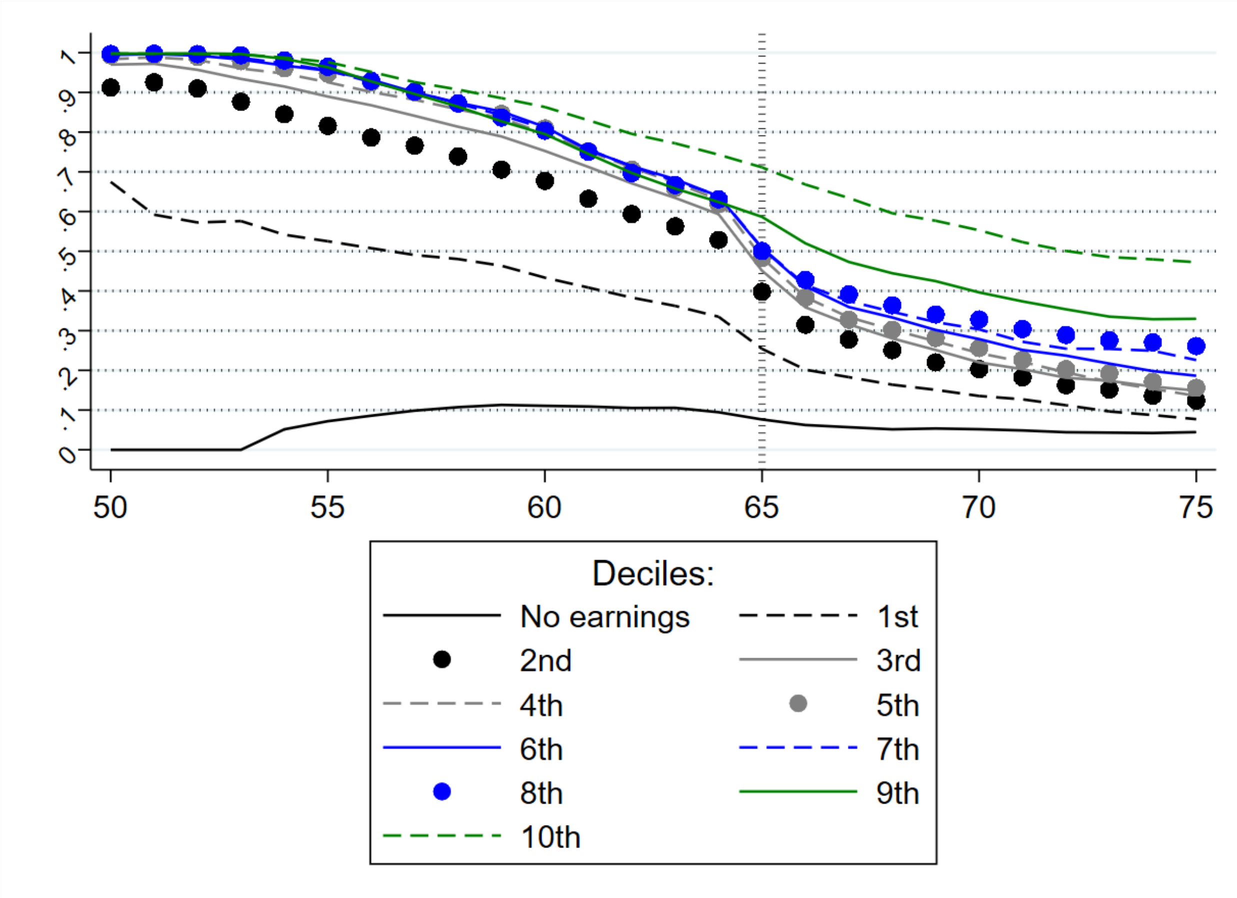
Schirle, Tammy. 2008. “Why have the labor force participation rates of older men increased since the mid-1990s?” *Journal of Labor Economics*, 26 (4): 549-594

Seibold, Arthur. 2021. “Reference Points for Retirement Behaviour: Evidence from German Pension Discontinuities.” *American Economic Review*, 111 (4): 1126-65

Stutely, James. 2022. “Labour Supply, Benefit Claiming, and Public Pension Reform in Canada.” Unpublished Manuscript, Thesis Chapter, Department of Economics at McMaster University

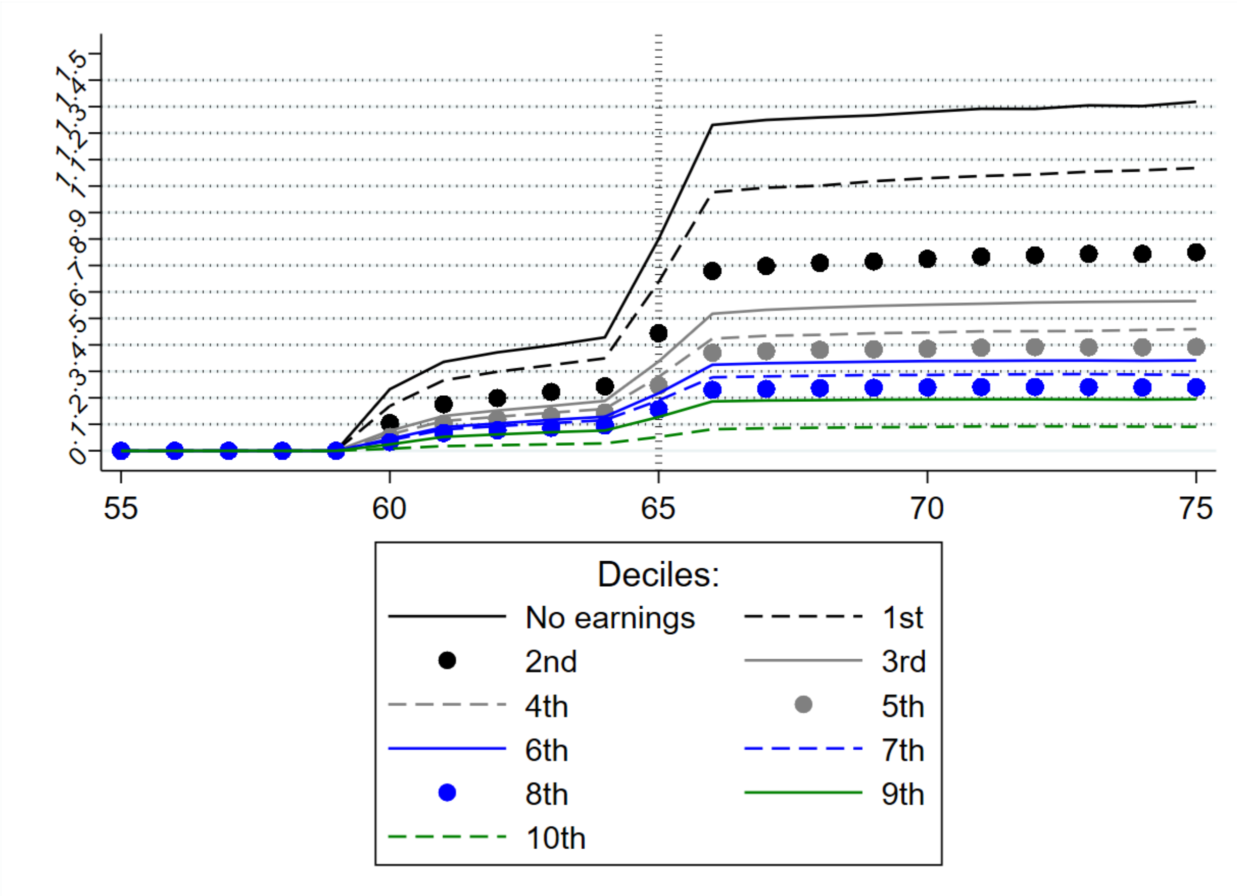
Figures and Tables:

Figure 1: Age Profile of Sample Probabilities of Employment Income Receipt



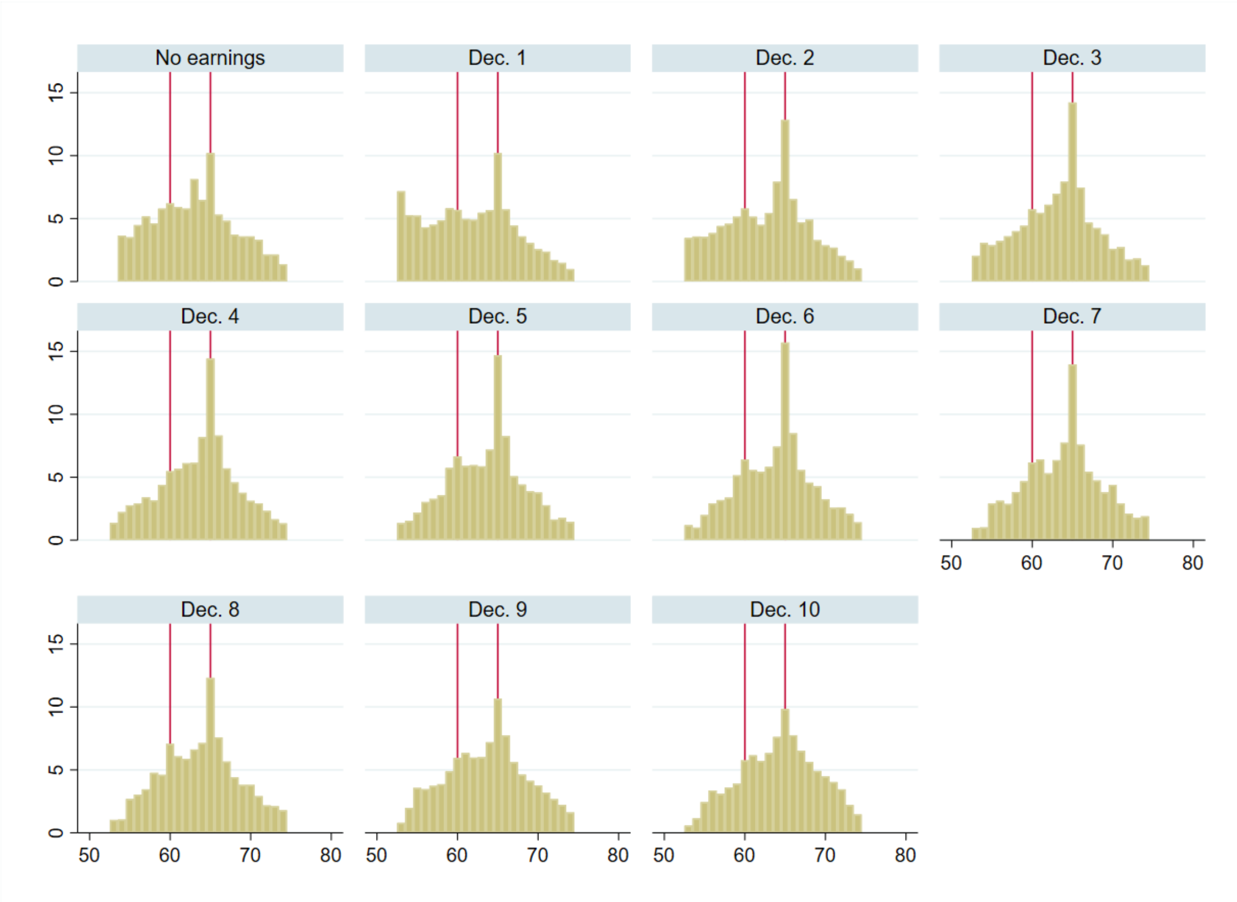
Notes: Author's calculations based on the Longitudinal Administrative Databank. Plotted on the y-axis is proportion with positive employment income (i.e., T4 + self-employment income).

Figure 2: Age Profile of Income Replacement Ratios



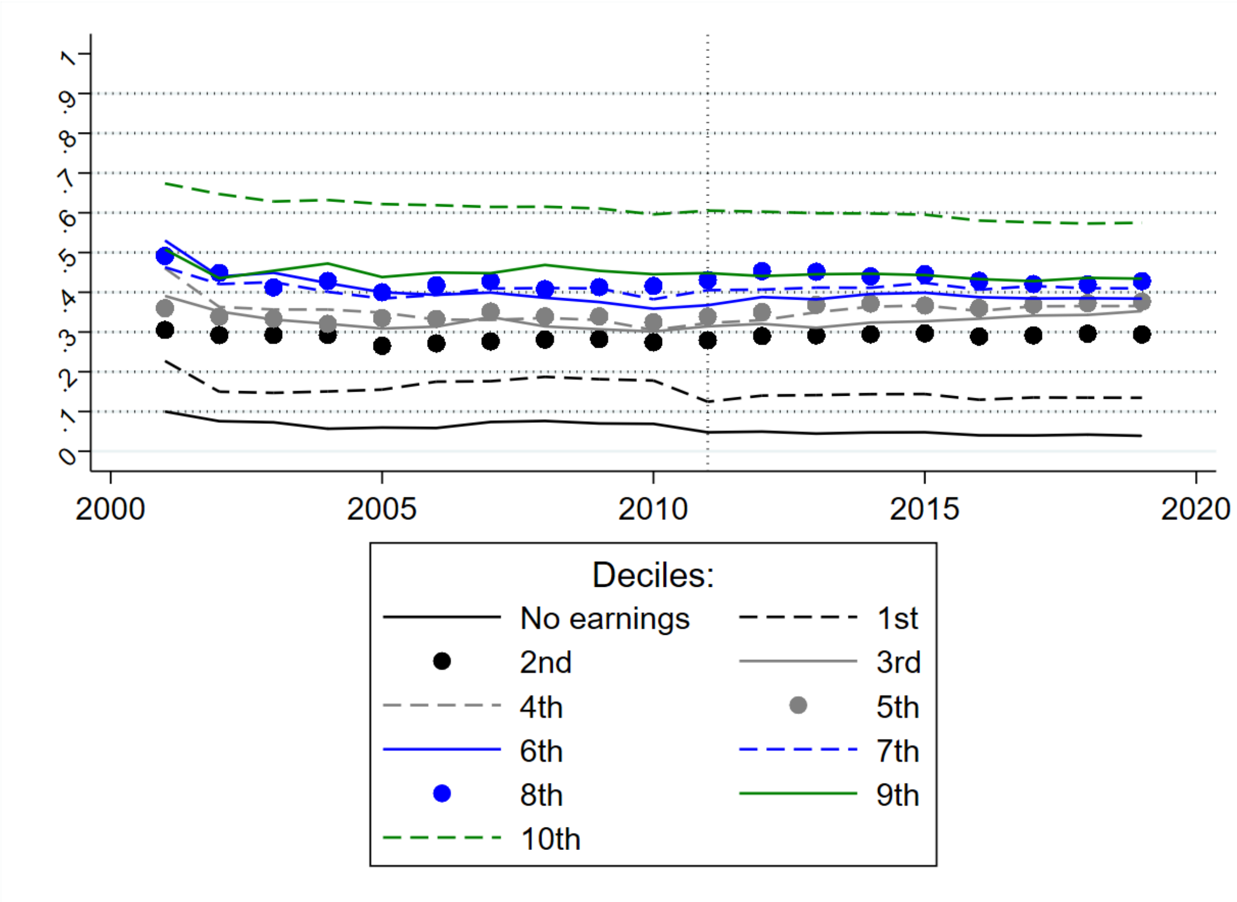
Notes: Based on Author's calculations using the Longitudinal Administrative Databank. Income replacement for this plot is measured as the ratio of OAS + C/QPP + Net-Federal Supplement Income (i.e., GIS and the Allowances) to net income averaged over ages 50-53.

Figure 3: Retirement-Age Distribution



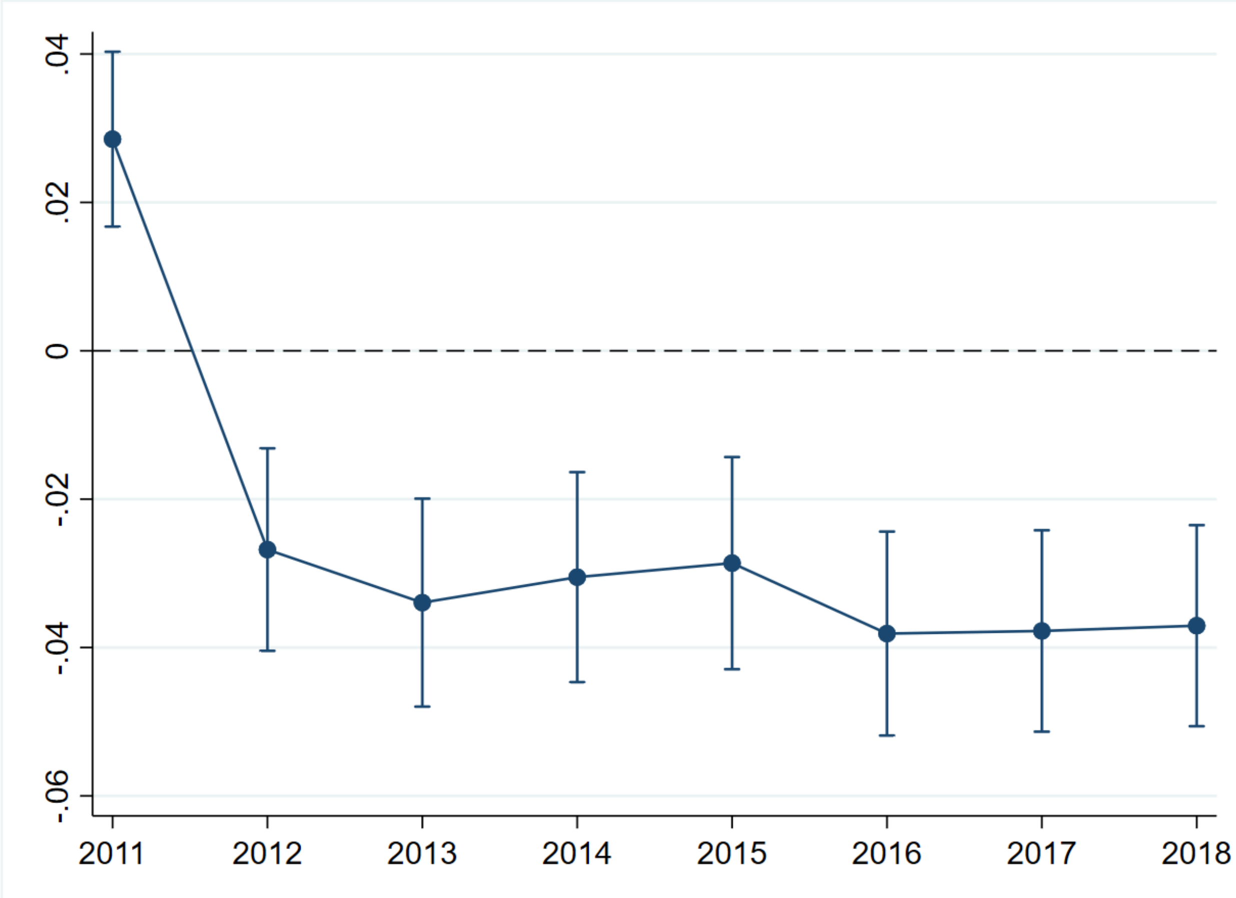
Notes: Authors' calculations based on the Longitudinal Administrative Databank. The sample used are those that survive and are observed filing income tax beyond age 66. Retirement-Age reflects the age at which I observe an individual to have their first two-year string of zero employment income (the sum of T4-earnings + self-employment income) conditional on having at least one year of positive employment income before that age.

Figure 4: By-Year Timeseries of Employment



Notes: Author’s calculations based on the Longitudinal Administrative Databank. Plotted on the y-axis is proportion with positive employment income (i.e., T4 + self-employment income).

Figure 5: DiD Employment Effects of the GIS Top-Up



Notes: Author's calculations based on the Longitudinal Administrative Databank. Plotted are the coefficients and 95% confidence intervals from the difference-in-differences estimator in equation (3).

Table 1: Summary statistics

Decile:	No-Earn	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Fixed Characteristics											
Female	0.729	0.717	0.666	0.620	0.589	0.575	0.506	0.420	0.366	0.305	0.182
	(0.444)	(0.450)	(0.472)	(0.485)	(0.492)	(0.494)	(0.500)	(0.494)	(0.482)	(0.460)	(0.386)
Married	0.576	0.726	0.755	0.742	0.752	0.749	0.746	0.759	0.784	0.793	0.838
	(0.494)	(0.446)	(0.430)	(0.438)	(0.432)	(0.434)	(0.435)	(0.428)	(0.411)	(0.405)	(0.369)
Lost from File	0.145	0.113	0.088	0.082	0.072	0.065	0.057	0.060	0.056	0.056	0.045
	(0.352)	(0.317)	(0.284)	(0.275)	(0.259)	(0.247)	(0.232)	(0.237)	(0.229)	(0.229)	(0.207)
Died	0.152	0.109	0.093	0.085	0.078	0.083	0.070	0.080	0.072	0.065	0.053
	(0.359)	(0.312)	(0.290)	(0.279)	(0.268)	(0.276)	(0.256)	(0.271)	(0.259)	(0.246)	(0.224)
Income and Contributions at Ages 50-53											
T4	0.000	0.783	0.823	0.880	0.921	0.952	0.965	0.971	0.977	0.976	0.930
	(0.000)	(0.412)	(0.382)	(0.325)	(0.270)	(0.213)	(0.183)	(0.167)	(0.150)	(0.154)	(0.254)
Self-employment	0.000	0.223	0.294	0.220	0.172	0.121	0.100	0.089	0.077	0.078	0.174
	(0.000)	(0.417)	(0.456)	(0.414)	(0.378)	(0.327)	(0.300)	(0.285)	(0.266)	(0.269)	(0.379)
RPP	0.004	0.062	0.121	0.194	0.297	0.440	0.506	0.570	0.622	0.662	0.494
	(0.062)	(0.240)	(0.326)	(0.395)	(0.457)	(0.496)	(0.500)	(0.495)	(0.485)	(0.473)	(0.500)
Pension Adjustment	0.007	0.073	0.138	0.228	0.347	0.495	0.567	0.632	0.702	0.759	0.647
	(0.086)	(0.260)	(0.345)	(0.420)	(0.476)	(0.500)	(0.496)	(0.482)	(0.457)	(0.427)	(0.478)
RRSP	0.046	0.184	0.353	0.476	0.591	0.661	0.712	0.759	0.776	0.819	0.867
	(0.210)	(0.387)	(0.478)	(0.499)	(0.492)	(0.473)	(0.453)	(0.428)	(0.417)	(0.385)	(0.339)

Table 1 (Continued): Summary statistics

Income, Composition, and Replacement at ages 65/66											
T4	0.078	0.231	0.361	0.441	0.484	0.491	0.509	0.472	0.462	0.451	0.508
	(0.269)	(0.422)	(0.480)	(0.497)	(0.500)	(0.500)	(0.500)	(0.499)	(0.499)	(0.498)	(0.500)
Self-	0.036	0.124	0.182	0.154	0.139	0.118	0.102	0.115	0.115	0.134	0.243
employment	(0.186)	(0.330)	(0.386)	(0.361)	(0.346)	(0.323)	(0.303)	(0.319)	(0.319)	(0.341)	(0.429)
OAS	0.963	0.970	0.972	0.968	0.971	0.972	0.972	0.965	0.966	0.956	0.869
	(0.188)	(0.170)	(0.164)	(0.177)	(0.168)	(0.166)	(0.165)	(0.183)	(0.181)	(0.205)	(0.337)
GIS	0.651	0.604	0.562	0.495	0.418	0.317	0.251	0.204	0.129	0.076	0.053
	(0.477)	(0.489)	(0.496)	(0.500)	(0.493)	(0.465)	(0.433)	(0.403)	(0.335)	(0.266)	(0.224)
Superannuation	0.320	0.414	0.477	0.546	0.648	0.738	0.796	0.838	0.885	0.902	0.814
	(0.467)	(0.493)	(0.500)	(0.498)	(0.478)	(0.440)	(0.403)	(0.368)	(0.319)	(0.297)	(0.390)
RRSP	0.120	0.192	0.234	0.277	0.325	0.344	0.376	0.366	0.381	0.382	0.331
	(0.325)	(0.394)	(0.424)	(0.448)	(0.469)	(0.475)	(0.484)	(0.482)	(0.486)	(0.486)	(0.471)
C/QPP	0.827	0.951	0.980	0.982	0.981	0.983	0.983	0.980	0.979	0.973	0.927
Retirement	(0.378)	(0.216)	(0.142)	(0.133)	(0.135)	(0.131)	(0.131)	(0.142)	(0.143)	(0.163)	(0.261)
Composition	0.923	0.849	0.724	0.644	0.617	0.562	0.516	0.480	0.418	0.375	0.282
	(0.243)	(0.296)	(0.283)	(0.273)	(0.258)	(0.237)	(0.206)	(0.202)	(0.171)	(0.168)	(0.166)
Income	1.223	1.192	0.902	0.795	0.742	0.663	0.603	0.556	0.464	0.405	0.304
Replacement	(1.081)	(1.072)	(0.571)	(0.717)	(0.723)	(0.589)	(0.482)	(0.395)	(0.298)	(0.232)	(0.332)
Sample Size (%)											
At Age 50	8410	5960	5960	5960	5960	5960	5960	5960	5960	5960	5955
	(12.37%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)	(8.76%)

Notes: Authors' calculations based on the Longitudinal Administrative Databank. Cells present proportions (ratios for the composition and replacement variables). Standard deviations are provided within the parentheses. Income replacement represents the ratio of Old Age Security, Guaranteed Income Supplement, and Canada/Quebec Pension Plan income to employment income at ages 50-53. Retirement composition presents the share of post-age 65 income that is Old Age Security, Guaranteed Income Supplement, and Canada/Quebec Pension Plan income.

Table 2: Estimated Effect of Income Support Benefits on Employment

	Log(OAS) (1)	Log(GIS) (2)	Log(GIS) (IV)
Decile:			
No-Earn	-0.02^{*}	-0.05^{***}	-0.05^{***}
	(-2.45)	(-6.65)	(-6.46)
1st	-0.00	-0.04^{***}	-0.04^{***}
	(-0.46)	(-5.36)	(-6.02)
2nd	0.01	-0.03^{***}	-0.03^{***}
	(1.12)	(-4.40)	(-4.24)
3rd	0.01	-0.03^{***}	-0.03^{***}
	(1.71)	(-4.45)	(-4.11)
4th	0.01***	-0.03^{***}	-0.03^{***}
	(2.05)	(-4.46)	(-3.65)
5th	0.01***	-0.04^{***}	-0.04
	(2.14)	(-4.62)	(-1.15)
6th	$0.02**^{*}$	-0.03^{***}	-0.03
	(2.66)	(-4.06)	(-1.22)
7th	0.02^{***}	-0.03^{***}	-0.03
	(3.01)	(-3.60)	(-0.86)
8th	0.02^{***}	-0.03^{***}	-0.03
	(3.33)	(-3.19)	(-1.02)
9th	0.02^{***}	-0.02^{***}	-0.02
	(3.49)	(-2.62)	(-0.83)
10th	0.04^{***}	-0.02***	-0.02
	(5.64)	(-2.23)	(-1.04)
N	1327450	1327450	1327450
adj. R^2	0.638	0.638	0.598

Notes: Author's calculations based on the Longitudinal Administrative Databank. Regressions are done using the log of employment income as the dependent variable. t statistics in parentheses;
and * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ levels of significance. OAS and GIS in levels are in $1,000 of 2022 dollars

Table 3: Estimates of Excess Employment Exit

	(1) No-Earn	(2) Dec. 1	(3) Dec. 2	(4) Dec. 3	(5) Dec. 4	(6) Dec. 5	(7) Dec. 6	(8) Dec. 7	(9) Dec. 8	(10) Dec. 9	(11) Dec. 10
B_1	-0.07^{***}	-0.12^{***}	-0.12^{***}	-0.14^{***}	-0.15^{***}	-0.15^{***}	-0.13^{***}	-0.13^{***}	-0.11^{***}	-0.09^{***}	-0.07^{***}
	(-26.86)	(-10.32)	(-21.81)	(-29.71)	(-33.59)	(-34.75)	(-30.51)	(-29.10)	(-25.07)	(-20.78)	(-16.05)
B_0	0.15^{***}	0.32^{***}	0.34^{**}	0.39^{***}	0.46^{***}	0.52^{***}	0.66^{***}	0.66^{***}	0.65^{***}	0.64^{***}	0.76^{***}
	(94.27)	(94.64)	(168.52)	(210.74)	(239.89)	(243.69)	(249.75)	(245.83)	(240.81)	(236.03)	(305.97)
B_1/B_0	-0.47	-0.38	-0.35	-0.36	-0.33	-0.29	-0.20	-0.20	-0.17	-0.14	-0.09
N	168310	120175	119900	118160	116960	117103	116915	117635	117795	116745	112495
adj. R^2	0.019	0.104	0.246	0.290	0.317	0.327	0.307	0.289	0.273	0.261	0.182

Notes: Author's calculations based on the Longitudinal Administrative Databank. The key estimate, B_1/B_0, reflects the degree to which employment is lower than would be predicted at the NRA, conditional on being employed up to the NRA.

Appendix:

Table A1: Robustness test

	(1) 10th	(2) 9th- 10th	(3) 8th – 10th	(4) 7th – 10th	(5) 6th – 10th	(6) 5th – 10th
Treat	-0.03***	-0.02***	-0.01***	-0.01***	-0.01	0.00
	(-5.35)	(-2.85)	(-2.46)	(-2.28)	(-1.32)	(0.26)
N	351490	351490	351490	351490	351490	351490
R^2	0.128	0.128	0.128	0.128	0.128	0.128

Notes: Author's calculations based on the Longitudinal Administrative Databank. Each column represents a different range of deciles considered to be in the "control" group. The coefficients (t-statistics) for the Treat row measure the effect of the 2011 reform on the employment probability for the 11th group (non-earners) and the 1st earnings decile group.

Chapter 3

Residency-Based Public Pensions and Immigrant Seniors' Employment

James Maxwell Stutely
Ph.D. Candidate

Department of Economics, McMaster University

Abstract

I study the effects of public pension eligibility on immigrant seniors' employment and take-up outcomes, under two scenarios. The first estimates the effect of crossing the age-65 eligibility threshold by estimating differentials in pre- to post-eligibility outcomes between immigrant seniors and a non-immigrant comparison group, and the second exploits variation in the eligibility criteria for immigrant seniors driven by residency requirements. My results indicate variation by immigrants' age-at-arrival. While those who landed earlier in life are more likely than non-immigrants to continue working beyond age 65, those who arrive later in life (especially after age 40), work less, with steeper employment declines after that age. I also find that members of late age-at-arrival cohorts reduce their employment after crossing the residency requirement threshold; this appears to be attributable to substitution effects arising from GIS tax-back provisions. Estimates from a regression discontinuity design, which compares observationally equivalent immigrants above and below the threshold, affirm these results.

1. Introduction

Understanding how immigrant seniors' employment and public pension take-up decisions are made is of interest to both policy makers and researchers. These decisions are complex and may depend on a combination of monetary and non-monetary factors. One factor that is likely to be important is eligibility conditions on public pension receipt, such as the ten-year residency requirement for partial, and 40 years for full, eligibility for the Old Age Security (OAS) pension in Canada. Research on the effects of such eligibility requirements is sparse, but its importance is growing with the immigrant share of senior populations in most high-income countries.

Using Canadian income-tax and administrative immigration data, I examine first differentials in immigrant to non-immigrant seniors' employment and take-up outcomes after crossing age-65 eligibility threshold for public pension receipt, and second, the link between residency requirements for public pension benefits, and immigrant seniors' employment and take-up decisions. To do so, I implement two econometric strategies: 1) I implement in a difference-in-differences design to study how crossing the eligibility threshold shifts the employment- and take-up-age profiles of immigrant seniors relative to that of non-immigrants; and 2) using a regression discontinuity design, I compare outcomes between observationally equivalent immigrants who are just above/below the ten-year rule threshold.

I focus on the impacts of two residency-based elements of Canada's public pension system: the Old Age Security (OAS) program and its low-income support component, the Guaranteed Income Supplement (GIS), and the "super GIS", which, for immigrant seniors' in receipt of partial OAS benefits, tops up GIS benefits to match full OAS benefits but with a higher federal claw back rate on earnings above a threshold (Baldwin and Shillington, 2017).

Although contributory, earnings-related Canada Pension Plan (CPP) retirement benefits do not impose residency requirements, their benefit-eligibility schedule depends on one's contributory work years in Canada; hence, the CPP program also factors into my empirical analysis insofar as the accrual effect from generating additional CPP entitlements from an additional year of work affects immigrant seniors' employment decisions.

OAS and the GIS are funded by general tax revenue and form an income floor for those over age 65 and constitute Canada's largest transfer expense to individuals (Department of Finance Canada, 2021). They are both subject to income testing, with a 15% tax back applied for individual incomes beyond a middle-income threshold in the case of OAS, and a tax-back rate of 50% on couple-level incomes above a low-income threshold for the GIS. They are also both residency-based: to receive OAS, one must have resided or been a citizen in Canada for at least ten years to receive a partial, prorated benefit, and 40 years to be eligible for the maximum OAS benefit. OAS is akin to the U.S.'s Old Age, Survivors, and Disability Insurance (OASDI) program, which legislates similar requirements but, unlike the U.S.'s OASDI program, OAS is a pure demogrant. OAS is similar to Australia's Age Pension, New Zealand's Superannuation, and the U.K.'s State Pension. GIS benefits, however, differentiate Canada's federal income support system for seniors from that in these latter countries. However, it is the most similar to the Supplemental Security Income (SSI) program in the United States.

Immigrant seniors' post-age 65 employment and take-up incentives vary considerably by years since landing as it relates to OAS and GIS eligibility. Those who by age 65 have reached at least 40 years of permanent residency in Canada face a similar set of incentive changes as non-immigrants at age 65: an income effect, arising from OAS and GIS, that may tend to hasten retirement; and, for those who work beyond age 65, a substitution effect, arising from the OAS recovery tax and GIS claw-back, that tends to incentivize retirement. For immigrant seniors with less than 40 years of residency, however, the GIS substitution effect on workers is likely much higher due to the higher claw-back rate on the super GIS provision. For these immigrants, it is predicted that employment more steeply declines compared to those with more years of residency and non-immigrants. A similar result is observed by Kaushal (2009) who finds that, given eligibility, immigrant seniors reduce their labour supply once in receipt of SSI benefits. Like with SSI benefit eligibility, GIS benefits can only be received after ten years of residency. However, an important difference is that a low-income immigrant senior may receive the full inflation-indexed GIS benefit, conditional on satisfying low-income eligibility criteria, plus the super GIS. Immigrant seniors in receipt of both a prorated OAS and the super GIS face a larger substitution effect on their labour supply compared to that of non-immigrants in receipt of the full OAS since the federal tax-back rate on GIS is much higher than that of OAS. These incentive effects on employment exit are stronger than those imposed by the SSI. It is to be expected that crossing the age-eligibility threshold for OAS and GIS hastens employment exit for immigrants with less than 40 years of residency by more than that of non-immigrants.

I use the Longitudinal Administrative Databank (LAD), a 20% representative panel of tax filers spanning the years 1982-2019, which, in addition to containing detailed income-tax information, is supplemented with information on non-taxable transfer payments, including the GIS. The LAD provides an immigrant identifier, for those who landed since 1952. I exploit the LAD's large sample size and panel component to construct separate employment and public pension take-up age profiles, spanning ages 50-75, for non-immigrants and immigrants by age-at-arrival.

I study how reaching age 65 differentially affects non-immigrants' employment compared to each of the immigrant age-at-arrival groups. This is like Borjas's (2011) analysis of the U.S. Censuses. However, my analysis tracks the same individuals over time, whereas Borjas's used pseudo cohorts generated from U.S. Censuses. In addition, my analysis relies on weaker identification assumptions than those of Borjas, In particular, my use of the regression discontinuity design at the residency requirement threshold, which was not feasible in the Censuses, provides credible evidence about the causal effects of this eligibility criterion on immigrants' employment decisions. Another closely related study is Lopez and Slavov (2021), who conducted a panel analysis of older immigrants' social security take-up decisions compared to the native born in the U.S. using the Health and Retirement Study (HRS). My empirical analysis is similar but has the advantage of comparing non-immigrants' labour supply separating age-at-arrival groups, which provides important policy input since the level of benefit eligibility is a function of age-at-arrival. Borjas's (2011) main conclusion was that labour supply among immigrant seniors is higher than that of their native-born counterparts, but that after crossing the residency requirement threshold for the U.S.'s OASDI, their labour supply falls to match that of the native born. I find similar results, but with additional insights in heterogeneity across age-at-immigration groups. For example, I observe that immigrants who landed before 20 years of age are more likely to work than non-immigrants, both before and after the NRA. In contrast, those who landed after age 30 tend to exhibit a much steeper decline in the employment probability after the NRA. This supports Schaafsma and Sweetman's (2001) finding that age-at-arrival is a crucial input in determining immigrants' labour market outcomes, but age-at-arrival also matters for the immigrant senior population.

I also provide the first causal estimates of the effect of residency requirements on immigrant seniors' employment and benefit take-up decisions. For instance, my estimates indicate that, for the post-age 65 population, crossing the residency requirement threshold induces a sharp reduction in labour supply for those who arrive late in life so that it falls below that of observationally similar immigrants who arrived earlier in life. I also uncover marked differences in public pension take-up, with a sharp spike in late age-at-arrival immigrants' take-up of GIS benefits after crossing the threshold. Estimates from a regression discontinuity design corroborate these results, providing further support for a casual interpretation.

Overall, I find that immigrant seniors' employment decisions are sensitive to both crossing the age-65 eligibility threshold for OAS and GIS and crossing the ten-year residency requirements threshold. Since immigrant seniors' take-up of GIS is higher than that of non-immigrants, the super GIS provision, which elicits large substitution effects on labour supply, appears to be a driving factor in immigrant seniors' decision to reduce their employment in response to these eligibility-threshold criteria.

I organize the rest of this paper accordingly. In section 2, I summarize some of the related research. I then outline key features and policy parameters of the OAS and GIS, as well as the CPP, programs in section 3. In section 4, I describe the LAD and my analysis sample, present my empirical framework, and discuss my results. Finally, in section 5, I discuss the policy and welfare implications of my paper, summarize results, and conclude.

2. Related Research

I contribute to the literature, which primarily focuses on the U.S., examining the labour supply effects of social security programs for seniors (e.g., Diamond and Gruber, 1999; Feldstein and

Liebman, 2002; Krueger and Meyer, 2002; Coile, 2015; Fetter and Lockwood, 2018) and a literature on the effects of public pension programs on retirement in Canada (e.g., Baker and Benjamin, 1999a, 1999b; Baker 2002; Baker, Gruber, and Milligan, 2003; Staubli and Zhao, 2022). Blundell, French, and Tetlow (2016) provide an international survey of this literature. It also relates to papers studying such programs' affects on incentives to work (e.g., Burtless and Moffitt, 1985; Baker and Benjamin, 1999b; Friedberg, 2000; Disney and Smith, 2002; Blundell, Meghir, and Smith, 2002; Baker, 2002; Baker, Gruber, and Milligan, 2003; French, 2005; Gelber, Isen, and Song, 2016; Blundell, French, and Tetlow, 2016; Gelber, Jones, and Sacks, 2017; Gelber, Jones, and Sacks, 2020).

Although the share of immigrants in the senior population in high-income countries is growing, none of these abovementioned studies factor in the labour supply effects of public pension residency requirements. Borjas (2011), and Lopez and Slavov (2021) study these effects in the U.S. context and find that, in general, immigrant seniors are more likely to work than their native-born counterparts, but that difference converges to zero after crossing the OASDI residency requirement threshold.

A Canadian literature investigated immigrants' labour supply and benefit take-up decisions but did not focus those for the seniors. For example, Schaafsma and Sweetman (2001) studied the relationship between age-at-immigration and the labour market outcomes of the working-age population. Crossley, McDonald, and Worswick (2001) examined working-age immigrants' take-up of employment insurance (EI) and social assistance as a function of years-since-landing, and Ostrovsky (2012) analyzed working-age immigrants' labour supply and EI take-up, using the LAD. Ostrovsky found that their labour supply and probability of EI take-up is not sensitive to years of permanent residency following entrance into the Canadian labour market. On the other hand, Zhang, Zhong, and de Chardon's (2020) life-cycle analysis indicates that Family Class immigrants and Refugees have lower net direct fiscal contributions (income taxes paid net of transfers received) than other immigration categories, especially after the NRA.

Another closely related literature examines the incomes and wealth of immigrant seniors after retirement in the U.S. It generally concludes that low levels of accumulated retirement wealth (i.e., contributory, earnings-related pension entitlements, workplace pension plan, retirement savings) might induce such immigrants to work longer than their non-immigrant counterparts. For example, using SIPP data, Heim, Lurie, and Ramnath (2011) find that immigrants participate far less in workplace pension plans compared to their U.S.-born counterparts. In addition, Favreault and Nichols (2011) note that senior immigrants in the U.S. have lower social security entitlements because, on average, they have shorter contributory-earnings histories. However, using the HRS linked to Social Security Administrative data, Sevak and Schmidt (2014) observe that while immigrants have fewer social security entitlements compared to the native-born in the U.S., they have higher levels of net worth. This is related to Vega and Aguila (2015) who suggest that a growing share of the senior immigrant population in the U.S. have foreign pension income. However, Sevak and Schmidt (2014), and O'Neil and Tienda (2015) observe that this is not the case for older, late age-at-arrival immigrants whose retirement preparedness is lower than that of the native born. While I am not able to observe wealth in the LAD, I contribute to this literature by focusing on labour supply and studying the effects of public pension rules on it. I am the first to examine the extent to which these effects depend on several indicators of earnings- and savings-history and pension plan participation, which was not possible given the data used in these previous studies.

While I do not directly address in this paper the relationship between health and retirement, the two are linked (e.g., Currie and Madrian, 1999; O'Donnell, van Doorslaer, and van Ourti, French and Jones, 2016; Blundell, Britton, Costa Dias, and French, 2021). Studies have revealed differences between immigrants' and non-immigrants' health behaviours and access to health care and physician services as a function of years-since-immigration (e.g., Bustillo and Anton, 2009; Garcia Gomez and Lopez Nicolas, 2006), and Sole-Auro, Guillen, and Crimmins (2009) find the elderly immigrants have particularly high usage rates. This link has been studied for numerous health outcomes, including mental health (Atalay and Barrett, 2014; Atalay et al., 2019) and mortality (Fitzpatrick and Moore, 2018; Brockmann et al., 2009), but the evidence is mixed. Recent studies exploited exogenous variation in pension eligibility rules to examine the causal link and conclude that raising statutory retirement ages reduces subjective mental health and objective health measures, such as obesity and cardiovascular disease (e.g., Bloemen, Hochguertel, and Zweernik, 2017; Kuhn, Staubli, Wuellrich, and Zweimuller, 2020; Barschkett, Geyer, Haan, and Hammerschmid, 2021). An examination of this link, compared between immigrant and non-immigrant seniors, is an avenue for future research.

3. Policy Environment

Canada's retirement income system has multiple pillars. First is the non-contributory, tax-financed Old Age Security (OAS) pension for those over age 65 who satisfy permanent residency requirements, and its low-income support Guaranteed Income Supplement (GIS) together with associated allowances for widows/widowers and spouses too young to be eligible but with an eligible partner. Second, there is a contributory, earnings-related public pension system, the Canada and Québec Pension Plans (CPP and QPP). Lastly, is the tax treatment of employer-sponsored registered pension plans (RPPs) and personal retirement savings vehicles, such as the Registered Retirement Savings Plans (RRSP). In addition, there are tax credits and several provincial low-income supplement programs and policies for those over age 65.

3.1. Old Age Security and Guaranteed Income Supplement

OAS is a demogrant paid to those aged 65 and older, subject to permanent residency requirements. Eligible recipients must have at least ten years of permanent residency in Canada after age 18. Immigrants may receive OAS without satisfying this residency requirement if their country of last permanent residence has a Social Security Agreement with Canada (known as Totalization Agreement in the U.S.). While I do not directly examine the impacts of Social Security Agreements, their effects are essentially "soaked up" in my regression analysis. Prorated benefits are paid to permanent residents with less than 40 years of permanent residency. For immigrants from a signatory Social Security Agreement country, the prorated OAS benefit schedule does not apply. A Social Security Agreement also allows emigrants to collect OAS benefits outside of Canada in a signatory country. Otherwise, 20 years of permanent residency is required to collect OAS outside of Canada. I leave the study of the impacts of these agreements for a subsequent analysis.

OAS benefits are taxable, and inflation adjusted. The 2022 maximum monthly benefit, $642.25, is paid to those whose previous year's personal net income is at most $79,845. For last year's net income exceeding that threshold, OAS recipients face a federal withholding (recovery) tax on benefits of 15%. Hence net benefits are zero for net income beyond $133,141. Since 2013, policy shifts permitted optional OAS deferral to at most age 70 with an increase of 0.6% per month and phased-in automatic enrollment for eligible 65-year-olds.

Within the OAS program is the couple-income tested (based on, if married or common-law, own and spouse's combined net income) GIS for low-income couples. The GIS's eligibility criteria are similar to that of the OAS, but permanent residents can receive a full GIS after 10 years of permanent residency. In addition, for those in receipt of a prorated OAS benefit, a "super GIS" tops them up to match full OAS benefits for low-income recipients. Eligibility for GIS requires receipt of OAS benefits and, for single individuals in 2022, a net income of $19,464 or less and, for couples, a net income of $25,728 or less if each spouse receives OAS and $46,656 if only one receives OAS. GIS benefits are subject to a 50% tax-back on net income, excluding OAS, in excess of an earnings exemption. The maximum monthly GIS supplement in 2022 is $1,219.68, and this amount is adjusted quarterly for inflation. GIS benefits are considered non-taxable with respect to personal income tax.

Labour Supply Incentives as a Function of Years Since Landing:

Post-age 65 labour supply incentives vary by years since landing. Consider three illustrative cases. First, an immigrant who by age 65 has reached at least 40 years of permanent residency in Canada. The immigrant faces a similar set of incentive changes as non-immigrants at age 65: an income effect, arising from OAS and GIS, that may tend to hasten retirement; and, for those who work beyond age 65, a substitution effect, arising from the OAS recovery tax and GIS claw-back, that tends to incentivize retirement.

Second, for immigrants who have more than ten, but less than 40, years of residency by age 65, labour supply incentives may be different from those of non-immigrants' after age 65 due to the OAS proration. First consider the case where the immigrant's income is high enough so that GIS is not applicable. If immigrants receive a prorated OAS at age 65, then the income effect at age 65 is lower than those than that for those with the full benefit, but it still may tend to hasten retirement. And again, for income is high enough, there will also be the earning disincentive from the OAS recovery tax. On the other hand, if the immigrant is lower income so GIS is applicable, then the super GIS top-up matches what they would receive in OAS benefits if they had 40 years of residency. However, the claw-back rate on GIS benefits is 50% Therefore, for GIS-receiving immigrant seniors, the super GIS strongly incentivizes less labour supply.

For immigrants who have less than ten years of residency at age 65, no OAS or GIS can be received (unless their country of last permanent residency was one for which had a signed Social Security Agreement with Canada). In this case, there will be a clear kink in their budget constraint at ten years-since-landing, at which time the incentive to work is greatly reduced.

Canada and Quebec Pension Plan Retirement:

Although they do not impose residency requirements for eligibility, briefly describing the C/QPP programs is nonetheless important as they relate to immigrant seniors' employment decisions.

C/QPP retirement benefits are funded by a payroll tax applied to employment income above the "Year's Basic Exemption" and up to a contributory maximum "Year's Maximum Pensionable Earnings". One must make significant C/QPP contributions after age 18 to be eligible. Benefits depend upon average contributions per year and the number of years contributing, where the lowest 17% (formerly 15%) of earnings years can be dropped in calculating the average. Because the number of contributing years is important in the formula, immigrants who arrived, and began working, in Canada far after the age of 18, may have quite low available C/QPP retirement benefit entitlements upon reaching the eligibility age, though such immigrants may have pension eligibility from pre-immigration employment.

The standard eligibility age for C/QPP take-up is age 65, but early (delayed) C/QPP commencement is available with actuarial penalties (rewards) from age 60 (to age 70). There is no advantage to C/QPP commencement after 70. The benefit is a function of the contributory-earnings history, which, if an immigrant is from a country of last permanent residency with a signed Social Security Agreement with Canada, includes pre-immigration contributions for those who work in Canada prior to gaining official status. For immigrants who arrived, and began working, in Canada later in life, the financial advantage from postponing C/QPP retirement benefits and working an additional year is higher than that for those who have significant work histories in Canada.

4. Empirical Analysis

4.1. Data and Sample

I use Statistics Canada's Longitudinal Administrative Databank (LAD), an anonymized panel comprising 20% of tax filers. It currently spans the years 1982 through 2019 and is topped up annually to remain nationally representative. Once selected into the LAD, tax filers are followed longitudinally until they cease to file income tax. In addition to income tax-relevant information, the LAD contains information on transfer income, demographic and geographic characteristics reported at the time of tax filing, and the application to immigrate. There is a landing year variable for immigrants who became permanent residents after 1952. There is also detailed landing information for those who landed between 1980 and 2015.

I select a random 5% sample from the LAD's registry file of tax filers aged 50-75 in the years 1986 to 2019 (1986 is the first year that registered pension plan contributions are observable in the LAD). I follow each from age 50 to 75, or until the end of the data period, with the restriction that there must be observations up to age 61 (a year after Canada's minimum pension take-up age). Hence, those who are observed to have died, emigrated from Canada, or otherwise stopped filing income tax before age 61 are dropped. Putting the boundary conditions differently, I select those born between 1936 and 1958: those born in 1936 were 50 in 1986 and 75 in 2011; those born in 1944 were 50 in 1994 and 75 in 2019; and those born in 1958 were 50 in 2008 and 61 in 2019. I allow for late-age-arrival immigrants to enter the sample after age 50.

Descriptive statistics are shown in Table 1. About 77% 103,755 cross-sectional units are non-immigrant, 19% are immigrants who attained permanent residency at or before age 50, and 4% landed in Canada after age 50. From this total, I drop those who are not observed filing income tax at age 50 from the non-immigrant category (13.4% of non-immigrants) and from the immigrant sample who landed at or before age 50 (17.0% of immigrants who landed before age 50). I also restrict the sample to those who are not sporadic filers (i.e., I remove those with at least two consecutive years alive but not filing), which amounts to 7.2% of the initial sample. For those for whom there is not an income tax record for an individual year (18.9% of the initial sample total), I impute the missing incomes by source by averaging adjacent years. After applying these restrictions, the analysis sample consists of 77,525 cross-sectional units, and 1,530,345 person-year observations.

In Table 2, I present summary statistics on income by source and means for other variables for the analysis sample at ages 50-53. It presents proportions with positive income by source. Table 3 shows dollar value means (in 2022 dollars) by source of income for the subset with a strictly positive values for the relevant source. Non-immigrants are observed to have a slightly higher incidence of non-zero employment earnings (i.e., T4-slip income and earnings from self-employment). In terms of retirement resources, non-immigrants appear to have a higher rate of RRSP contributions and substantially higher rates of RPP contributions and

Pension Adjustment filing (i.e., the value placed on benefits accruing under an RPP or deferred profit-sharing plan for tax purposes during the tax year). However, the LAD does not include measures of wealth and inheritance, both of which may contribute to immigrants' well-being in retirement (Morissette, 2019). In addition, immigrants who landed at or before age 50 appear to have a substantially higher rate of Social Assistance income at ages 50-53 compared to non-immigrants.

Differences in region of residence are also observed: non-immigrants at ages 50-53 were more likely to reside in the Atlantic provinces (Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island) and the Prairies (Manitoba and Saskatchewan) compared to immigrants, while immigrants were more likely to reside in Ontario or in British Columbia. A similar pattern was observed in Warman's (2007) analysis of Canadian Census data to examine the working-age population.

Table 3 shows that non-immigrants at ages 50-53 had a higher average net income than immigrants, where net income represents tax filers' total income less deductions and social benefit repayments. Non-immigrants also appear to have higher average total deductions (i.e., the sum of all income tax deductions). In addition, non-immigrants are observed to have paid higher average net federal and provincial taxes than immigrants while also earning on average about $5,000 more in employment income.

Quite marked differences between non-immigrants and immigrants in their incidences and averages of income by source, taxes paid, and income tax deduction are found at age 65, as depicted in Tables 4 and 5. Of note, Table 4 suggests that immigrants who landed at or before age 50 had a higher rate of non-zero employment income compared to non-immigrants, but a much lower rate of OAS, C/QPP and RPP pension receipt. They are, however, observed to have a much higher rate of GIS receipt compared to non-immigrants despite the ten-year residency requirements rule, and a higher rate of social assistance receipt, as shown in Table 5.

Table 4 also indicates that the rate of social assistance receipt at age 65 is particularly high for immigrants who landed after age 50. Subsequent research may explore provincial differences in immigrants' social assistance receipt. For example, I suspect a large portion of this high rate of social assistance receipt is immigrant seniors in Ontario taking up Ontario Disability Support Program (ODSP) benefits. Once in receipt of OAS, one is no longer eligible for ODSP; hence, satisfying the residency requirement for OAS eligibility represents a shift from provincial to federal income support payments (Cheadle et al., 1994).

In terms of averages at age 65, immigrants who landed at or before age 50 earn more employment income and pay more net federal and provincial personal income tax than non-immigrants but receive much more in GIS low-income support, which likely reflects receipt of the super GIS. Despite earning more employment income than non-immigrants, immigrants who landed at or before age 50 have on average lower net incomes, with substantially less income from an RPP.

4.2. Age Profiles of Employment and Public Pension Take-Up & Income

Several interesting patterns emerge from age profiles of employment, and OAS and GIS take-up, by immigrant status and landing age. These are plotted in Figures 1-3. Of particular note, Figure 1 shows that all late age-at-arrival immigrants in the 60+ group who were filing tax returns before their landing age had non-zero employment income at ages 50-52, before their landing age. This can be attributable to some immigrants having been workers and filed income tax in Canada before attaining permanent residency. According to Table 1, this represents about 14.5%

of immigrants whose landing age was after age 50. In addition, a discrete drop in employment age at ages 52-54 is present among this group, but the sample size of those who landed after age 60 and were present and working at ages 50-52 is small.

Consistent with Schaafsma and Sweetman's (2001) conclusion that younger immigrants tend to have comparably better labour market outcomes than those of natives, Figure 1 shows that immigrants who obtained permanent residency in Canada before the age of 20 tend to have a higher employment rate than non-immigrants while those who landed after age 40.

Figures 2 and 3 indicate that age-at-immigration also matters for public pension take-up. As expected, virtually all non-immigrants, and immigrants who landed early in life, commence receipt of OAS benefits at age 65.[8] However, it also indicates that OAS take-up is incomplete for immigrants who landed between ages 40-49, even though by age 65 they would have been a permanent resident for more than ten years. This may be reflective of immigrant seniors' misunderstanding of public pension eligibility criteria (Bastani, Giebe and Miao, 2020), or that immigrant seniors are deferring their OAS in the post-2013 years.

Despite being less likely to take-up OAS on average, immigrants who landed between ages 40 and 59 and do take up OAS appear to more likely to take-up GIS/Allowances supplements compared to non-immigrants and those who landed earlier in life. This is particularly noticeable after age 65, and likely reflects the super GIS provision that tops-up missing OAS benefits due to benefit proration.

[8] Some are not observed receiving OAS at age 65 exactly due to their birth month. If their birth month is later in their year, their OAS income received at age 65 may not be reported on the income tax return until the year they turn 66.

4.3. Measuring Mean Differences in Age Profiles of Employment

I now study how the age profiles for employment and public pension take-up differ between immigrants and non-immigrants after controlling for income, geographical, and demographic characteristics. I estimate the following pooled OLS specification:

$$y_{i,t} = \alpha_0 + \beta_0 immig_i + \beta_1 Age_{i,t} + \sum_a \beta_a \left(Age_{i,t} \times immig_i\right) + \beta_X X_{i,t} + \epsilon_{i,t} \quad (1)$$

In equation (1), the dependent variable, $y_{i,t}$, is an indicator for positive employment income, or positive public pension income, by individual *i* in time period *t*. Included on the right-hand-side is a constant term, α_0, a set of age indicators, $Age_{i,t}$, omitting age 50 for the employment regressions, age 61 for the OAS regressions, and age 59 for the GIS/Allowances regressions. Included also is an indicator equal to one if individual *i* is an immigrant, $immig_i$, an interaction term between immigrant status and the age fixed effects, $Age_{i,t} \times immig_i$, a vector of both time-invariant and time-varying observable characteristics, $X_{i,t}$, and an idiosyncratic error term, $\epsilon_{i,t}$, which when using a random effects estimator includes both an idiosyncratic component and an individual-specific random intercept component, $\epsilon_{i,t} = \eta_i + \phi_{i,t}$. To deal with potential heteroscedasticity in the error variance, I cluster standard errors at the (panel) individual level.

Included in $X_{i,t}$ are time-varying indicators, such as province indicators (omitting Ontario), and an indicator for being married or common-law, and time-invariant indicators for being female, having had RPP or RRSP contributions or filed a Pension Adjustment at ages 50-55, and a polynomial in landing age. Separate age profiles by immigrant landing category would have been estimated, but immigration category is only available for those who landed between 1952 and 1979. I present descriptive statistics on this group in the Appendix.

Of particular interest in equation (1) are the estimates of the β_a's, which measure the mean probability difference in employment between immigrants compared to non-immigrants at age *a*, relative to the difference between the two groups at the omitted age. I plot these estimates, with 95% confidences intervals, in Figures 4 - 6. Omitted from these plots are estimates of the mean probability differences at the omitted age, β_0; hence, the figures present the estimated values of the β_a coefficients relative to the estimate value of β_0.

In terms of employment, I observe an inverted u-shaped pattern in the relative ($\beta_0 = -0.033$) mean difference in the employment probability, as displayed in Figure 4. At ages 51-55, there is little estimated difference in older immigrants' employment probability compared to non-immigrants, but the difference climbs markedly to around 10 percentage points higher after age 60, Canada's early retirement age for C/QPP receipt, which may reflect immigrant seniors' having less in terms of contributory C/QPP entitlements or perhaps a lower rate of RPP pension participation. However, at age 65, I estimate that that difference begins to halve to about 5 percentage points higher and remains as such until age 75. This pattern is similar to that observed using U.S. Censuses by Borjas (2011), who indicated that eligibility for Social Security (OAS and GIS in Canada) reduced older immigrants' labour supply. However, in contrast to Borjas's result that immigrant seniors' employment probability converges to that of natives after crossing the ten-year residency requirement threshold for public pension eligibility, my results suggest that immigrant seniors' employment participation remains higher than that of non-immigrants even after age 65.

As also shown in Figure 5, the relative mean probability difference in immigrant seniors' OAS take-up (compared to that of non-immigrants is almost 20 percent at age 65 but converges to zero thereafter. On the other hand, Figure 6 indicates that immigrant seniors' receipt of

GIS/Allowance benefits is much higher. The relative mean probability difference in the rate of GIS take-up after age 65 reaches as much as 17 percentage points higher for immigrant seniors.

4.4. Employment Effects of Residency Requirements

To examine the effects of residency requirements on immigrant seniors' employment and take-up decisions, I turn to a difference-in-differences setting in years-since-landing (YSL), estimating it on a sample of those aged 65 and over. In this framework, I can estimate differences in theses outcomes for landed immigrants, before and after crossing the ten-year residency requirements threshold, across YSL values spanning 0 years to 67 years. Accordingly, I estimate a two-way fixed effects model of the following form

$$y_{i,t} = \alpha_0 + \mu_i + \sum_{ysl=0}^{66} \beta_{ysl} YSL_{i,t} + \beta_X X_{i,t} + \epsilon_{i,t} \quad (2)$$

In equation (2), I focus on estimates of β_{ysl}, which capture the effects of a set of indicators equal to one if individual *i*'s years-since-landing value, $YSL_{i,t}$, in year *t* is equal to *ysl*. The β_{ysl}s are to be interpreted as the mean difference in outcomes at each *ysl* value, at each YSL value compared to when ysl is 67, the omitted group. They are plotted, with 95% confidence intervals, in Figures 7 - 9.

I find evidence in Figure 7 that crossing the ten-year residency requirements threshold reduces immigrant seniors' employment probability. I observe an interesting pattern at the ten-year threshold: landed immigrants aged 65 and over with less than ten years of permanent residency appear to have a higher employment probability compared to that of immigrant seniors with 67 years of permanent residency by around 5 percentage points, but it is significantly lower for immigrants with YSL just above ten years. However, this difference in employment converges to zero when YSL reaches around 20 years of permanent residency. Hence, this result suggests that the residency requirement eligibility-threshold for OAS and GIS receipt does impact the employment decision by reducing it.

Another interesting result emerges when considering take-up of OAS and GIS. The first, as depicted in Figure 8, is that, for immigrants who just cross the ten-year residency requirements threshold, their probability of OAS receipt ranges from between ten and 40 percentage points lower than that for non-immigrants. I estimate that a statistically significant difference in OAS take-up in recent arrivals compared to that of immigrant seniors with 67 years of permanent residency until YSL reaches around 45 years of permanent residency. This may be reflective of lack of salience with respect to public pension eligibility criteria among the immigrant senior population.

GIS take-up shows a much different pattern, as displayed in Figure 9. My estimates suggest that immigrant seniors' probability of GIS take-up increases to almost 40 percentage points higher than that for those with 67 years of permanent residency just after crossing the ten-year threshold. This difference begins to converge to zero after 20 YSL and becomes statistically not different from zero by around 40 YSL, when immigrants are no longer eligible for the super GIS because they will have attained eligibility for full OAS.

4.5. Regression Discontinuity Design

In this section, I implement a regression discontinuity design (RDD) that explicitly compares immigrant seniors who have been in Canada just short of ten years with those who have crossed that threshold. This strategy answers the question of how eligibility for OAS and GIS, based on the ten-year rule, affects employment and take-up outcomes. The argument in favor of interpreting the coefficient estimates as causal effects is that if not for the ten-year rule, there should be no reason why outcomes vary discontinuously at any value of years-since-landing.

I estimate the RDD using a local linear specification of the following form

$$Y_{it} = \alpha_{it} + \tau D_{i,t} + \beta_1 (YSL_{i,t} - c) + \beta_2 D_{i,t} \times (YSL_{i,t} - c) + \beta_x X_{it} + \epsilon_{it} \quad (3)$$

In equation (3), Y represents the outcome variable, in this case either a dummy for having positive employment income or receiving GIS benefits. The ten-year residency requirement threshold is represented by c, and D is a dummy equal to one if years-since-landing, YSL, is greater than or equal to c such that, letting b represent the bandwidth, $c - b \leq YSL \leq c + b$. I use Calonico, Cattaneo, and Titiunik (2014), and Pei et al.'s (2022a; 2022b) bandwidth selection criteria and select a bandwidth of 5.15. In the X vector, I include dummies for gender, being married, and province.

The benefit of using the local linear specification is that it reduces some bias that may arise when using data that is farther away from the threshold. However, a required assumption is that treatment assignment must be "as good as random" at the threshold, which ensures that treatment status is exogenous (e.g., Imbens and Lemieux, 2008). In the case of the ten-year residency requirement rule, I consider the threshold to be clearly exogenous, as evidenced by no discrete change in immigrants at the threshold. In addition, among the set demographics and landing characteristics available, covariates are observed to be continuous around and through the threshold.

To motivate the regression discontinuity design, I plot in Figure 10 the probability of having positive employment income as a function of years-since-landing on ten years of either side of the ten-year eligibility threshold. This figure includes the sub-group of individuals aged

65 and above. It shows a marked drop in the employment probability, by roughly 15 percentage points, at the ten-year threshold. However, the estimates of the β_2 coefficient from equation (3), which estimates in a multivariate context the average treatment effect on immigrant seniors' employment by crossing the ten-year threshold, suggest that crossing the ten-year threshold reduces immigrant seniors' post-age 65 employment probability by approximately 9.5 percentage points, as displayed in Table 6. These results appear to be robust to how the function of years-since-landing is specified – I also considered square, cubic, and quartic polynomials in years-since-landing.

5. Conclusions

Using income-tax and related administrative panel data, I investigate how crossing two eligibility threshold, the age-eligibility threshold for OAS and GIS receipt and the ten-year residency requirement threshold, effects immigrant seniors' employment decisions. I implement three empirical strategies. First, I estimate how reaching Canada's normal retirement age (NRA) for public pension eligibility, age 65, differentially affects the age profiles of employment of those who do not satisfy residency requirements compared to those who do. Second, using a two-way fixed effects model in a difference-in-differences setting, I compare post-age 65 employment and benefit take-up outcomes of immigrants as they cross the ten-year threshold to those of immigrants who arrived earlier in life. Finally, using a regression discontinuity design, I compare outcomes between observationally equivalent immigrants who are just above/below the threshold.

My results suggest that immigrant seniors' employment decisions are sensitive to both crossing the age-65 eligibility threshold for OAS and GIS and crossing the ten-year residency requirements threshold. The super GIS provision, which elicits large substitution effects on labour supply, appears to be a driving factor in immigrant seniors' decision to reduce their employment in response to crossing these eligibility thresholds.

References

Atalay, Kadir, and Garry Barrett. 2014. "The causal effect of retirement on health: New evidence from Australian pension reform." *Economic Letters*, 125 (3): 392-395

Atalay, Kadir, Garry Barrett, and Anita Staneva. 2019. "The effect of retirement on elderly cognitive functioning." *Journal of Health Economics*, 66, 37-53

Baker, Michael. 2002. "The Retirement Behavior of Married Couples: Evidence from the Spouse's Allowance." *Journal of Human Resources*, 37 (1): 1-34

Baker, Michael, and Dwayne Benjamin. 1997. "The Role of the Family in Immigrants' Labor-Market Activity: An Evaluation of Alternative Explanations." *American Economic Review*, 18 (4): 705-27

Baker, Michael, and Dwayne Benjamin. 1999a. "Early Retirement Provisions and the Labor Force Behavior of Older Men: Evidence from Canada." *Journal of Labor Economics*, 17 (4): 724-56.

Baker, Michael, and Dwayne Benjamin. 1999b. "How do Retirement Tests Affect the Labor Supply of Older Men?" *Journal of Public Economics*, 71: 27-51

Baker, Michael, Jonathan Gruber, and Kevin Milligan. 2004. "The retirement incentive effects of Canada's Income Security Programs." *Canadian Journal of Economics*, 36 (2): 261-290

Baldwin, Bob, and Richard Shillington. 2017. "Unfinished Business: Pension Reform in Canada." *Faces of Aging*, Institute for Research on Public Policy, Accessed 2022-07-15 at https://irpp.org/research-studies/unfinished-business-pension-reform-in-canada/

Barschkett, Mara, Johannes Geyer, Peter Haan, and Anna Hammerschmid. 2021. "The Effects of an Increase in the Retirement Age on Health: Evidence from Administrative Data." *DIW Berlin Discussion Paper*, No. 1985, Accessed 2022-07-12 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3984994

Bastani, Spencer, Thomas Giebe, and Chizeng Miao. 2020. "Ethnicity and tax filing behavior." *Journal of Urban Economics*, 116, issue C

Bloemen, Hans, Stefan Hochguertel, and Jochem Zweerink. 2017. "The causal effect of retirement on mortality: Evidence from targeted incentives to retire early." *Health Economics*, 26 (12): 204-18

Blundell, Richard, Eric French, and Gemma Tetlow. 2016. "Retirement Incentives and Labor Supply." *Handbook of the Economics of Population Aging*, Chapter 8, 457-566

Blundell, Richard, Jack Britton, Monica Costa Dias, and Eric French. 2020. "The Impact of Health on Labor Supply Near Retirement." *Journal of Human Resources*, Access 2022-07-15 at http://jhr.uwpress.org/content/early/2020/11/04/jhr.58.3.1217-9240R4.abstract

Borjas, George. 2011. "Social Security Eligibility and the Labor Supply of Older Immigrants." *ILR Review*, 64 (3): 485-501

Brockmann, Hilke, Rolf Muller, and Uwe Helmert. 2009. "Time to retire – Time to die? A prospective cohort study of the effects of early retirement on long-term survival." *Social Science & Medicine*, 69 (2): 160-4

Burtless, Gary, and Robert Moffitt. "1985. "The Joint Choice of Retirement Age and Postretirement Hours of Work." *Journal of Labor Economics*, 3 (2): 209-36

Coile, Courtney, and Jonathan Gruber. 2007. "Future Social Security Entitlements and the Retirement Decision." *Review of Economics and Statistics*, 89 (2): 234-46

Coile, Courtney. 2015. "Economic Determinants of Workers' Retirement Decisions." *Journal of Economic Surveys*, 29 (4): 830-53

Crossley, Thomas, James McDonald, and Christopher Worswick. 2001. "Immigrant Benefit Receipt Revised: Sensitivity to the Choice of Survey Year and Model Specification." *Journal of Human Resources*, 36 (2): 379-97

Currie, Janet, and Brigitte Madrian. 1999. "Health, health insurance and the labor market." *Handbook of Labor Economics*, Chapter 50, Part C, 3309-3416

Department of Finance Canada. 2021. "Annual Financial Report of the Government of Canada Fiscal Year 2020-2021," retrieved from https://www.canada.ca/en/department-finance/services/publications/annual/2021.html

Diamond, Peter, and Jonathan Gruber. 1999. "Social Security and Retirement in the United States." In *Social Security and Retirement around the World*, edited by Jonathan Gruber and David A. Wise, 437-73. Chicago: University of Chicago Press

Favreault, Melissa, and Austin Nichols. 2011. "Immigrant Diversity and Social Security: Recent Patterns and Future Prospects." *Boston College Center for Retirement Research*, Working Paper no. 2011-8

Feldstein, Martin, and Jeffrey Liebman. 2002. "Social Security." In *Handbook of Public Economics*, Vol. 4, edited by Alan J. Auerbach and Martin Feldstein, 2245-324. Amsterdam: Elsevier

Fitzpatrick, Maria, and Timothy Moore. 2018. "The mortality effects of retirement: Evidence from Social Security eligibility at age 62." *Journal of Public Economics*, 156: 121-37

French, Eric. 2005. "The Effects of Health, Wealth, and Wages on Labor Supply and Retirement Behaviour." *Review of Economic Studies*, 72 (2): 395-427

French, Eric, and John Bailey Jones. 2016. "Health, Health Insurance, and Retirement: A Survey." *Annual Review of Economics*, 9: 383-409

Friedberg, Leora. 1999. "The Effect of Old Age Assistance on Retirement." *Journal of Public Economics*, 71 (2): 213-31

Friedberg, Leora. 2000. "The Labor Supply Effects of the Social Security Earnings Test." *Review of Economics and Statistics*, 82 (1): 48-63

Gelber, Alexander, Damon Jones, and Daniel Sacks. 2020. "Estimating Adjustment Frictions Using Nonlinear Budget Sets: Method and Evidence from the Earnings Test." *American Economic Journal: Applied Economics*, 12 (1): 1-31

Gelber, Alexander, Damon Jones, Daniel Sacks, and Jae Song. 2022. "The Employment Effects of the Social Security Earnings Test." *Journal of Human Resources*, 57 (2): 341-371

Heim, Bradley, Ithai Lurie, and Shanthi Ramnath. 2011. "Immigrant-native differences in employment-based retirement plan participation." *Journal of Pension Economics and Finance*, 11 (3): 365-88

Kaushal, Neeraj. 2009. "Elderly Immigrants' Labor Supply Response to Supplemental Security Income." *Journal of Policy and Analysis Management*, 29 (1): 137-62

Kuhn, Andreas, Stefan Staubli, Jean-Phillipe Wuellrich, and Josef Zweimuller. 2020. "Fatal attraction? Extended unemployment benefits, labor force exits, and mortality." *Journal of Public Economics*, 191, Accessed 2020-07-12 at https://www.sciencedirect.com/science/article/abs/pii/S0047272719301483

Kreuger, Alan, and Bruce Meyer. 2002. "Labor Supply Effects of Social Insurance." In *Handbook of Public Economics*, Vol. 4, edited by Alan J. Auerbach and Martin Feldstein, 2327-92, Amsterdam: Elsevier.

Lopez, Mary, and Sita Slavov. 2020. "Do immigrants delay retirement and social security claiming?" *Applied Economics*, 52 (10): 1105-23

O'Donnel, Owen, Eddy van Doorslaer, and Tom van Ourti. 2016. "Health and Inequality." *Handbook of Income Distribution*, Chapter 17, Accessed 2022-07-12 at https://ideas.repec.org/p/tin/wpaper/20130170.html

O'Neil, Kevin, and Marta Tienda. 2015. "Age at Immigration and the Incomes of Older Immigrants, 1994 – 2010." *The Journals of Gerontology*, 70 (2): 291-302

Ostrovsky, Yuri. 2012. "The dynamics of immigrant participation in entitlement programs: evidence from Canada, 1993-2007." *Canadian Journal of Economics*, 45 (1): 107-136

Pei, Zhuan, David Lee, David Card, and Andrea Weber. 2020a. "Local Polynomial Order in Regression Discontinuity Designs." *NBER Working Paper no. w27424*, accessed 2022-08-08 at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3637725

Pei, Zhuan, David Lee, David Card, and Andrea Weber, 2020b. "Local Polynomial Order in Regression Discontinuity Designs, rdmse Stata package." Accessed 2022-08-08 at https://peizhuan.github.io/programs/

Schaafsma, Joseph, and Arthur Sweetman. 2001. "Immigrant Earnings: Age at Immigration Matters." *Canadian Journal of Economics*, 34 (4): 1066-99

Sevak, Purvi, and Lucie Schmidt. 2014. "Immigrants and Retirement Resources." *Household Finance eJournal*

Staubli, Stefan, and Qiondga Zhao. 2022. "The Long-Run and Distributional Impacts of Public Pensions." Accessed 2022-08-02 at https://sites.google.com/site/stefanstaubli/publications

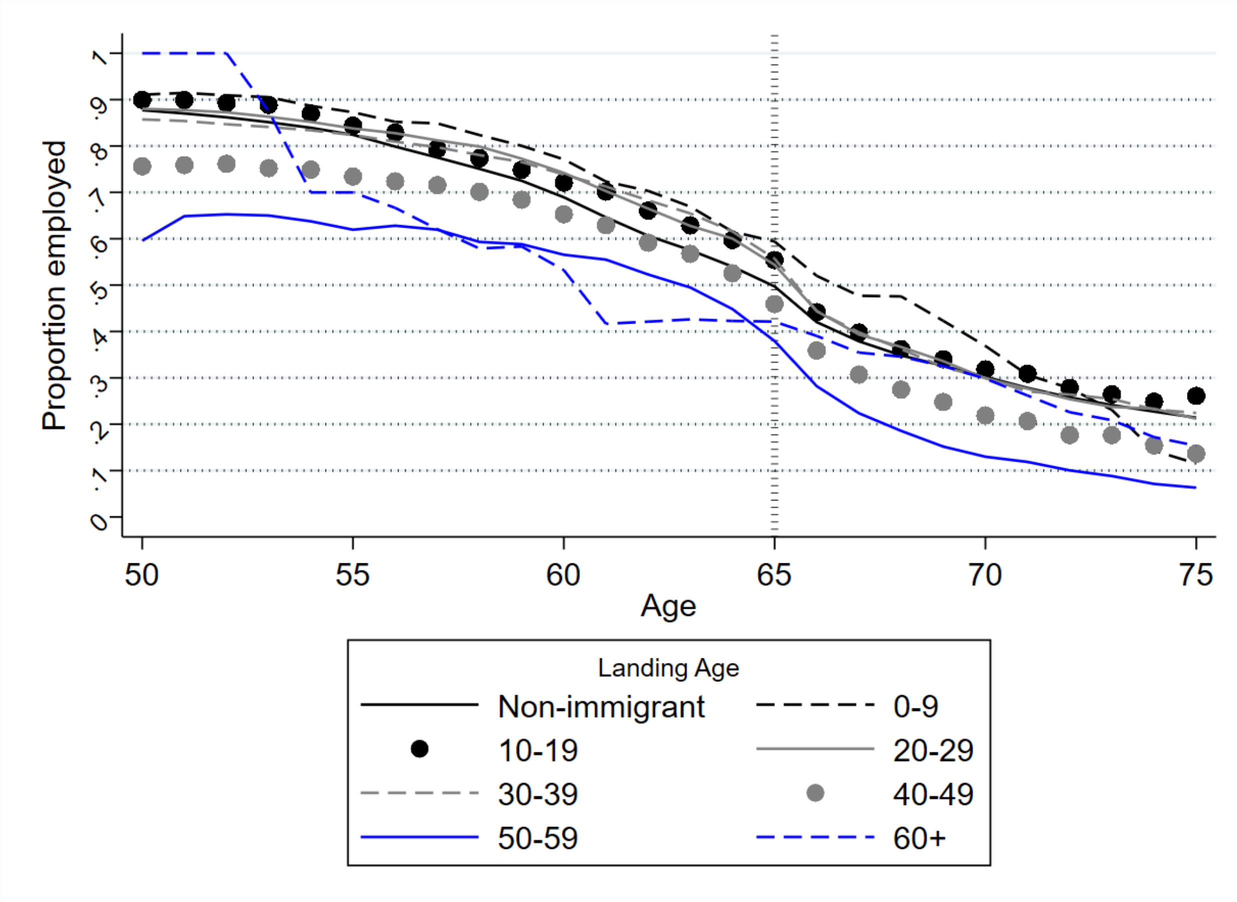
Vega, Alma, and Emma Aguila. 2017. "Foreign retirement income among new older immigrants in the United States." *International Migration*, 55 (3): 38-56

Warman, Casey. 2007. "Ethnic enclaves and immigrant earnings growth." *Canadian Journal of Economics,* 40 (2): 401-22

Zhang, Haozhen, Jianwei Zhong, and Cedric de Chardon. 2020. "Immigrants' net direct fiscal contribution: How does it change over their lifetime?" *Canadian Journal of Economics*, 54 (4): 1642-62

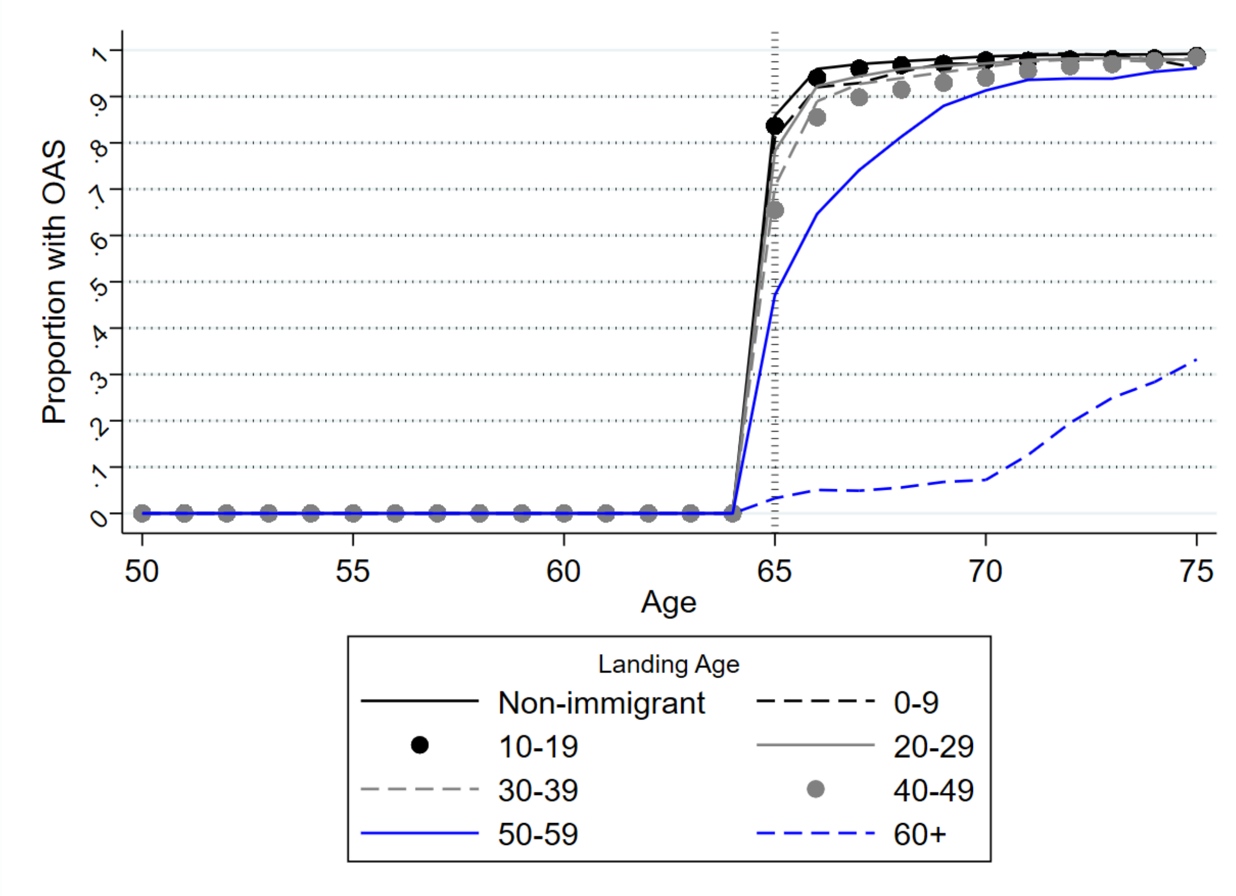
Tables and Figures

Figure 1: Age Profile of Employment Probabilities by Landing Age and Immigrant Status



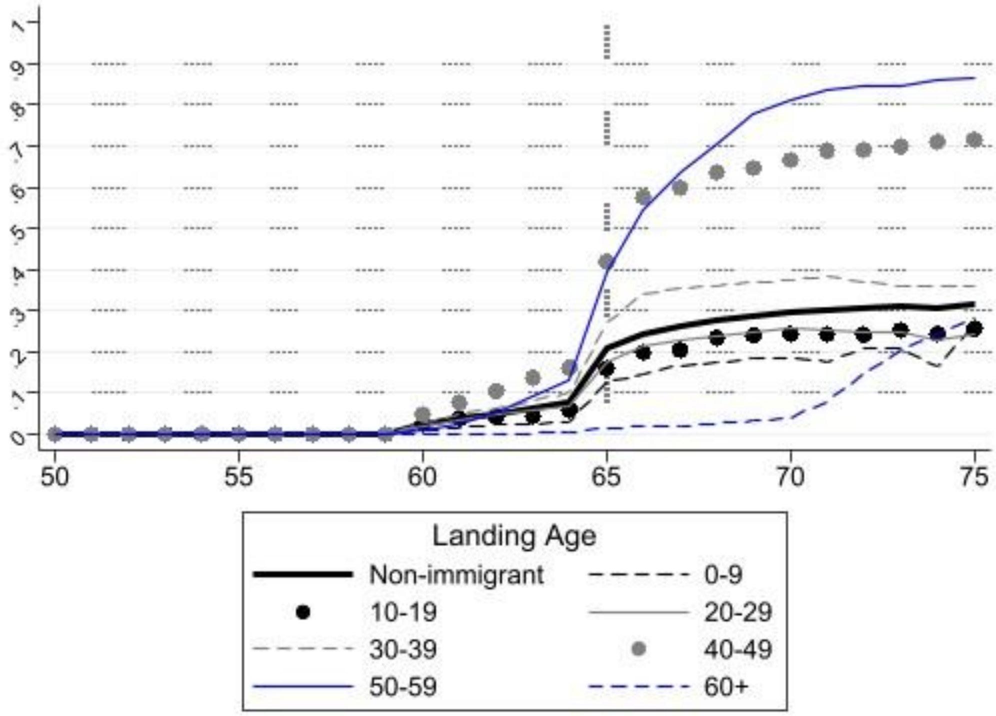
Notes: Author's calculations using the Longitudinal Administrative Databank. Employment earnings reflects both T4-earnings (salary income) and positive self-employment income. Note that some immigrants are observed having employment income before their landing age. For this group, it is possible that they were temporary workers before attaining permanent residency.

Figure 2: Age Profile of OAS Take-Up Probabilities by Landing Age and Immigrant Status



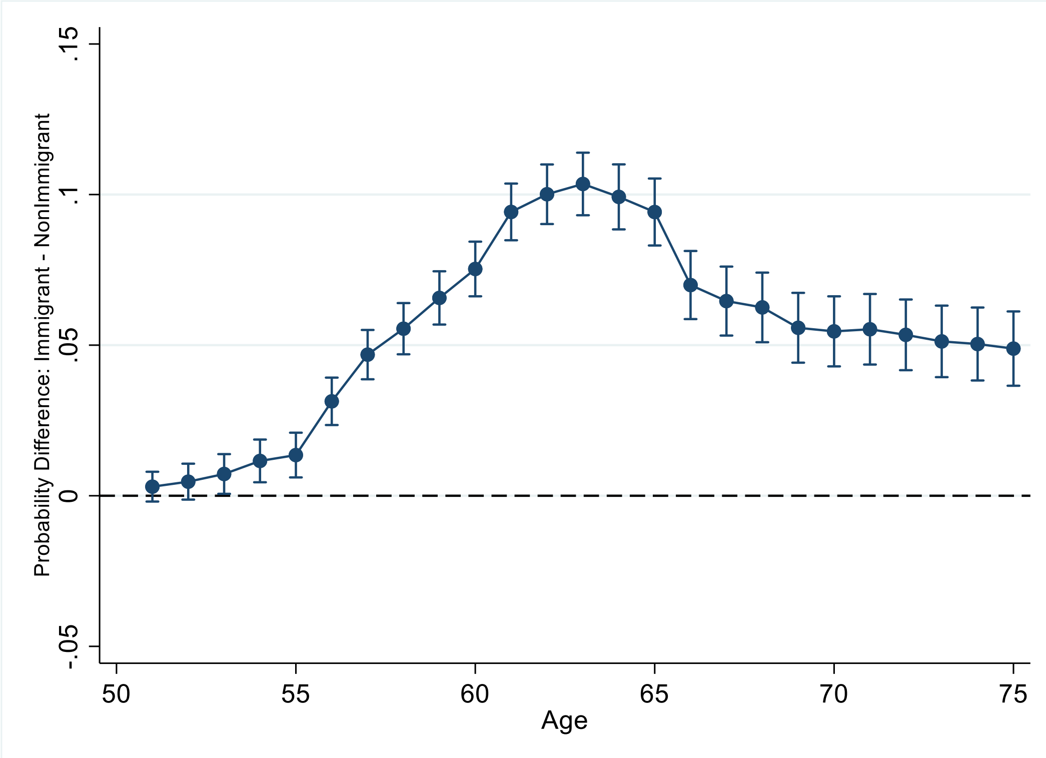
Notes: Author's calculations using the Longitudinal Administrative Databank. Some immigrants in the 60+ landing age group are observed receiving OAS benefits before crossing the ten-year residency requirement threshold. This group is likely from a country of last permanent residency in which has a signed Social Security Agreement with Canada.

Figure 3: Age Profile of GIS/Allowance Take-Up Probabilities by Landing Age and Immigration Status



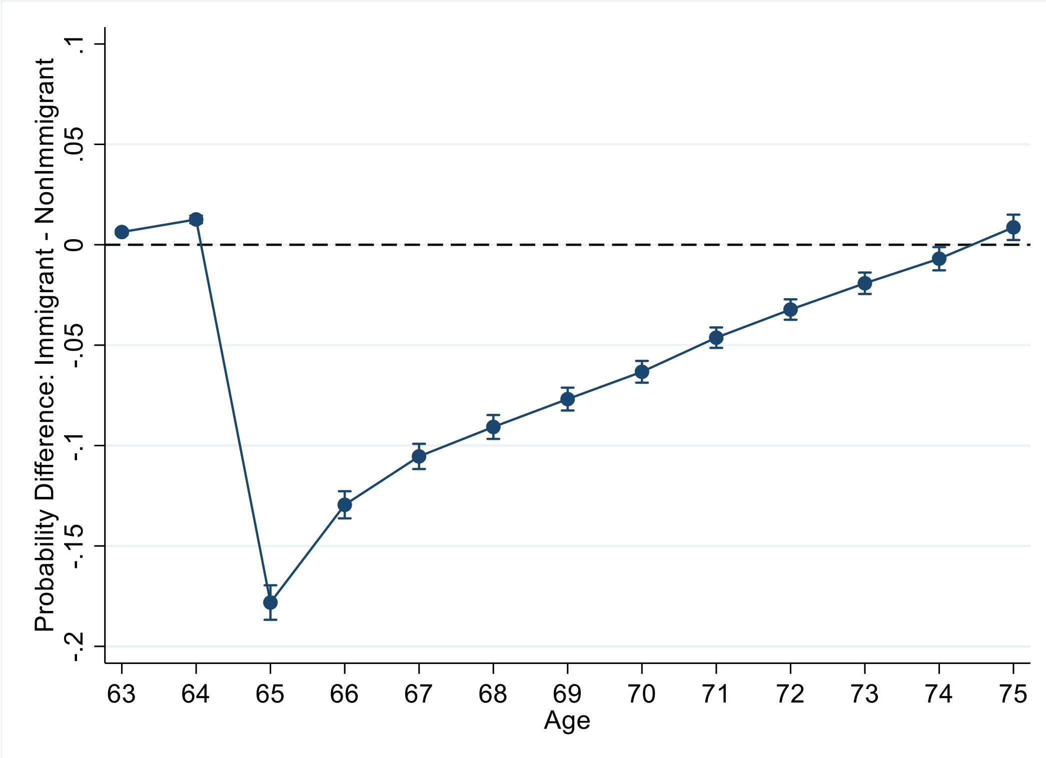
Notes: Author's calculations using the Longitudinal Administrative Databank (LAD). GIS/Allowances income from the Guaranteed Income Supplement and the Allowances (Spouse's and Survivor's). Some immigrants in the 60+ landing age group are observed receiving GIS/Allowances benefits before crossing the ten-year residency requirement threshold. This group is likely from a country of last permanent residency in which has a signed Social Security Agreement with Canada

Figure 4: Mean Difference between Immigrants' and Non-Immigrants' Probability of Employment by Age



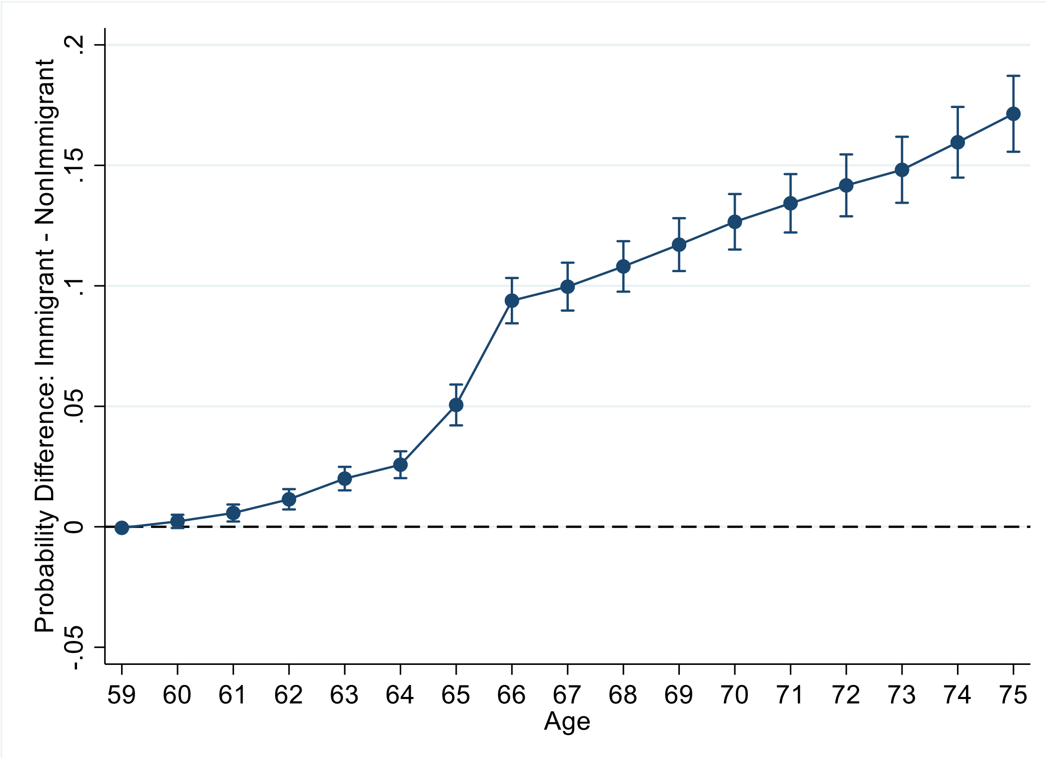
Notes: Author's calculations using the Longitudinal Administrative Databank. Employment earnings reflects T4-earnings (salary income) and positive self-employment income. Mean difference was calculated based on a regression of an indicator for having employment earnings on an indicator for immigrant status interacted with a set of age dummies.

Figure 5: Mean Difference between Immigrants' and Non-Immigrants' Probability of OAS Take-Up by Age



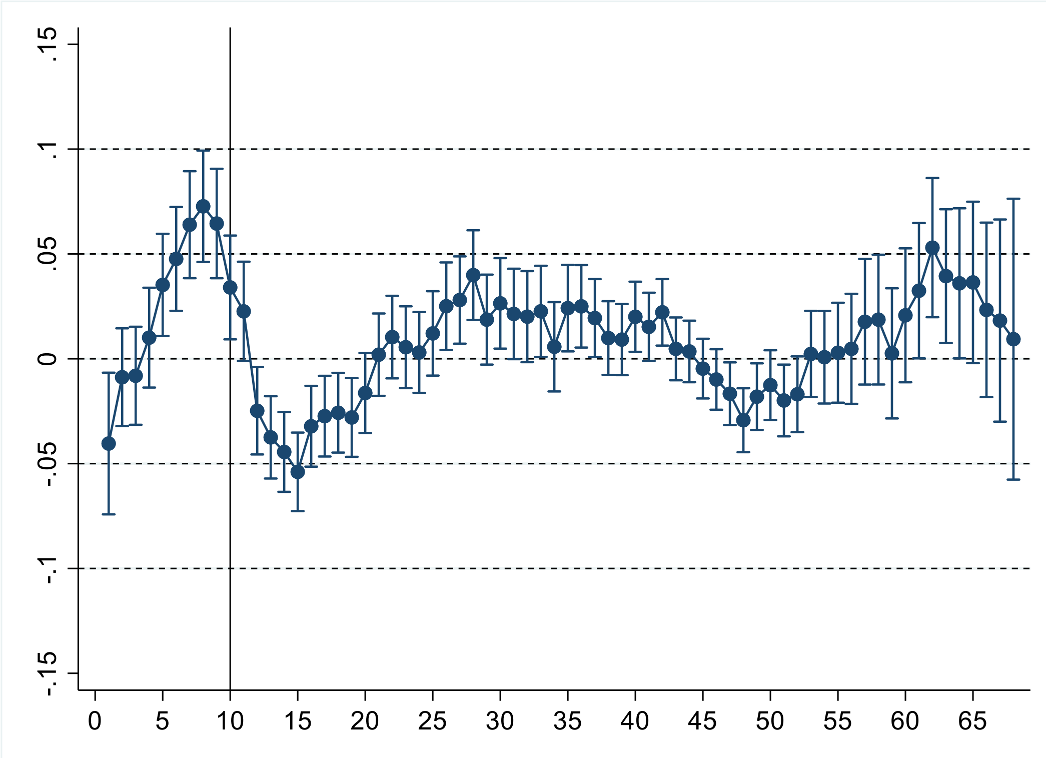
Notes: Author's calculations using the Longitudinal Administrative Databank. Mean difference was calculated based on a regression of an indicator for having Old Age Security income on an indicator for immigrant status interacted with a set of age dummies.

Figure 6: Mean Difference between Immigrants' and Non-Immigrants' Probability of GIS/Allowances Take-Up by Age



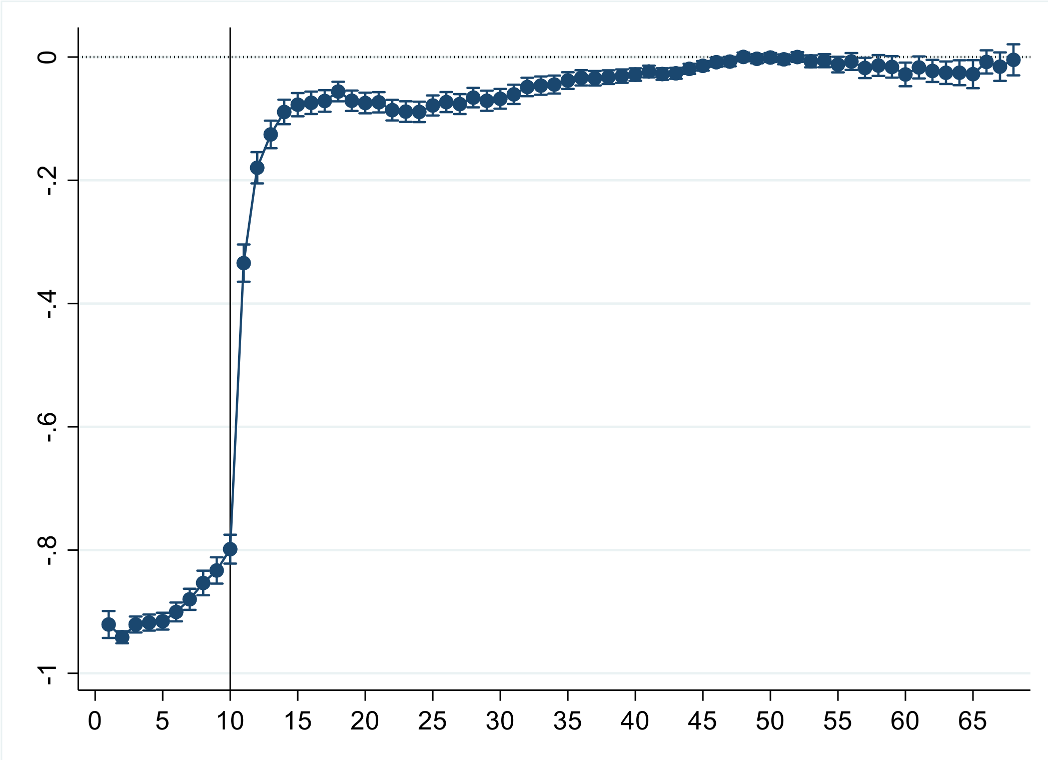
Notes: Author's calculations using the Longitudinal Administrative Databank. Mean difference was calculated based on a regression of an indicator for having Net Federal Supplement income on an indicator for immigrant status interacted with a set of age dummies. Net Federal Supplement income reflects income from the Guaranteed Income Supplement and the Allowances (Spouse's and Survivor's).

Figure 7: DiD Estimates of Immigrants' Employment Probability by Years Since Landing



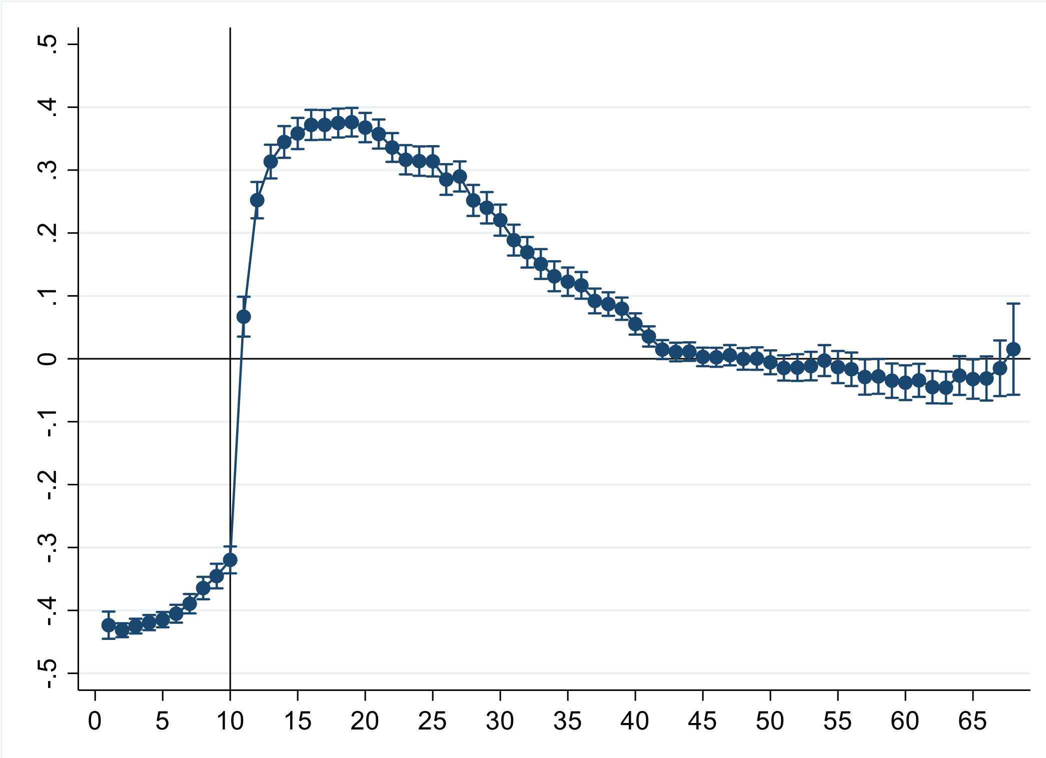
Notes: Author's calculations using the Longitudinal Administrative Databank. Employment earnings reflects T4-earnings (salary income) and positive self-employment income). This figure includes the age 65 and above sample. Mean difference was calculated based on a regression of an indicator for having employment earnings on an indicator for immigrant status interacted with a set of years since landing. Omitted are immigrants with a years-since-landing value of 67. The y-axis represents the estimated difference in the outcome for immigrants relative to that of their non-immigrant counterparts; that is, the outcome value for immigrants less that of their non-immigrant counterparts.

Figure 8: DiD Study Estimates of Immigrants' OAS Take-Up Probability by Years Since Landing



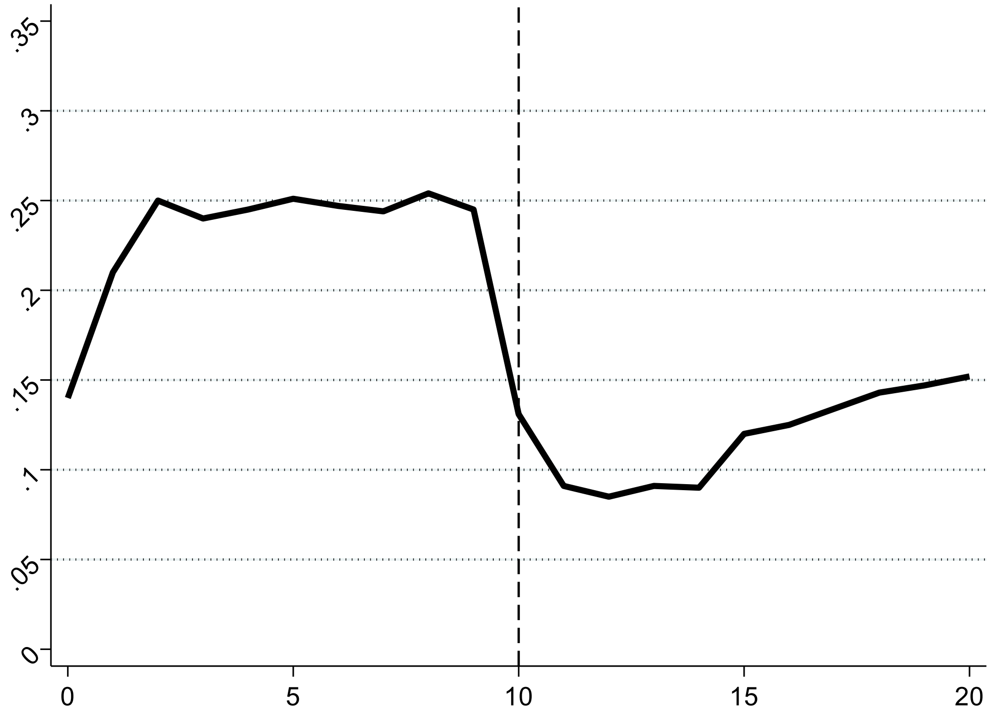
Notes: Author's calculations using the Longitudinal Administrative Databank. This figure includes the age 65 and above sample. Mean difference was calculated based on a regression of an indicator for having OAS income on an indicator for immigrant status interacted with a set of years since landing. Omitted are immigrants with a years-since-landing value of 67. The y-axis represents the estimated difference in the outcome for immigrants relative to that of their non-immigrant counterparts; that is, the outcome value for immigrants less that of their non-immigrant counterparts.

Figure 9: DiD Study Estimates of Immigrants' GIS Take-Up Probability by Years Since Landing



Notes: Author's calculations using the Longitudinal Administrative Databank. This figure includes the age 65 and above sample. Mean difference was calculated based on a regression of an indicator for having GIS income on an indicator for immigrant status interacted with a set of years since landing. Omitted are immigrants with a years-since-landing value of 67. The y-axis represents the estimated difference in the outcome for immigrants relative to that of their non-immigrant counterparts; that is, the outcome value for immigrants less that of their non-immigrant counterparts.

Figure 10: Post-Age 65 Immigrants' Employment Probability by Years Since Landing



Notes: Author's calculations using the Longitudinal Administrative Databank. This figure includes the age 65 and above sample of immigrants only. The y-axis represents the unconditional proportion of this group that is employed; the x-axis, year-since-landing. The dashed vertical line is at 10 years-since-landing to highlight the effect on the employment probability of crossing the ten-year residency requirement threshold for OAS/GIS eligibility.

Table 1: Descriptive Statistics on Cross-Sectional Units

	Non-immigrant	Landed at or before age 50	Landed after age 50	Total
Total	79800 (76.91%)	19625 (18.91%)	4330 (4.17%)	103755
Female	0.498 (0.500)	0.461 (0.498)	0.543 (0.498)	0.493 (0.500)
Complete Cohort	0.293 (0.455)	0.247 (0.432)	0.432 (0.495)	0.290 (0.454)
Incomplete Cohort	0.707 (0.455)	0.753 (0.432)	0.568 (0.495)	0.710 (0.454)
First file after age 50	0.134 (0.341)	0.170 (0.376)	0.955 (0.207)	0.175 (0.380)
Always lost	0.033 (0.178)	0.080 (0.271)	0.022 (0.148)	0.041 (0.199)
Never lost	0.746 (0.436)	0.651 (0.477)	0.030 (0.171)	0.698 (0.459)
Sporadic filer	0.070 (0.255)	0.086 (0.280)	0.056 (0.230)	0.072 (0.259)
Lost once	0.152 (0.359)	0.183 (0.387)	0.891 (0.311)	0.189 (0.391)
Died	0.160 (0.366)	0.098 (0.297)	0.049 (0.216)	0.143 (0.351)
Filing before landing	0.000 (0.000)	0.000 (0.000)	0.145 (0.352)	0.006 (0.078)

Notes: Author's calculations from the Longitudinal Administrative Databank. Cells present proportions with standard deviations in parentheses. 'Filing before landing' refers to filing income tax at ages 50 and above before observed landing year. The total count reflects counts of cross-sectional units (i.e., individuals).

Table 2: Proportion with income and contributions by source, filing income tax, and in province of residence at ages 50-53

	Non-immigrant	Landed at or before age 50	Landed after age 50	Total
	62570 (80.71%)	14170 (18.28%)	790 (1.01%)	77525
Employment earnings	0.880 (0.325)	0.879 (0.327)	0.656 (0.475)	0.877 (0.328)
Interest or Investment income	0.538 (0.499)	0.555 (0.497)	0.283 (0.451)	0.539 (0.498)
Dividend income	0.251 (0.434)	0.219 (0.413)	0.032 (0.176)	0.243 (0.429)
RRSP contributions	0.544 (0.498)	0.516 (0.500)	0.120 (0.325)	0.535 (0.499)
RPP contributions	0.363 (0.481)	0.247 (0.431)	0.034 (0.182)	0.338 (0.473)
Pension adjustment	0.411 (0.492)	0.322 (0.467)	0.041 (0.198)	0.391 (0.488)
Market income	0.933 (0.250)	0.943 (0.231)	0.795 (0.404)	0.934 (0.249)
Capital gains or loss	0.199 (0.399)	0.181 (0.385)	0.025 (0.158)	0.194 (0.395)
Transfer income	0.603 (0.489)	0.684 (0.465)	0.771 (0.421)	0.619 (0.486)
Social assistance	0.063 (0.242)	0.056 (0.230)	0.130 (0.336)	0.062 (0.241)
Disability benefits	0.018 (0.132)	0.013 (0.114)	0.003 (0.050)	0.017 (0.129)
Atlantic	0.098 (0.297)	0.014 (0.117)	0.015 (0.123)	0.081 (0.273)
Quebec	0.292 (0.455)	0.135 (0.342)	0.110 (0.313)	0.261 (0.439)
Ontario	0.318 (0.466)	0.539 (0.498)	0.493 (0.500)	0.360 (0.480)
Prairies	0.074 (0.261)	0.033 (0.178)	0.036 (0.186)	0.066 (0.248)
Alberta	0.092 (0.288)	0.086 (0.280)	0.085 (0.280)	0.091 (0.287)
BC	0.115 (0.319)	0.188 (0.390)	0.231 (0.421)	0.130 (0.336)

Notes: Author's calculations from the Longitudinal Administrative Databank. Cells present proportions with standard deviations in parentheses. The total count reflects counts of cross-sectional units (i.e., individuals). Market income= total income excluding government transfer payments. Employment earnings= income from T4-slips and from non-zero self-employment income (positive or negative).

Table 3: Average income, deductions, and taxes paid in 2022 dollars by source for tax filers aged 50-53

	Non-immigrant	Landed at or before age 50	Landed after age 50
Net income	44500 (73008.934)	40500 (53034.594)	17700 (31109.470)
Total deductions	7500 (15686.554)	6800 (15001.351)	3700 (8627.002)
Net federal taxes	9500 (31507.376)	8300 (26049.590)	4700 (15812.452)
Net provincial taxes	6100 (18934.489)	4900 (15599.510)	3000 (10317.829)
Employment earnings	56500 (1.09e+05)	51600 (86669.255)	24900 (54744.100)
Interest or investment	2600(11542.860)	2800 (10983.123)	3300 (6649.997)
Dividend income	7000 (51647.736)	5900 (25769.096)	6500 (10712.408)
RRSP contributions	7100 (10593.211)	6500(7585.815)	6400 (13631.756)
RPP contributions	3400 (2592.302)	3100 (2554.929)	2300 (1836.913)
Pension adjustment	7100 (4899.804)	6300 (5450.501)	6600 (5910.510)
Market Income	57900(1.19e+05)	51200 (90291.595)	22900 (52434.950)
Capital gains or loss	25400 (1.01e+05)	23400 (78442.224)	10000 (21519.681)
Social assistance	8400(5013.149)	9200 (5901.126)	9200(7252.035)
Disability benefit	7000 (1072.385)	6900 (1214.800)	7000 (1496.435)
Transfer income	4700 (5964.266)	3900 (5740.618)	2900 (4099.265)

Notes: Notes: Author's calculations from the Longitudinal Administrative Databank. Cell present means and standard deviations are in parentheses. Due to confidentiality requirements, income values greater than $1,000 around rounded to base 100 and values less than $1,000 are rounded to base 10. The total count reflects counts of cross-sectional units (i.e., individuals). Employment earnings= income from T4-slips and from self-employment income (negative and positive). Averages are based on the sub-sample of those with non-zero income by source, deductions, and taxes paid.

Table 4: Proportion with income and contributions by source, filing income tax, and in province of residence at age 65

	Non-immigrant	Landed at or before age 50	Landed after age 50	Total
	47705 (77.70%)	10585 (17.24%)	3110 (5.06%)	61395
Employment earnings	0.554 (0.497)	0.568 (0.495)	0.421 (0.494)	0.549 (0.498)
Old Age Security	0.957 (0.203)	0.919 (0.273)	0.525 (0.499)	0.929 (0.257)
Registered Pension Plan	0.654 (0.476)	0.559 (0.497)	0.201 (0.401)	0.614 (0.487)
C/QPP	0.953 (0.211)	0.902 (0.297)	0.330 (0.470)	0.913 (0.282)
C/QPP disability	0.076 (0.265)	0.078 (0.269)	0.011 (0.106)	0.073 (0.260)
GIS or Allowance	0.349 (0.477)	0.428 (0.495)	0.440 (0.497)	0.367 (0.482)
Social Assistance	0.084 (0.277)	0.125 (0.331)	0.342 (0.475)	0.104 (0.306)
RRSP withdrawal	0.287 (0.452)	0.296 (0.456)	0.058 (0.234)	0.277 (0.447)
Atlantic	0.104 (0.305)	0.015 (0.121)	0.011 (0.106)	0.084 (0.277)
Quebec	0.297 (0.457)	0.135 (0.342)	0.091 (0.287)	0.259 (0.438)
Ontario	0.323 (0.468)	0.540 (0.498)	0.547 (0.498)	0.372 (0.483)
Prairies	0.072 (0.258)	0.031 (0.174)	0.026 (0.160)	0.063 (0.242)
Alberta	0.087 (0.282)	0.084 (0.277)	0.110 (0.313)	0.088 (0.283)
BC	0.125 (0.331)	0.193 (0.395)	0.225 (0.417)	0.142 (0.349)

Notes: Author's calculations from the Longitudinal Administrative Databank. Cell present proportions and standard deviations are in parentheses. The total count reflects counts of cross-sectional units (i.e., individuals) who survived and are filing income tax beyond age 65. Employment earnings= income from T4-slips and from self-employment income (negative and positive).

Table 5: Average income, deductions, and taxes paid in 2022 dollars by source for tax filers at age 65

	Non-immigrant	Landed at or before age 50	Landed after age 50	Total
Net income	38400 (58816.762)	36900 (42103.026)	14900 (29036.740)	37000 (55365.700)
Total deductions	9100 (23219.901)	8300 (20377.518)	2800 (8753.330)	8800 (22538.414)
Net federal tax	6000 (28665.481)	6300 (15879.433)	5700 (43267.992)	6100 (27251.402)
Net provincial tax	3700 (16457.012)	3800 (20204.268)	3300 (29660.341)	3700 (17343.271)
Employment income	24200 (68097.700)	30600 (56833.316)	16800 (45890.851)	25100 (65550.291)
Old Age Security	6200 (1161.476)	5500 (1735.881)	2400 (1554.862)	6000 (1456.932)
RPP	21100 (21869.223)	17400 (20951.447)	13200 (62599.954)	20400 (23058.664)
C/QPP	7400 (3206.693)	6500 (3707.001)	1400 (1773.147)	7100 (3387.030)
C/QPP disability	6300 (3879.138)	5800 (3601.910)	4200 (2279.016)	6200 (3828.739)
GIS and Allowances	3800 (2763.109)	5300 (3965.138)	10800 (4282.818)	4500 (3585.583)
Social assistance	3200 (3132.694)	2200 (2962.508)	3200 (4651.368)	3000 (3424.171)
RRSP withdrawal	13700 (40613.998)	12900 (37423.482)	4800 (6129.632)	13500 (39840.078)

Notes: Author's calculations from the Longitudinal Administrative Databank. Cell present means and standard deviations are in parentheses. Due to confidentiality requirements, income values greater than $1,000 around rounded to base 100 and values less than $1,000 are rounded to base 10. The total count reflects counts of cross-sectional units (i.e., individuals) who survived and are filing income tax beyond age 65. Employment earnings= income from T4-slips and from self-employment income (negative and positive). Averages are based on the sub-sample of those with non-zero income by source, claimed deductions, and taxes paid.

Table 6: Regression Discontinuity Design Estimates of the Effect of the Ten-Rule on Employment

RDD Specification:	Local Linear	Squared	Cubic	Quartic
$\hat{\beta}_2$	-0.095***	-0.082***	-0.11***	-0.086***
	(0.001)	(0.002)	(0.001)	(0.002)
Constant	0.157***	0.192***	0.152***	0.184***
N	814	814	814	814
F	31.2	31.0	31.4	3.4
R2	0.48	0.46	0.49	0.46

Notes: Author's calculations based on the Longitudinal Administrative Databank. A bandwidth of 5.2 was selected. Standard errors are in parentheses. An estimate with *** is significant at the 1% level, with ** is significant at the 5% level, and with * is significant at the 10% level.

Appendix

- Additional details on Canada's income support system for seniors

Canada's retirement income system consists of three main pillars: 1) a two-part non-contributory, tax-financed Old Age Security (OAS) program for those over age 65 and the low-income support Guaranteed Income Supplement (GIS), plus allowances for widows/widowers and spouses too young to be eligible but with an eligible partner; 2) a contributory, earnings related public pension system, the Canada and Quebec Pension Plans (CPP and QPP); and 3) the tax treatment of employer-sponsored registered pension plans and personal retirement savings vehicles. In addition, there are age-based tax credits and several provincial low-income supplement programs for those over age 65.

Age 65 is Canada's NRA, which corresponds to the earliest eligibility-age for OAS and the GIS, but also the receipt of full C/QPP retirement benefits – C/QPP retirement benefits can commence as early as age 60, but with a downward actuarial adjustment applied; if commenced after age 65, an upward actuarial adjustment is applied, with no actuarial advantage to C/QPP commencement after age 70. Unlike most high-income countries, Canada is not increasing its NRA beyond age 65.

In this paper, I focus on the main components of the OAS and GIS programs. OAS is a residency-based social pension for those aged 65. Benefits are taxable, inflation-adjusted (quarterly, since 1973), and financed through general tax revenues. The 2022 maximum monthly benefit, $642,25, is paid to those whose previous year's personal net income (total taxable income less non-contributory public pension benefits, claimed income tax and credits and deductions, and social security contributions and repayments) is at most $79,845. OAS benefits are considered taxable income. For net income exceeding that threshold, OAS recipients face a federal withholding tax on benefits of 15%. OAS benefits are zero for net income beyond $133,141. Since 2013, OAS benefits can be deferred until age 70 with an actuarial adjusted increase of 0.6% per month (7.2% per year). In addition, since 2013, OAS automatic enrollment is available for eligible seniors.

Within the OAS program is the couple-income tested (based on, if married, own and spouse's combined net income) GIS benefit for low-income couples (including single individuals). Eligibility for GIS requires receipt of OAS benefits and, for single individuals in 2022, a net income of $19,464 or less and, for couples, a net income of $25,728 or less if each spouse receives OAS and $46,656 if only one receives OAS. GIS benefits are subject to a 50% tax-back on net income, excluding OAS, in excess of an earnings exemption. Maximum monthly GIS benefits in 2022 are $1,219.68, and this amount is adjusted quarterly for inflation. Unlike with OAS benefits, the GIS benefit is considered non-taxable. In 2008, the GIS earnings exemption was increased from $500 to fully exempting the first $3,500 of (non-self-employment) employment income for the tax-back. This increase also applied to the allowances program, which are subject to a 75% tax-back rate. Although not within the timeframe of this paper, beginning in 2020, the earnings exemption was raised to $5,000 from employment and self-employment income. In addition, 50 percent of the next $10,000 of employment or self-employment income is also exempt. There is no actuarial advantage to deferring GIS benefits.

Since 2011, GIS eligible seniors with next to no non-OAS/GIS income (i.e., next to no private income or C/QPP income: $2,000 or less for singles; $4,000 or less combined for couples) receive an annual GIS top-up of $600 for single seniors and $840 for couples. The top-up was increased in 2016 to $947 annually. The tax-back rate on these top-up benefits is 25%, meaning GIS recipients who also receive the top-up are subject to a 50%+25%=75% tax-back rate on private income. These top-up benefits are completely phased when private income exceeds $4,400 for singles and $7,360 combined for couples.

- Immigration Category

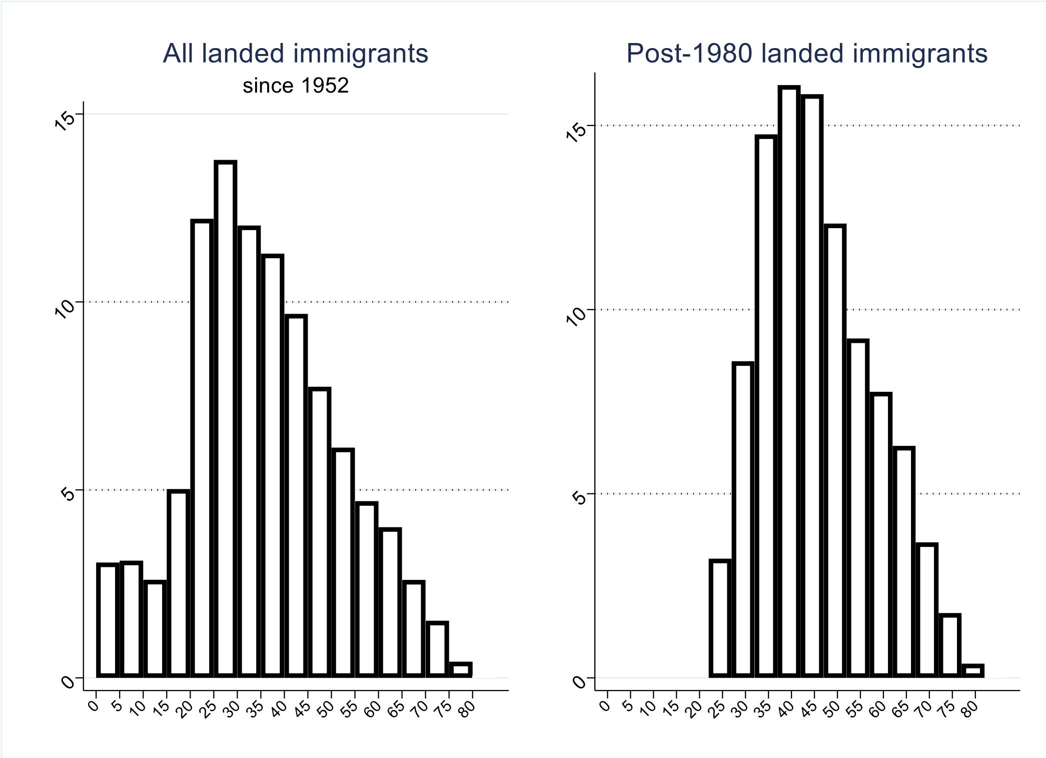
Among the set of post-1980 immigrant arrivals, I also observe variation in post-NRA labour supply and federal income support take-up by immigrant admission category. Of particular note, labour supply appears to be particularly sensitive to the ten-year eligibility rule among those from the Family Class. In addition, those from the Family Class, Live-in Caregiver, and Refugee admission categories have the highest rates of GIS income receipt. These results are unlike Ostrovsky's (2012) analysis of younger, working-age immigrant. He found that their labour supply and probability of making Employment Insurance claims is not sensitive to years of permanent residency following entrance into the Canadian labour market. On the other hand, my results relate to Zhang, Zhong, and de Chardon's (2020) life-cycle analysis, which indicates that Family Class immigrants and Refugees have lower net direct fiscal contributions (income taxes paid net of transfers received) than other immigration categories, especially after the NRA, which is likely due to lower labour supply and higher levels of GIS receipt.

As mentioned in section 5.1., due to data limitations, my empirical analysis up to this point could not account for differences in immigrant seniors' landing characteristics. This sub-section focuses on the population of landed immigrants whose landing characteristics can be observed. That is, those who landed between 1980 and 2015. Figure 19 plots a histogram of landed immigrants' landing age for the whole sample of immigrants and for those who landed between 1980 and 2015. It shows that this latter sample of immigrants are those who obtained Canadian permanent residency relatively later in life, after the age of 30. The purpose of this sub-section is to outline summary statistics on the late age-at-arrival immigrant population and to tie this descriptive analysis into the empirical analysis in the preceding sub-sections.

Table 13 shows that among this sub-population, men are much more likely to be married at landing and women more likely to be single at landing. Late age-at-arrival men are also more likely to report their highest level of education received, which is, on average, about 12 years compared to about 10 years for women. The men are also more likely to report being able to speak English, while over half of the late age-at-arrival women report being not able to speak English or French. Most of the late age-at-arrival population immigrated to Canada from a country of last permanent residency that is ranked by the World Bank's Economy Income Ranking to be high-mid income to high income. The Family Class represents most of the late age-at-arrival immigrants in Canada.

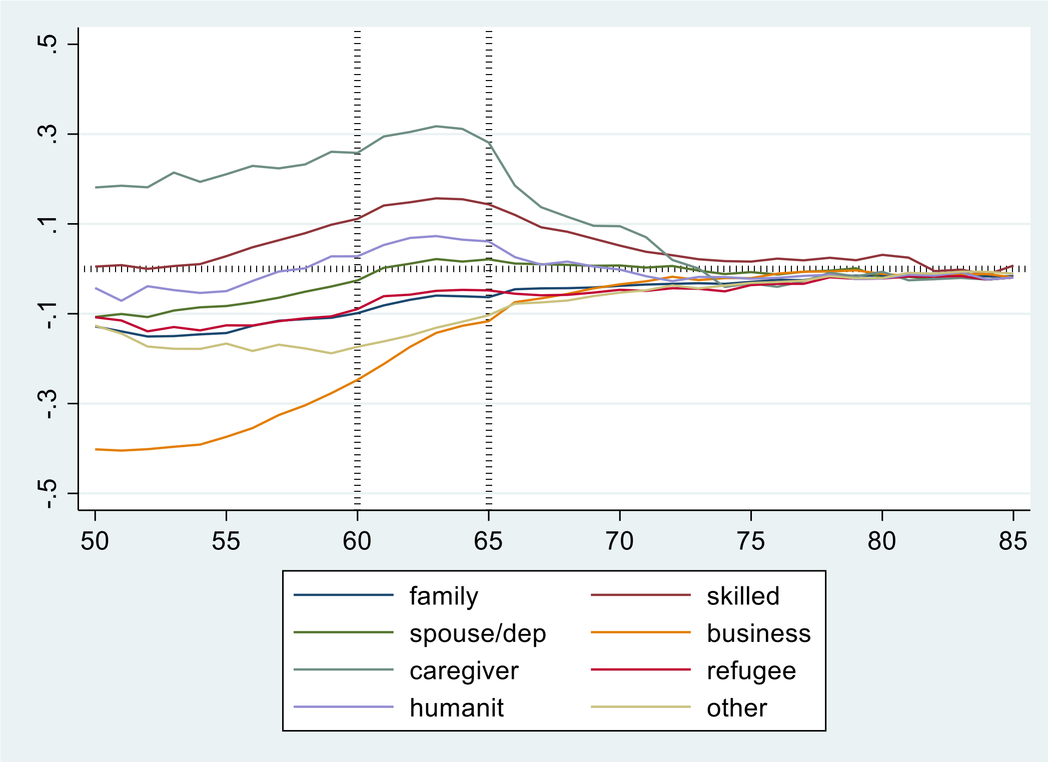
I present in Table 14 proportion by income source, separately for each immigrant admission category. The table also present a column for the non-immigrant group plus the pre-1980 arrivals for reference. I observe that, for each admission category, the rate of eventually receiving the GIS benefit is above 50%. But that rate is particularly high for those from the Family Class, Live-in Caregiver group, Refugees, and those admitted through Humanitarian and Compassionate programs. These groups also present a much higher rate, compared to non-immigrants, of claiming Social Assistance income. Unsurprisingly, they are much less likely to have receipt of any private pension income. In Figure 20, I plot mean differences in the age-profile of post-1980 landed immigrants', by category, employment participation compared to the non-immigrant and pre-1980 landed immigrant groups. Of particular note, before the NRA, age 65, both those from the Family Class and Skilled principal applicants have a relatively high incidence of positive employment income. That difference dissipates sharply after the NRA, particularly for those in the Family Class.

Figure 19: Age-at-Arrival Distribution of Landed Immigrants in my Sample



Notes: Author's calculations using the Longitudinal Administrative Databank.

Figure 20: Mean difference in employment earnings probability by admission category



Notes: Author's calculations based on the Longitudinal Administrative Databank. Employment earnings reflects income from T4-earnings (salary income) and positive self-employment income. Mean differences were calculated using a regression of an indicator for having positive employment earnings on and indicator for immigrant status, for each admission category group, interacted with a set of age dummies. The reference group in this regression is the non-immigrant plus pre-1980 arrival immigrant group.

Table 12: Landing Characteristics of the post-1980 to 2015 Cohort of Landed Immigrants

Sex	Men, 53%	Women, 47%
Marital Status at Landing		
None	4%	7%
Married	88%	58%
Single	8%	35%
sum	100%	100%
Education		
Unreported	9%	23%
Reported	91%	77%
Mean years	11.88	9.76
Language		
Neither	44%	57%
English	52%	39%
French	3%	3%
Source country (World Bank economy income ranking)		
None	8%	9%
Low	7%	6%
Low-Mid	34%	33%
High-Mid	24%	26%
High	32%	29%
Admissions class		
Other	16%	19%
Skilled	20%	7%
Family	43%	61%
Refugee	7%	5%
Economic, PA	11%	5%
Economic, SD	2%	4%

Notes: Author’s calculations using the Longitudinal Administrative Databank.

Table 13: Proportions with income by source for the post-1980 immigrant arrival population

	Family class	Skilled	Spouse & Dependent	Business	Caregiver	Refugee	Humanitarian	Other
	22.10%	22.35%	11.62%	15.23%	2.31%	14.73%	4.80%	6.85%
Employment insurance	0.520 (0.500)	0.460 (0.499)	0.444 (0.497)	0.177 (0.382)	0.646 (0.479)	0.540 (0.498)	0.609 (0.488)	0.388 (0.487)
Investment income	0.639 (0.480)	0.776 (0.417)	0.787 (0.409)	0.889 (0.314)	0.655 (0.476)	0.593 (0.491)	0.519 (0.500)	0.752 (0.432)
GIS	0.709 (0.454)	0.518 (0.500)	0.555 (0.497)	0.511 (0.500)	0.762 (0.426)	0.743 (0.437)	0.770 (0.421)	0.486 (0.500)
Social Assistance	0.402 (0.490)	0.239 (0.426)	0.196 (0.397)	0.219 (0.414)	0.345 (0.476)	0.517 (0.500)	0.548 (0.498)	0.225 (0.418)
Self-employed	0.251 (0.434)	0.383 (0.486)	0.307 (0.461)	0.405 (0.491)	0.265 (0.442)	0.312 (0.463)	0.286 (0.452)	0.291 (0.454)
T4-earnings	0.774 (0.418)	0.857 (0.350)	0.775 (0.418)	0.553 (0.497)	0.961 (0.193)	0.786 (0.410)	0.831 (0.375)	0.744 (0.437)
Private Pension	0.334 (0.472)	0.496 (0.500)	0.506 (0.500)	0.258 (0.438)	0.448 (0.498)	0.353 (0.478)	0.258 (0.438)	0.491 (0.500)
RRSP withdrawal	0.359 (0.480)	0.470 (0.499)	0.451 (0.498)	0.247 (0.431)	0.718 (0.450)	0.423 (0.494)	0.396 (0.489)	0.428 (0.495)
OAS	0.850 (0.357)	0.787 (0.410)	0.846 (0.361)	0.649 (0.477)	0.931 (0.254)	0.891 (0.311)	0.878 (0.328)	0.803 (0.398)

Notes: Author's calculations based on the Longitudinal Administrative Databank. Cells present proportions and standard deviations are in parentheses. This table reflects the post-1980 immigrant arrival population only. Proportions reflect ever having been observed, at least once, with positive income by source. The youngest age-at-arrival in the post-198

Conclusion

In light of population aging, most high-income countries are raising their normal retirement age (NRA) for public pension benefit eligibility. Unusually, Canada is not raising its NRA, and has instead since 2012 pursued a variety of public pension policy shifts to incentivize postponing retirement. Most importantly among them, these include relaxing employment conditions on benefit eligibility and enhancing the incentives for extended working lives by augmenting benefit entitlements for each additional year of work. However, an empirical regularity is retirement-age bunching at the NRA, including for Canada the early retirement age (ERA), age 60, which may be attributable to societal norms or heuristics. This raises policy concerns about the effectiveness of Canada's recent financial reforms to stimulate delayed retirements. For this thesis, I set out to understand how the public pension system's key policy parameters affect retirement decisions, whether changes to them break the link between retirement and benefit claiming, and to what extent these changes affect retirement decisions given retirement-age bunching. Throughout this thesis, I made use of high-quality, administrative income-tax data and conducted cutting-edge design-based empirical research strategies.

In Chapter 1, I asked, "Does eliminating employment conditions for retirement benefit eligibility affect seniors' employment decisions?" Answering this is crucial to address efficiency and cost concerns regarding reforms that remove earnings tests on pension income to encourage extended working lives. If doing so elicits a sufficient increase in employment, then it increases efficiency and lowers program costs by increasing the number of contributors; if not, it results only in a mechanical increase in the level and number of benefit payouts. However, a number of papers uncover retirement-age bunching at statutory benefit-eligibility ages and advise that such changes in financial incentives too little to delay retirement. (e.g., Behaghel and Blau, 2012;

Seibold, 2021; Gruber, Kanninen, and Ravaska, 2022; Lalive, Magesan, and Staubli, forthcoming). I also found marked retirement-age bunching at the NRA as well as the Early Retirement Age (ERA) of age 60 where in Canada individuals can first become eligible for positive if reduced public pensions. I sought to measure the extent to which eliminating employment conditions on benefit eligibility affected these empirical moments. I examined the employment effects of two separate earnings tests on public pension income applied to two different statutory benefit-eligibility ages: one at ages above Canada's NRA, age 65; the other at ages above the ERA, age 60, but below the NRA. Using income-tax and related data, I evaluated their impacts using two empirical designs: 1) a staggered difference-in-differences design that exploits a natural experiment in 2012 that eliminated an earnings test on retirement benefit receipt for workers aged 60-64 in Canada, excluding those from the province of Quebec who did not face this policy change until two years later; and, 2) a regression-kink design to measure changes in the employment rate for those aged 65-70 with incomes in the neighborhood of an earnings test cut-off, both before and after a reform that effectively eliminated that cut-off. At the ERA, I detected both a decrease in retirement-age bunching and an increase in the rate of early claiming. However, at the NRA, I found next to no change in retirement behaviour, suggesting the continued importance of the NRA retirement norm.

While completing Chapter 1, I realized that the public pension reforms of 2012 asymmetrically incentivized older workers to postpone their retirement across the earnings distribution, favouring those on the higher end who tend to have greater expected longevity. Accordingly, in Chapter 2, I asked, "How Do Public Pension Programs Differentially Affect Seniors' Labour Supply Across the Career Earnings Distribution?" Answering this is crucial for addressing equity issues in public pension reforms that aim to encourage postponed retirement:

not all older workers have equal opportunities and incentives to extend their working lives, and these are highly correlated with one's position on the career earnings distribution. Standard lifecycle models predict that public pension programs may reduce seniors' labour supply, either through substitution effects that arise from implicit taxes on pension income, or because the generosity of transfers induce large income effects. However, the relative importance of these two effects is nuanced since it may vary substantially across the earnings distribution. Using Canadian income-tax and related data, I conducted three empirical designs: 1) I estimated how an increase in income support payments differentially affects employment age-profiles across the career earnings distribution, measured as the earnings distribution at the common peak-earning ages of 50 to 53; 2) using a bunching design, I measured the extent of excess employment exit across the earnings distribution at Canada's NRA for income support eligibility, age 65; and 3) exploiting a policy experiment that topped-up support payments, while also increasing an earnings test on these benefits, for seniors only on the bottom of the earnings distribution, I studied whether low-income seniors' post-reform labour supply changed relative to an unaffected group of higher earners. My results indicated that an increase in the low-income support Guaranteed Income Supplement (GIS) benefit reduces seniors' employment, particularly among those with low career earnings, by more than Old Age Security (OAS) benefits, which appear to have a negligible marginal effect. In addition, I uncovered some evidence that the GIS benefit causes some seniors on the margin of GIS eligibility to reduce their labour supply in order to receive it. Overall, I found that seniors on the low-end of the career earnings distribution have a particularly high rate of excess employment exit at the NRA, which indicates that many of them postpone their retirement until benefit receipt. Hence, they may be particularly vulnerable group in the event that the NRA were to increase.

Finally, in Chapter 3, I asked, “How do senior immigrants’ labour supply decisions differ from Canadians at birth?” In particular, I focused on the role of permanent residency requirements in determining immigrants’ retirement decisions. This is a significant policy question, particularly as it relates to old-age poverty, because the share of older immigrants in Canada’s senior population is growing. For many immigrants, later labour market integration may lead to retirement income shortfalls: among other reasons, this can arise from a lack of contributory, earnings-related public or private pension entitlements or a lack of accumulated private retirement savings. In high-income countries, tax-financed income support systems may cover some of this shortfall, but they often restrict eligibility of benefits to those with a certain number of years of permanent residency or work in the country. For example, in Canada, ten years of permanent residency is required for partial eligibility, and 40 years for full eligibility. While remaining employed may support senior immigrants’ retirement incomes in the meantime, little research has investigated their labour supply decisions and how it relates to such eligibility criteria. Using Canadian income-tax and related data, I examined the impact of residency requirements for income support benefits on senior immigrants’ labour supply decisions in two steps: 1) I estimated how reaching Canada’s normal retirement age (NRA) for income support eligibility, age 65, differentially affects the age-profiles of labour supply of those who do not satisfy residency requirements compared to those who do; and 2) in a difference-in-differences setting, I compared post-age 65 labour supply outcomes of immigrants who are just below to those just above the ten-year permanent residency mark. I found that immigrants who arrive early in life have higher employment rates than non-immigrants, but this difference dissipates, on average, after the NRA is attained. In contrast, I observed that those that arrive later in life, particularly after 40 years of age, work less than the non-immigrant group. They also claim more low-income support GIS benefits after age 65. I estimated that these late age-at-arrival immigrants significantly reduce their labour supply below the non-immigrant groups once they satisfy the ten-year rule for income support eligibility.