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Steeve Marchand

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UNIVERSITÉ LAVAL
Faculté des sciences sociales
HEC MONTRĒAL
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Who Benefits from Tax-Preferred Savings Accounts?

Steeve Marchand*

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Abstract

Many countries use tax-preferred saving accounts to incentivize individuals to save for retirement. The two main forms of tax-preferred saving accounts – TEE and EET – tax savings at the contribution and withdrawal years respectively. Thus the relative returns of the two savings vehicles depend on the effective marginal tax rates in these two years, which in turn depend on earning dynamics. This paper estimates a model of earning dynamics on a Canadian longitudinal administrative database containing millions of individuals, allowing for substantial heterogeneity in the evolution of income across income groups. The model is then used, together with a tax and credit calculator, to predict how the returns of EET and TEE vary across these groups. The results suggest that TEE accounts yield in general higher returns, especially for low-income groups. Comparing optimal saving choices predicted by the model with observed saving choices in the data suggests that EET are over-chosen, especially in the province of Quebec. These results have important implications for "nudging" policies that are currently being implemented in Quebec, forcing employers to automatically enrol their employees in savings accounts similar to EET. These could yield very low returns for low-income individuals, which are known to be the most sensitive to nudging.

JEL Codes: D14, H24, J18, J26

Keywords: Personal savings; Taxation; Public policy

*Postdoctoral researcher, University of California, Berkeley (email: steeve.marchand@berkeley.edu). I thank Charles Bellemare, Vincent Boucher, Bernard Fortin, Guy Lacroix, Thomas Lemieux, Derek Messacar and Pierre-Carl Michaud for useful comments. I am grateful to the Industrial Alliance Research Chair on the Economics of Demographic Change for financial support. Part of the analysis presented in this paper was conducted at the Quebec Interuniversity Centre for Social Statistics which is part of the Canadian Research Data Centre Network (CRDCN). The services and activities provided by the QICSS are made possible by the financial or in-kind support of the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), the Canada Foundation for Innovation (CFI), Statistics Canada, the Fonds de recherche du Québec - Société et culture (FRQSC), the Fonds de recherche du Québec - Santé (FRQS) and the Quebec universities. The views expressed in this paper are those of the author, and not necessarily those of the CRDCN or its partners.

1 Introduction

Many countries use tax-preferred saving accounts to incentivize individuals to save for retirement. These accounts yield returns that depend on effective marginal tax rates (EMTRs) at the contribution and withdrawal years and may therefore benefit disproportionately to individuals with specific career paths. Given the heterogeneity of career paths, combined with the complexity of fiscal systems, it is far from obvious who benefits the most from these plans. The question of whether different types of tax-preferred saving accounts are equally well suited for low-income and high-income individuals, those with children, or those who live alone, has important policy implications for governments that consider using these instruments to promote saving. Another important question is whether individuals are effectively able to choose the best available tax-preferred savings account. Again, the answer may vary substantially across income groups or individual characteristics if financial literacy varies across these, as evidence suggests (Lusardi and Mitchell, 2011; Lusardi and Tufano, 2015). Answering these questions would lead to important policy implications regarding the type of tax-preferred saving account that governments should encourage, for example by "nudging" individuals in saving in a specific type of account. Still, the academic literature currently offers little insights to guide these policies.

This paper aims at filling these gaps. I estimate a model of income dynamics on a rich Canadian longitudinal administrative database that comprises millions of individuals, allowing for substantial heterogeneity in income paths across income groups and other characteristics. I calculate the relative returns of the two main types of tax-preferred savings accounts based on predicted earnings dynamics, retirement incomes and implied EMTRs, shedding light on optimal choices of savings accounts given predicted income paths. I then explore whether individuals effectively tend to choose the "optimal" saving account as predicted by the model.

Importantly, I leave out the question of whether individuals should save less or more and only focus on determining the best savings vehicle given that an individual sacrifices a given amount of after-tax income to save for retirement. Taking stance on a desirable savings rate is a more complex question that requires a judgment on the time preferences individuals should have, as well as assumptions on the form of the utility function. The underlying assumptions needed to answer this paper's questions are considerably weaker. Given a lifetime income path, a known tax-code and any market rate of return, an individual will always prefer to invest a dollar of current-period disposable income in the tax-preferred savings vehicle that will yield the highest tax-relief. Naturally, future income and tax-code are uncertain. I therefore detail the conditions under which the after-tax return of one savings vehicle is a mean-preserving spread of the other, so that it is less desirable for any individual with concave utility (Rothschild and Stiglitz, 1970).

I focus on the two main types of tax-preferred savings accounts, often labelled taxable-exempt-exempt (TEE) and exempt-exempt-taxable (EET), where the three letters of the acronyms, from left to right, represent three chronological periods: (1) the contribution period, when money is invested in a savings account, (2) the accumulation period, when savings accumulate interests and (3) the withdrawal period, when savings are withdrawn from the account. Thus, with TEE accounts, savings are taxed the year the money is invested, whereas with EET accounts it is taxed the year it is withdrawn. Therefore comparing the returns from the two mainly involves comparing EMTRs in these two periods (this is explained in more details in the next section). EET is the most widely used plan in most OECD countries (OECD, 2015). In Canada, as in most OECD countries, employers' private pension plans are treated as EET. For individuals wishing to save by themselves, both savings vehicles are available through tax-preferred savings accounts: EET is available through the Registered Retirement Savings Plan (RRSP) and TEE through Tax-free Savings Accounts (TFSA). The possibility of choosing between RRSP and TFSA makes Canada a natural choice to study choices between the two. Furthermore, the richness of the Longitudinal Administrative Database (LAD), discussed in Section 3, allows to study how predicted returns and observed choices differ across a large number of groups specific to income levels, province, gender or family status. Despite this, Canada has been the subject of very few studies on tax-preferred savings accounts.[1]

The predictions of the model of income dynamics, combined with a calculator of income taxes and credits that allows to calculate EMTRs, suggests that TEE types of savings vehicles tend in general to yield higher returns in the Canadian population. This finding applies to almost every subpopulation considered, but the predicted benefit of choosing a TEE over an EET is even stronger for low-income groups. The finding that EET policies seem particularly ill-suited for lower income groups is of particular importance for governments developing

[1]There are nevertheless some notable studies on Canadian tax-preferred savings accounts. Milligan (2002)'s findings suggest that EET contributions in Canada are sensitive to EMTRs, and that individuals' contributions are in part motivated by tax smoothing considerations. Milligan (2003) studies how contribution limits to tax-preferred accounts affect contribution levels and provides evidence that they affect even individuals no reaching the limit.

policies aiming at increasing savings through these incentives. For example, the government of the province of Quebec has recently implemented a policy aimed at increasing individuals' savings through these vehicles. Between 2016 and 2017, employers in Quebec with a least ten employees were progressively required to automatically enrol all employees to contribute a fraction of their wage in a Voluntary Retirement Savings Plan (VRSP), if they were not already using a comparable employer pension plan. This policy could in theory not affect savings choices if individuals ignored choices made for them by their employer and reallocate their savings themselves. There is however substantial evidence that a large proportion of individuals is sensitive to nudging in their savings decisions (see Beshears et al., 2009). Chetty and Friedman (2014) show that automatic enrolment in employers pension plans affects savings rates for most individuals in Denmark, especially among those who are the least financially sophisticated and the least prepared for retirement. Messacar (2017) arrives at similar findings in Canada, noting that the propensity of one's savings rate to be affected by nudging is inversely related to her education level. This paper's findings on the non-suitability of EET accounts for low income individuals complement these findings. If nudging policies are aimed at improving retirement prospects for individuals who are the least prepared or able to make sound decisions, these policies should not only aim at influencing these individuals' savings rate, but also at favouring good savings choices given these individuals' situation. The results suggest that making VRSP accounts of the TEE type instead of EET would favour to a greater extent individuals targeted by these policies. While the literature provides little evidence that changing the type of account in which individuals save would change individuals' savings rates (e.g. see Beshears et al., 2017, who use administrative data from employers introducing TEE on top of EET and find no effect on savings rate), low-income individuals' preparation for retirement could still be improved by better returns from contributing to savings account more suited to their situation.

Comparing the optimal choices predicted by the model to choices observed in the LAD reveals several interesting findings. Even though differences in income dynamics and tax codes across provinces do not result in significant differences in predicted optimal choices, there is a large difference in choices between Quebec and the other provinces considered. TEE in Quebec are chosen only around 30% of the time, but are predicted to be the best choice 70% of the times. In Ontario and British Columbia, TEE are also predicted to be the best choice around 70% of the time and are favoured over EET in more than 50% of the cases. Also, low-income individuals do seem to take their situation into account and favour TEE more often than higher-income individuals.

The next section discusses the link between EMTRs and optimal savings choices. Section 3 discusses the data and Section 4 presents the income dynamics model. Section 5 then uses this model to simulate income paths and calculate the implied EMTRs. Section 6 compares optimal contribution choices, as predicted by the model, with observed choices in the data, Section 7 discusses how uncertainty may affect the results, and Section 8 concludes.

2 Effective marginal tax rates and returns from tax-preferred savings accounts

With TEE accounts, savings is taxed the year the money is invested, whereas it is taxed the year it is withdrawn with EET accounts. It is well known that the relative returns between the two depend on how the EMTRs differ in the contributory year and in the withdrawal year. Assume a two-period model where τ_0 and τ_1 are the EMTRs at the contribution and withdrawal year respectively. Under a TEE regime, the amount withdrawn in period 1 when giving up one dollar of after-tax income in period 0 is simply $R^{TEE} = (1 + r)$, where r is the interest rate. Under an EET regime, one must invest $1/(1 - \tau_0)$ to give up one dollar of after-tax income in period 0, so the after-tax amount withdrawn in period 1 is $R^{ETT} = \frac{(1-\tau_1)}{(1-\tau_0)}(1+r)$. Thus, to compare the return of EET relative to TEE, one must simply compare the EMTR that is avoided by contributing to a EET in period 0 with the EMTR that must be paid in period 1 on the withdrawal: R^{TEE} is smaller, equal or larger than R^{EET} if τ_1 is respectively smaller, equal or larger than τ_0.

In practice, the relevant EMTRs must be calculated using the complex fiscal rules that apply to EET contributions and withdrawals. I define the EMTR of the contribution period as follows:

$$EMTR_{contrib}(earn, \mathbf{x}) = 1 + \frac{\Delta dispinc}{\Delta contrib} \mid earn, \mathbf{x}, \tag{1}$$

where $earn$ is earnings, $\Delta contrib$ is an increase in EET contributions (I use 100$ in the graphs below), $\Delta dispinc$ is the variation in disposable income (i.e. income after taxes, credits, transfers and contributions) that results from the increase in contribution, and $\mathbf{x}$ is the vector of all characteristics that are taken into account in the calculation of taxes and transfers. Note that $\Delta dispinc$ can potentially vary between $-\Delta contrib$ and zero. An EMTR of zero would mean that investing 100$ in an EET reduces disposable income by 100$, so the individual does not avoid any tax or transfer clawback by contributing. An EMTR of one would mean that disposable income is not reduced by the contribution, implying that the individual avoids a 100% tax or clawback rate on the amount she invests.

I define the EMTR affecting withdrawals as follows:

$$EMTR_{withdraw}(retinc, \mathbf{x}) = 1 - \frac{\Delta dispinc}{\Delta retinc} \mid retinc, \mathbf{x}, \tag{2}$$

where *retinc* is private pension incomes (EET withdrawals in Canada are treated as pension income in tax returns), $\Delta retinc$ is an increase in *retinc* (I use 100$ in the graphs below), and $\Delta dispinc$ is the resulting increase in disposable income.

Figure 1 presents the EMTRs for single individuals and couples without children, in the fiscal year 2015, for Canada's three most populous provinces (Ontario, Quebec and British Columbia).[2] The solid lines depict EMTRs on contributions to EET before age 65. For both single individuals and couples, and for all provinces, these EMTRs are very low for low-income individuals and tend to increase with income.[3] The dashed lines show the EMTRs on pension withdrawal incomes for individuals over 65 years old. These EMTRs are the highest for low-income individuals – generally higher than EMTRs for contributions. This is due to high clawback rates of public pension schemes targeted at low-income seniors.[4] These high EMTRs on withdrawals can tend to make TEE savings vehicles more interesting for individuals expecting low incomes when withdrawing after age 65.

3 Data

I use data from the Longitudinal Administrative Database (LAD), a Canadian administrative longitudinal database developed by Statistics Canada using T1 family files. The first

[2] I calculate the EMTRs using *SimTax*, a Canadian calculator of taxes and transfers developed by myself and other members of the *Industrial Alliance Research Chair on the Economics of Demographic Change*.

[3] The low EMTRs on contributions for low-incomes contrast with usual high EMTRs on earnings for low incomes. This difference is mainly explained by social assistance: since one cannot claim additional social assistance by contributing to a EET (social assistance calculations ignore contributions to tax-preferred saving accounts), the high EMTRs on earnings caused by social assistance does not affect EMTRs on contributions.

[4] Canadians of at least 65 years old are eligible to the Guaranteed Income Supplement (GIS), which is clawed back with income at a rate of 50%, or even 75% in some income ranges.

available year is 1982. A random sample of 20% of Canadian tax filers was selected in 1982. Selected households are followed each year until individuals die or emigrate from Canada, and additional households are added each year to reach 20% of tax filers for each years. The last available year is the 2013 data, so I observe individuals for at most 31 years. Variables include most lines appearing in the Canadian income tax return, so the LAD is very rich in terms of income sources. It is however less rich in terms of other socio-demographic variables. It includes gender, age, province of residence, marital status and the age of all children. The large number of observations (20% of Canadian tax filers represents more than five millions of observations per year) makes the LAD a natural choice to study income dynamics while allowing for substantial heterogeneity in income processes. This heterogeneity allows to investigate whether EET and TEE are more or less suited to low-income or high-income individuals, men or women, or whether their returns vary by family status.

Importantly, the LAD also contains information on contributions to RRSP (EET tax-preferred savings account) and TFSA (TEE type).[5] Figure 2 presents the proportion of individuals contributing to RRSP and TFSA savings accounts at 30 y/o by year and earnings quintile. The propensity to contribute to both RRSP and TFSA increase with earnings quintile. For the lowest quintile, the proportion of individuals contributing to a TFSA account is higher than it is for a RRSP account, while the opposite is true for the highest quintiles. Also, since TFSAs are only available since 2009, the sharp increase in the proportion of individuals contributing to it probably results in part from a period of transition for which this saving vehicle is less known.

I use the LAD to estimate (1) a model of earnings dynamics, (2) a model of private retirement income and (3) to analyze choices between TEE and EET. The data treatment used for each of these analyses is discussed separately in the subsequent sections.

4 Modelling income dynamics

This section presents the models used to estimate parameters that will allow to simulate income path in the next section. I estimate a model of earnings dynamics, as well as a model of retirement incomes.

[5]Statistics Canada matched the information from TFSA contribution to the LAD even though TSFA are not recorded in the Canadian tax returns.

4.1 The earnings dynamics model

I estimate a model largely inspired from the earnings dynamics structure used in Gourinchas and Parker (2002). Let $y_{i,t}$ be real earnings of individual i at year t. I assume the following:

$$log(y_{i,t}) = f(age_{i,t}) + \alpha_t + p_{i,t} + \mu_{i,t}, \tag{3}$$

$$p_{i,t} = \rho p_{i,t-1} + \epsilon_{i,t}, \tag{4}$$

where $\mu_{i,t}$ is i's transitory shock at year t, $\epsilon_{i,t}$ is his permanent shock and ρ is the persistence of the permanent shocks. The model includes year-specific fixed effects α_t, and a parametric function of age $f(age_{i,t})$. I let $f(age_{i,t})$ be the third degree polynomial function $f(age_{i,t}) = \beta_1 age_{i,t} + \beta_2 age_{i,t}^2 + \beta_3 age_{i,t}^3$, where $age_{i,t}$ is i's age minus 30.

With panel data, this model can be estimated in two parts. First, assuming $E\left[\eta_{i,t}|age_{i,t}\right] = 0$, where $\eta_{i,t} \equiv p_{i,t} + \mu_{i,t}$, I estimate the age trends parameters β_1, β_2 and β_3 using a within individual regression with years fixed effects. Second, I estimate the variance of the permanent income shocks (σ_ϵ^2) and of transitory income shocks (σ_μ^2) by a minimum distance estimation, which compares the covariance matrix of the residual earnings with the theoretical covariance matrix. Let $\boldsymbol{\theta}$ be the vector of parameters to be estimated $[\rho, \sigma_\epsilon, \sigma_\mu]'$ and $\boldsymbol{\theta}_0$ be the vector of these parameters' real values. Let also $\hat{\boldsymbol{\Omega}}(\boldsymbol{\theta}_0)$ be the observed covariance matrix, and $\Sigma(\boldsymbol{\theta})$ the theoretical covariance matrix implied by the above structure, with the off-diagonal and on diagonal elements respectively given by :

$$E\left[\eta_{i,t}\eta_{i,s}\right] = \rho^{|t-s|}\frac{\sigma_\epsilon^2}{1-\rho^2}, \tag{5}$$

$$V\left[\eta_{i,t}\right] = \frac{\sigma_\epsilon^2}{1-\rho^2} + \sigma_\mu^2. \tag{6}$$

The (equally weighted) minimum distance estimator is then given by:

$$\hat{\boldsymbol{\theta}} = \arg\min_{\boldsymbol{\theta}} vech\left(\Sigma(\boldsymbol{\theta}) - \hat{\boldsymbol{\Omega}}(\boldsymbol{\theta}_0)\right)' vech\left(\Sigma(\boldsymbol{\theta}) - \hat{\boldsymbol{\Omega}}(\boldsymbol{\theta}_0)\right). \tag{7}$$

and the standard errors of the estimates are estimated using:[6]

$$V[\hat{\boldsymbol{\theta}}] = \left(\mathbf{G}'\mathbf{G}\right)^{-1}\left(\mathbf{G}'V[vech(\hat{\boldsymbol{\Omega}}(\boldsymbol{\theta}_0))]\mathbf{G}\right)\left(\mathbf{G}'\mathbf{G}\right)^{-1} \tag{8}$$

[6]See Section 6.7 of Cameron and Trivedi (2005) for the proof.

where $G \equiv \partial \left(vech\left[\Sigma(\boldsymbol{\theta})\right]\right)/\partial\boldsymbol{\theta}'\right)|_{\boldsymbol{\theta}_0}$ and $V[vech(\hat{\boldsymbol{\Omega}}(\boldsymbol{\theta}_0))]$ is estimated by bootstraps.

I estimate the above two-part model using the LAD on earnings, converted in real 2010 dollars using Statistics Canada's Consumer Price Index, of individuals born between 1953 and 1958, since these individuals are observed at least from age 30 to age 55. I only use observation from ages 30 to 55 so that the age range is identical across birth cohorts. Importantly, I allow for substantial heterogeneity in earnings dynamics by estimating the model separately for each combination of gender, province, marital status at age 30 and earnings quintile at age 30. Since I use the log of earnings as the dependent variable, only observations with strictly positive earnings are used. Therefore, it is worth keeping in mind that the results presented latter in the paper apply to individuals with uninterrupted careers. I consider the three most populous Canadian provinces (Quebec, Ontario and British Columbia), and the four following marital status:

1. Single individual without children,
2. Couple without children,
3. Single individual with one or more children,
4. Couple with one or more children.

The "single individual with one or more children" category is only considered for women, because of the lower number of observations for men in this category.

The estimates of the age trend parameters of the first part of the model are presented in Table 1. Because of the large number of parameters, this section's discussion rather summarizes the predicted age trends resulting from these estimates. Note from the table that most of the estimates underlying the predicted trends are estimated very precisely because of the large number of observations, with the majority of the estimates having a *p-value* of less than 0.001.

Figure 3 shows the predicted earnings for each combination of gender, group of provinces at age 30, marital status at age 30 and earnings quintile at age 30. Note that the slopes of the predicted trends correspond increases of earnings in percentages, since the dependent variable is the log of earnings. Predicted log earnings tend to increase with age, but tends to increase at a slower rate as age increases. Furthermore, the increase tends to be more important for the lowest quintile, so a 30-years-old low-income individual should in general expect his earnings to increase significantly throughout his career.

The estimates of the parameters of the error component model are presented in Table 2. The most noticeable tendency is that the persistence of persistence shocks tends to decrease with income quintile at 30 y/o. The two other parameters – the variance of persistent and transitory shock – do not display any obvious trend, but differ significantly across groups.

4.2 The retirement income model

This section describes how private retirement incomes are predicted using the LAD database. Using a two-part estimation, I predict private retirement taxable incomes from employers' pension plans and or from other private sources, excluding income from RRSPs (individual EET accounts).[7] I use individuals observed at least from ages 45 to 70. This allows to observe both earnings in the end of career and retirement incomes, and thus to predict the latter as a function of the former. Although the analysis models retirement incomes at 70 years old only, all results are robust to using 75 years old instead; these results are available upon request. The first part of the model estimates the probability that a 70-years-old individual receives any private retirement income using the following model:

$$b_{1i}^{*} = \gamma_0 + \gamma_1 log(\bar{y}_i) + \gamma_2 log(cqpp_i) + \gamma_3 couple_i + \upsilon_i \tag{9}$$

where b_{1i}^{*} is a latent variable, $\bar{y}_i$ is the average annual earnings the individual received from 45 to 55 years old, $cqpp_i$ is her Canadian or Quebec Pension Plan income and $couple_i$ is a dummy that equals one if the individual is in a couple and zero otherwise. The observable outcome is b_{1i}, which equals one if $b_{1i}^{*} \geq 0$ and zero otherwise. This model is estimated separately for each combination of provinces and gender. I assume the error term υ_i follows a logistic distribution and use a logit estimation to estimate the model.

In the second step, I estimate the amount of private retirement income – conditioning on receiving an amount strictly greater than zero – using a OLS estimation of the following model:

$$b_{2i} = \delta_0 + \delta_1 log(\bar{y}_i) + \delta_2 log(cqpp_i) + \delta_3 couple_i + \psi_i \tag{10}$$

[7] More precisely, the variable I define as private retirement income corresponds to the line 115 of the Canadian federal tax return.

where b_{2i} is the log of private retirement pension income. The model is again estimated separately for each combination of provinces and gender.

Table 3 presents the estimates of the models. Earnings are positively related to private pension incomes in both the first and the second step and is the most important predictor for men. For men, a one percent increase in average earnings from 45 to 55 years old is associated with a little more (for Quebec) or a little less (for Ontario and British Columbia) than a one percent increase in private retirement income. For women, income from Canadian or Quebec Pension Plan (CPP or QPP) is a stronger predictor of private retirement income than earnings history.

5 Who can potentially benefit from EET and TEE?

In this Section, I first use the income models from the previous section to simulate heterogeneous private income paths. I then use a calculator of taxes and other government transfers to calculate incomes from public sources and EMTRs on EET contributions and withdrawals. I finally use these EMTRs to investigate whether EET or TEE is the optimal choice given the simulated income path.

I run 10000 simulations. Each one goes as follows:

1. I assume that persistent shocks at age 29 are zero.

2. I generate log earnings from 30 to 55 years old using the coefficients and variances estimated from equations (3) and (4) – for each combination of gender, province, marital status at age 30 and earnings quintile at age 30, and using the year fixed effect from the last available year (2013). I convert these earnings *ex post* in 2015 constant dollars using Statistics Canada CPI.

3. For each simulation and each group, I calculate CPP or QPP benefits according to earnings history as follows:

$$b_{CPP} = \frac{1}{26} \sum_{t=30}^{55} 0.25 \min(MPE, y_{i,t}), \tag{11}$$

where MPE is the *Maximum annual Pensionable Earnings* used in 2015 (53600$). This formula corresponds to simplified rules from 2015 and assumes the parameters from these rules remain fixed in real terms.[8] It also assumes the individual chooses to start receiving CPP/QPP at the normal age (65 years old).

4. For each simulation, I then use the estimated parameters from equations (9) and (10) to predict private pension income at 70 years old as a function of the earnings history and CPP/QPP that are generated in the previous steps.

5. Using SimTax – a Canadian calculator of taxes and transfers (see Marchand et al. (2015)), I compute, for each simulation, the EMTRs on a 1000$ contribution to an EET account at each age between 30 and 55. I also compute the EMTR on a 1000$ EET withdrawals at 70 years old.[9]

Figure 4 shows the average difference in EMTRs on EET withdrawals and on EET contributions across simulations – in percentage points– for each combination of age province, gender, family status at 30 years old and earnings quintile at 30 years old. A positive value means that the EMTR on EET withdrawals at 70 years old tends to be higher than the EMTR on EET contribution at the current age, and thus that TEE should tend to be favoured. For women, EMTRs tend to be most of time higher at 70 years old in all provinces, except for those with children in the highest earnings groups. The picture is slightly more complicated for men. In all provinces, men who are single and without children at 30 years old should most of the time favour TEE. For men in a couple without children, this is only true for the lowest quintile groups. Finally, for men in a couple with children at 30 years old, EET are predicted to be optimal most of the time.

To sum up these findings, Tables 4 and 5 present the proportions of simulations for which TEE should be favoured over EET as predicted by the model. Table 4 shows that the dominance of TEE over EET is varies little across provinces. It does vary, however, across earnings quintiles: TEE is favoured in 73% to 79% of simulations for the lowest quintile, whereas it is only favoured in 55% to 59% of simulations for the highest quintile. Table 5 shows how these proportions vary across family status at 30 years old. The negative relation with earnings quintile still arises conditionally on family status. Also, single individuals,

[8] Using the complete set of rules would not be possible, because they depend on earnings history since 18 years old.

[9] I use 1000$ contributions and withdrawals instead of 1 or 100$ in order to illustrate more realistic contribution and withdrawal behaviours.

with or without children, should tend to favour TEE more often than individuals in couples according to the model. Overall, these results suggest that TEE should in general be favoured, especially for the lowest income groups.

6 Are predicted optimal choices in line with observed choices?

This section compares the predicted optimal choices from last section with observed choices in the LAD. Recall that, in Canada, individuals wishing to invest themselves for retirement in a tax-preferred savings account may contribute to a RRSP (of the EET type) or to a TFSA (of the TEE type), both of which are observable in the LAD. As shown in Figure 2 TFSAs were only introduced in 2009 in Canada, and the proportion of individuals contributing to them has kept increasing since then. I therefore only use data from 2013, the last available year in the LAD, in the analysis. Since the analysis focusses on optimal contribution choice conditional on contributing, I exclude individuals who did not contribute to a TFSA or to a RRSP in the year. Furthermore, for simplicity, I focus on individuals who either invested in a RRSP or in a TFSA – and not in both.

Figure 5 presents the proportion of simulations where TEE is favoured, as well as the proportion of individuals choosing TEE in the LAD. Figure 5a first decomposes these proportions by province. The results are worrying for Quebec: although Quebec's earnings dynamics and tax code creates no obvious disadvantage of choosing a TEE, it is chosen only around 30% of the times in this province, and around 50 and 55% of the times in British Columbia and Ontario. Figure 5b suggests that predicted optimal choices are more in line with observed choices for men than they are for women. It is however important to keep in mind that the income dynamics model might perform worst in predicting income trends that are still relevant in 2013, since the data used to estimate the model go back to 1983, and women's careers have evolved substantially since then. Figure 5c suggests that, while single individuals may benefit more often from TEE, they do not seem to choose this account significantly more often. Finally, Figure 5d suggests a positive finding for low-income individuals: the lowest earnings quintile chooses TEE almost 80% of the times, a proportion very much in line with that predicted by the model.

7 How would risk aversion change the picture?

The predictions of optimal choices in Section 5 implicitly assume risk neutrality. However, at least two sources of uncertainty may affect optimal choices between EET and TEE. First, while the present tax code is known, future tax code may change for policy reasons. That is to say that the tax rate from TEE is given while the one from EET is uncertain. Assume an individual sacrifices one dollar of disposable income in period 0 to save it for period 1. Assume also for now, in order to isolate the effect of this source of uncertainty, that future income is given. Recall from Section 2 that the amount withdrawn in period 1 if investing in a TEE is $R_1^{TEE} = (1+r)$, where r is the interest rate. If investing in an EET, this amount is $\tilde{R}_1^{EET} = \frac{1-\tilde{\tau}_1}{1-\tau_0}(1+r)$, where $\tilde{\tau}_1 = \tau_1 + \epsilon$. Assume $E(\epsilon) = 0$, so that individuals have no information suggesting that future tax rates should systematically increase or decrease. Then, uncertainty on future tax rate only adds noise to $\tilde{R}_1^{EET}$, diminishing the desirability of EET for any risk averse individual (Rothschild and Stiglitz, 1970). If TEE was already the optimal choice without uncertainty (i.e. if $\tau_1 > \tau_0$), then adding this uncertainty makes TEE an even better choice if the individual is risk averse. If EET was the optimal choice without uncertainty, then TEE could become the optimal choice depending on the individual's risk premium. Therefore, uncertainty on future tax code would favour TEE even more than the results in Section 5.

A second source of uncertainty that can affect the return of EET relative to TEE is risk on future income. Assume that the future tax code is known (and thus ignore risks on the tax code discussed in the previous paragraph). Let the total tax amount that the individual will have to pay in period 1 be $T(\tilde{y}_1)$, where $\tilde{y}_1$ is the uncertain future before-tax income. An individual sacrificing one dollar of disposable income in period 0 to invest in a TEE or in an EET will respectively have the following after-tax income in period 1:

$$\tilde{c}_1^{TEE} = \tilde{y}_1 - T(\tilde{y}_1) + 1 + r, \tag{12}$$

$$\tilde{c}_1^{EET} = \tilde{y}_1 - T(\tilde{y}_1) + \frac{1-\tau_1(\tilde{y}_1)}{1-\tau_0(y_0)}(1+r). \tag{13}$$

Note that the marginal tax rate $\tau_1(\tilde{y}_1)$ is the derivative of $T(\tilde{y}_1)$ with respect to $\tilde{y}_1$. After having invested one dollar of after-tax income in TEE and EET, respectively, a one dollar shock in future before-tax income will create the following variations in future disposable income:

$$\frac{\partial c_1^{TEE}}{\partial \tilde{y}_1} = 1 - \tau_1(\tilde{y}_1), \tag{14}$$

$$\frac{\partial c_1^{EET}}{\partial \tilde{y}_1} = 1 - \tau_1(\tilde{y}_1) - \tau_1'(\tilde{y}_1)\frac{(1+r)}{1-\tau_0(y_0)}. \tag{15}$$

Noting that $\frac{(1+r)}{1-\tau_0(y_0)} > 0$, it follows that shocks on future before-tax income y_1 will be attenuated by a EET, relative to a TEE, if $\tau_1' > 0$ and accentuated if $\tau_1' < 0$. The intuition behind this result is straightforward: progressive taxation (i.e. $\tau_1' > 0$) leads to less variable after-tax income, whereas the opposite is true for regressive taxation (i.e. $\tau_1' < 0$). Therefore, for risk-averse individuals, uncertainty on income increases the desirability of EET compared to TEE with progressive taxation and decreases it with regressive taxation.

In practice, as shown in Figure 4, EMTRs are neither clearly increasing nor clearly decreasing with income, so the effect of income uncertainty on the relative desirability of EET and TEE for risk-averse individuals is ambiguous. However EMTRs after 65-years-old do show an important decrease for lower income group that results from the high clawback rate of government transfers for low-income seniors. Overall, the progressivity of the Canadian EMTRs seems unlikely to be pronounced enough to invalidate the results from Section 5 that favour TEE, especially for the low-income individuals, for which TEE may be even more desirable.

8 Discussion and policy implications

This paper suggests that, given income dynamics across income groups and the Canadian tax code, TEE savings vehicles tend to yield higher returns than EET, especially for the lowest income groups. This is in large part due to the very high EMTRs resulting from the clawbacks of social transfers. While the main analysis considered EMTRs implicitly assumed risk neutrality, it is likely that risk aversion favours TEE accounts even more. First, uncertainty on future tax code adds noise to the future return of EET accounts. Second, uncertainty on income may only favour EET if the progressivity of taxation is significant. For low-income individuals the decreasing EMTRs resulting from the clawbacks of social transfers are therefore likely to favour TEE even more, as before-tax income shocks are accentuated by EET accounts under regressive taxation. Observed choices in the LAD suggests that low-income individuals do take their situation into account and favour TEE more often than higher-income individuals.

Another finding is that TEE is much less favoured in Quebec than in Ontario or British Columbia, a result than is not explained by differences in taxation or in income dynamics across provinces. These findings are important considering that the government of Quebec is currently implementing policies aimed at nudging more individuals to save in EET accounts. Employers not currently offering an equivalent pension plan are now required to automatically enrol their employees in VRSPs, which are of the EET type. It is likely that these policies will lead low-income individuals to make saving choices that are less suited to their situation. Since richer and more educated individuals are probably more able to ignore default choices made by their employer and make saving choices according to their own situation (see Chetty and Friedman (2014) and Messacar (2017)), it would seem natural that nudging policies be more oriented toward individuals with lower incomes. Thus, making VRSPs of the TEE type instead of EET would be a policy worth considering. Future research should explore in greater length potential financial literacy problems in Quebec and their implications for nudging policies.

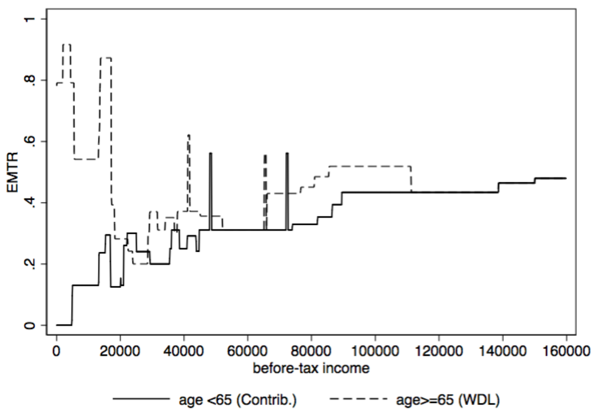
Importantly, this paper simply focuses on determining the best savings vehicle given an individual's income path, and given that the individual sacrifices a given amount of disposable income at the current period to save for retirement. Consequently, it does not address the more complex question of whether individuals should save less or more. On the one hand, it is not at all obvious that we should seek to promote a higher savings rate for all income groups, considering that retirement may come with lower necessary expenses, that it can be partly financed through housing equity and that it can be easier for retirees to economize (Skinner, 2007). On the other hand, various behavioural biases, for example hyperbolic discounting (see Frederick et al. (2002) for a review), bounded rationality and self-control (see Thaler and Benartzi (2004) for a review) may cause individuals to save less than what would maximize their long-term well-being.[10] Therefore, although this paper suggests that nudging individuals into EET might not yield the highest return for the lowest income groups, it does not necessarily suggest that the policy is worst than doing nothing. But, although nudging

[10]See Benartzi and Thaler (2007) for a review of various heuristics that may lead to systematic biases in retirement savings decisions.

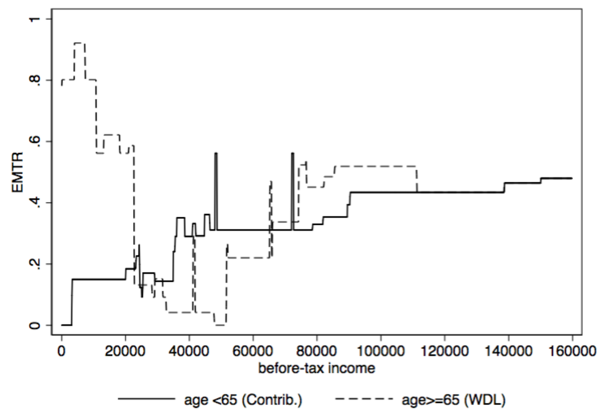
individuals into EET savings vehicles can be justified, the benefits of such policies would likely be less concentrated in highest income groups if they were rather nudged in a TEE vehicles.

Figure 1: Effective Marginal Tax Rates (EMTR) for contributions before age 65 and pension withdrawals after age 65; fiscal year 2015 ; no child; graphs for couples assume one individual has all before-tax income

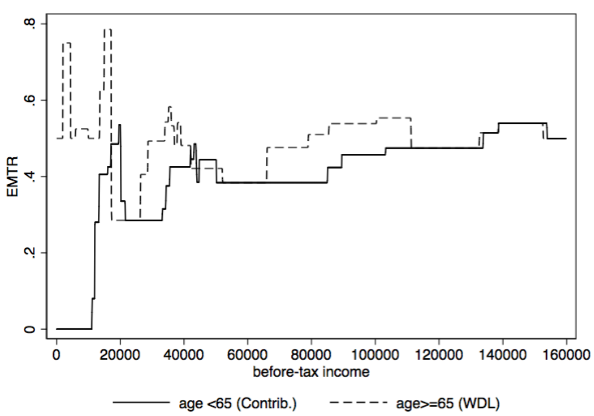
(a) Ontario - Single individuals



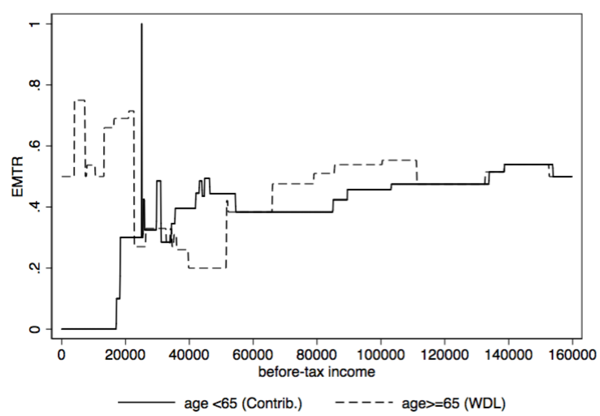
(b) Ontario - Couples



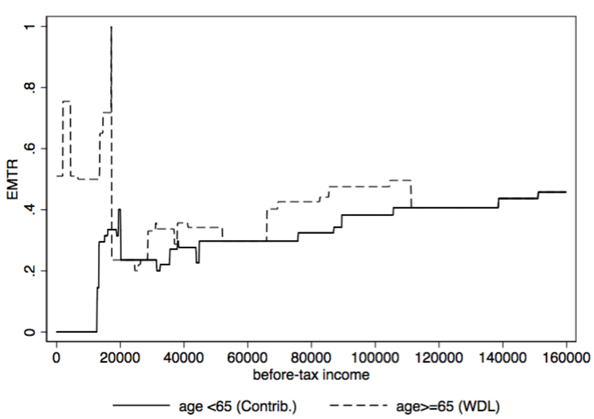
(c) Quebec - Single individuals



(d) Quebec - Couples



(e) British Columbia - Single individuals



(f) British Columbia - Couples

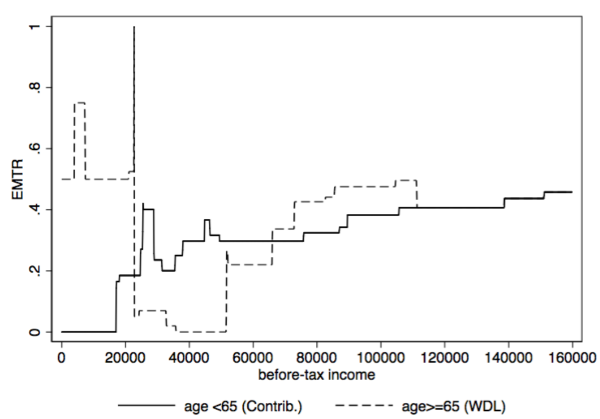


Figure 2: Proportion of individuals contributing to RRSP and TFSA savings accounts at 30 y/o by year and earnings quintile

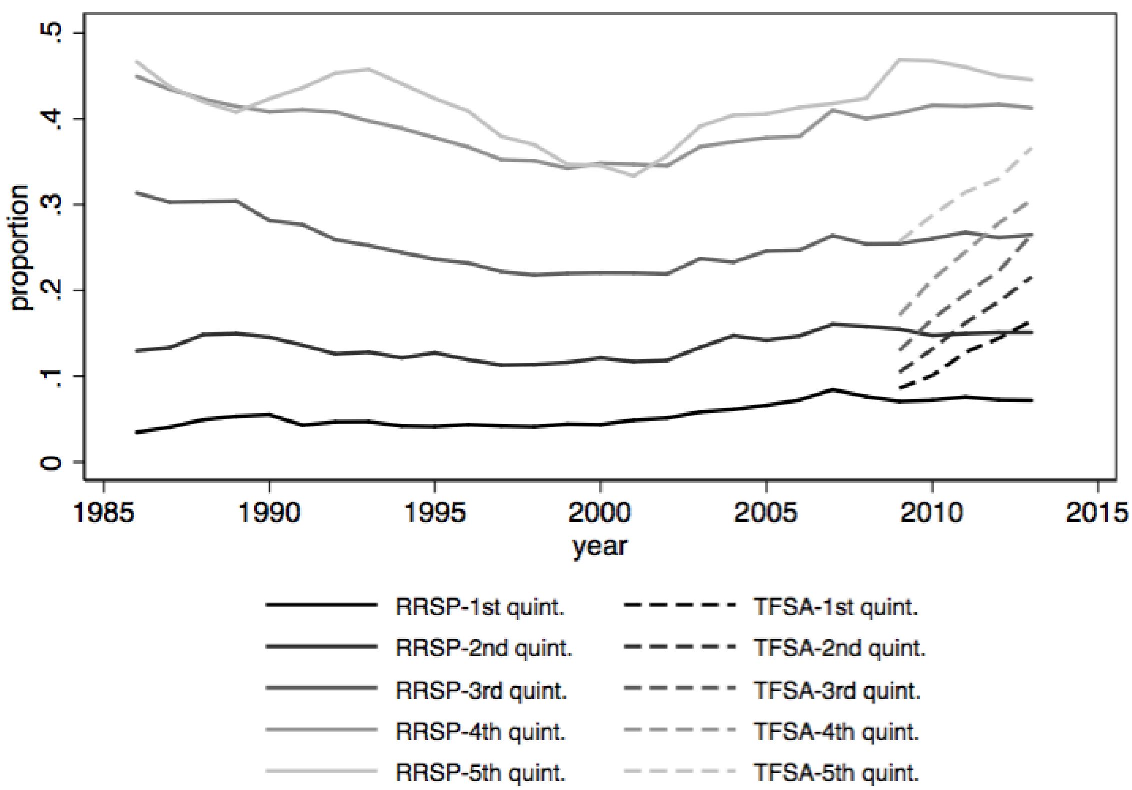


Table 1: Estimated coefficients of earnings age trends by family status and earnings quintile at 30 y/o - within individual regressions with year fixed effects (not shown) - p-values in square brackets

					Women-Quebec					
	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age - 30$	0.1438	0.0529	0.0161	0.0121	0.0119	0.1305	0.0385	0.0025	0.0003	0.0002
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.2651]	[0.8910]	[0.9334]
$(age - 30)^2$	-0.0094	-0.0021	-0.0002	0.0011	0.0014	-0.0078	-0.0015	0.0015	0.0023	0.0027
	[0.0000]	[0.0000]	[0.3924]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age - 30)^3$	0.0002	0.0000	0.0000	-0.0001	-0.0001	0.0002	0.0000	-0.0001	-0.0001	-0.0001
	[0.0000]	[0.0556]	[0.1997]	[0.0000]	[0.0000]	[0.0000]	[0.0184]	[0.0000]	[0.0000]	[0.0000]
constant	9.3530	10.0102	10.2863	10.5619	10.8895	9.1925	9.9281	10.2250	10.5217	10.7926
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	43735	58970	65215	69565	61745	34950	47745	60885	69180	62210
N. indiv.	2005	2540	2620	2735	2510	1625	2080	2510	2760	2565
	Single-with child at 30 y/o					Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age - 30$	0.1357	0.0248	0.0131	0.0071	0.0080	0.1265	0.0196	-0.0078	-0.0162	-0.0178
	[0.0000]	[0.0000]	[0.0005]	[0.0500]	[0.0759]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age - 30)^2$	-0.0057	0.0020	0.0026	0.0028	0.0045	-0.0042	0.0033	0.0047	0.0058	0.0059
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age - 30)^3$	0.0001	-0.0001	-0.0001	-0.0001	-0.0002	0.0000	-0.0001	-0.0002	-0.0002	-0.0002
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
constant	8.9728	9.7236	10.1942	10.5152	10.6890	8.8088	9.6755	10.0969	10.3305	10.6444
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	35070	31335	26925	21725	14570	147745	157975	171500	166290	126105
N. indiv.	1705	1365	1120	855	585	6840	6690	6965	6555	4960
					Men-Quebec					
	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age - 30$	0.1237	0.0398	0.0142	0.0160	-0.0027	0.1583	0.0683	0.0312	0.0227	0.0152
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.2640]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age - 30)^2$	-0.0069	-0.0016	0.0002	0.0016	0.0027	-0.0105	-0.0036	-0.0006	0.0010	0.0022
	[0.0000]	[0.0000]	[0.3526]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0005]	[0.0000]	[0.0000]
$(age - 30)^3$	0.0001	0.0000	-0.0000	-0.0001	-0.0001	0.0002	0.0000	-0.0000	-0.0001	-0.0001
	[0.0000]	[0.2379]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0003]	[0.0000]	[0.0000]
constant	9.5249	10.2970	10.5760	10.8340	11.0059	9.9067	10.4479	10.6562	10.8362	11.1303
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	124675	109275	97960	71175	46380	67835	75755	86110	73950	54530
N. indiv.	5705	4685	4005	2900	1950	2845	2990	3315	2905	2215
	Couple-with child at 30 y/o									
	q1	q2	q3	q4	q5					
$age - 30$	0.1388	0.0565	0.0274	0.0228	0.0127					
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]					
$(age - 30)^2$	-0.0088	-0.0029	-0.0006	0.0007	0.0027					
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]					
$(age - 30)^3$	0.0002	0.0000	-0.0000	-0.0001	-0.0001					
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]					
constant	9.7250	10.3712	10.6248	10.8633	11.0916					
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]					
N. obs.	122320	171895	215615	206895	174670					
N. indiv.	4920	6545	7970	7795	6730					

Table 1 (continued) - Estimated coefficients of earnings age trends by family status and earnings quintile at 30 y/o - within individual regressions with year fixed effects (not shown) - p-values in square brackets

Women-Ontario

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age-30$	0.1386	0.0540	0.0228	0.0188	0.0098	0.1373	0.0504	0.0031	0.0008	-0.0020
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.1473]	[0.6703]	[0.2284]
$(age-30)^2$	-0.0097	-0.0039	-0.0011	-0.0004	0.0013	-0.0107	-0.0032	0.0000	0.0006	0.0015
	[0.0000]	[0.0000]	[0.0000]	[0.1074]	[0.0000]	[0.0000]	[0.0000]	[0.9684]	[0.0092]	[0.0000]
$(age-30)^3$	0.0002	0.0001	0.0000	0.0000	-0.0001	0.0003	0.0001	0.0000	0.0000	-0.0001
	[0.0000]	[0.0000]	[0.0816]	[0.0008]	[0.0000]	[0.0000]	[0.0000]	[0.3377]	[0.0001]	[0.0000]
constant	9.4181	10.0548	10.3526	10.6421	10.8510	9.4635	10.0445	10.3006	10.5689	10.8568
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	39210	62975	74045	84270	93940	34365	61175	80595	103725	124035
N. indiv.	2195	3160	3390	3710	4280	1890	2995	3640	4495	5495

	Single-with child at 30 y/o					Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age-30$	0.1474	0.0361	0.0100	-0.0039	-0.0054	0.1318	0.0279	-0.0139	-0.0323	-0.0333
	[0.0000]	[0.0000]	[0.0029]	[0.3002]	[0.2624]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age-30)^2$	-0.0066	0.0004	0.0022	0.0031	0.0035	-0.0049	0.0024	0.0051	0.0067	0.0068
	[0.0000]	[0.2713]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age-30)^3$	0.0001	-0.0001	-0.0001	-0.0001	-0.0002	0.0001	-0.0001	-0.0002	-0.0002	-0.0002
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
constant	9.0230	9.8024	10.1694	10.3718	10.7707	8.8455	9.7238	10.0594	10.2354	10.5411
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	43715	36000	31570	26205	17335	195315	202830	234905	235245	230180
N. indiv.	2620	1845	1475	1165	795	9780	9180	10175	10000	9670

Men-Ontario

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age-30$	0.1240	0.0461	0.0209	0.0163	0.0032	0.1766	0.0786	0.0410	0.0297	0.0133
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0590]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age-30)^2$	-0.0080	-0.0022	-0.0006	0.0010	0.0016	-0.0115	-0.0044	-0.0014	-0.0004	0.0015
	[0.0000]	[0.0000]	[0.0008]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0069]	[0.0000]
$(age-30)^3$	0.0002	0.0000	-0.0000	-0.0001	-0.0001	0.0002	0.0001	0.0000	-0.0000	-0.0001
	[0.0000]	[0.0000]	[0.0946]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.7618]	[0.0000]	[0.0000]
constant	9.6998	10.3793	10.6569	10.8628	11.0362	10.0309	10.5822	10.7309	10.9433	11.0884
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	111900	112320	109665	103695	89370	72660	87285	104640	119325	114510
N. indiv.	6490	5695	5135	4780	4140	3570	3945	4450	5060	5010

	Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5
$age-30$	0.1495	0.0653	0.0391	0.0294	0.0128
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age-30)^2$	-0.0103	-0.0039	-0.0012	-0.0001	0.0018
	[0.0000]	[0.0000]	[0.0000]	[0.3039]	[0.0000]
$(age-30)^3$	0.0002	0.0001	-0.0000	-0.0000	-0.0001
	[0.0000]	[0.0000]	[0.0001]	[0.0000]	[0.0000]
constant	9.8846	10.4694	10.7368	10.9294	11.1028
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	102255	159135	229695	305435	326810
N. indiv.	5070	6930	9400	12480	13640

Table 1 (continued) - Estimated coefficients of earnings age trends by family status and earnings quintile at 30 y/o - within individual regressions with year fixed effects (not shown) - p-values in square brackets

Women-British-Columbia

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age-30$	0.1212	0.0601	0.0181	0.0042	-0.0121	0.1185	0.0428	-0.0035	-0.0143	-0.0298
	[0.0000]	[0.0000]	[0.0000]	[0.2053]	[0.0001]	[0.0000]	[0.0000]	[0.4024]	[0.0000]	[0.0000]
$(age-30)^2$	-0.0084	-0.0045	-0.0010	0.0012	0.0023	-0.0080	-0.0017	0.0008	0.0016	0.0035
	[0.0000]	[0.0000]	[0.0349]	[0.0038]	[0.0000]	[0.0000]	[0.0036]	[0.0930]	[0.0001]	[0.0000]
$(age-30)^3$	0.0002	0.0001	0.0000	-0.0001	-0.0001	0.0002	0.0000	-0.0000	-0.0000	-0.0001
	[0.0000]	[0.0000]	[0.7039]	[0.0000]	[0.0000]	[0.0000]	[0.1177]	[0.4158]	[0.0001]	[0.0000]
constant	9.2553	10.0556	10.4042	10.5601	10.7418	9.3190	9.9085	10.2606	10.5242	10.6776
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	15455	21695	22110	30170	38210	13020	20875	23240	31285	44715
N. indiv.	935	1255	1205	1490	1880	805	1150	1205	1540	2185

	Single-with child at 30 y/o					Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age-30$	0.1381	0.0310	0.0096	-0.0104	-0.0110	0.1345	0.0222	-0.0146	-0.0490	-0.0673
	[0.0000]	[0.0000]	[0.1697]	[0.1603]	[0.1730]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age-30)^2$	-0.0073	-0.0007	0.0029	0.0039	0.0038	-0.0056	0.0039	0.0062	0.0089	0.0097
	[0.0000]	[0.3174]	[0.0004]	[0.0000]	[0.0001]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
$(age-30)^3$	0.0001	-0.0000	-0.0001	-0.0001	-0.0002	0.0001	-0.0002	-0.0002	-0.0003	-0.0003
	[0.0000]	[0.8401]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
constant	8.9394	9.8772	10.2215	10.3016	10.7052	8.9174	9.6508	10.0082	10.1446	10.3265
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	16510	12995	8745	6915	6135	66160	57435	51210	56165	69660
N. indiv.	1080	755	480	365	305	3685	3025	2585	2710	3245

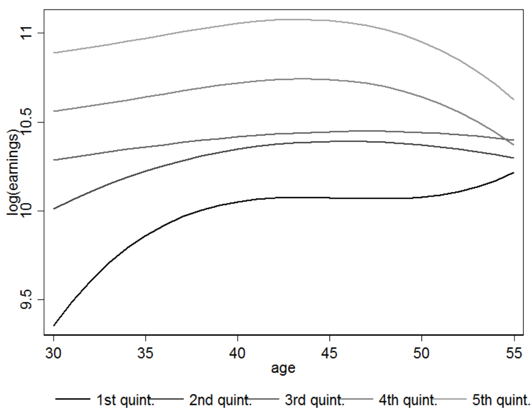
Men-British Columbia

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$age-30$	0.1207	0.0484	0.0158	0.0111	-0.0100	0.1604	0.0779	0.0341	0.0205	-0.0035
	[0.0000]	[0.0000]	[0.0000]	[0.0002]	[0.0001]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.1448]
$(age-30)^2$	-0.0068	-0.0021	0.0004	0.0018	0.0021	-0.0092	-0.0045	-0.0018	-0.0000	0.0024
	[0.0000]	[0.0000]	[0.2625]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.9705]	[0.0000]
$(age-30)^3$	0.0001	0.0000	-0.0000	-0.0001	-0.0001	0.0002	0.0001	0.0000	-0.0000	-0.0001
	[0.0000]	[0.1272]	[0.0003]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0069]	[0.0020]	[0.0000]
constant	9.6479	10.3565	10.6518	10.8806	11.0340	9.8387	10.5723	10.7762	10.9338	11.0590
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	40860	38460	32480	34615	42340	25490	27350	26930	32580	41995
N. indiv.	2650	2265	1830	1805	2120	1430	1430	1330	1575	2005

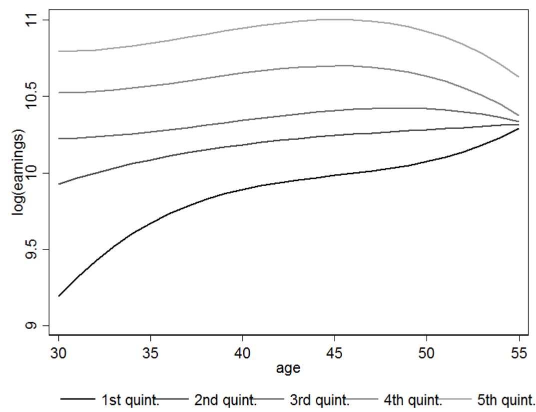
	Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5
$age-30$	0.1507	0.0677	0.0315	0.0203	0.0016
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.2390]
$(age-30)^2$	-0.0093	-0.0039	-0.0013	-0.0004	0.0014
	[0.0000]	[0.0000]	[0.0000]	[0.0874]	[0.0000]
$(age-30)^3$	0.0002	0.0001	0.0000	-0.0000	-0.0001
	[0.0000]	[0.0000]	[0.6069]	[0.0001]	[0.0000]
constant	9.8880	10.5110	10.7324	10.9515	11.1354
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
N. obs.	35935	46855	52610	69935	116405
N. indiv.	1960	2350	2575	3345	5425

Figure 3: Predicted earnings ($ 2010) by province group, family status at 30 y/o and earnings quintile at 30 y/o

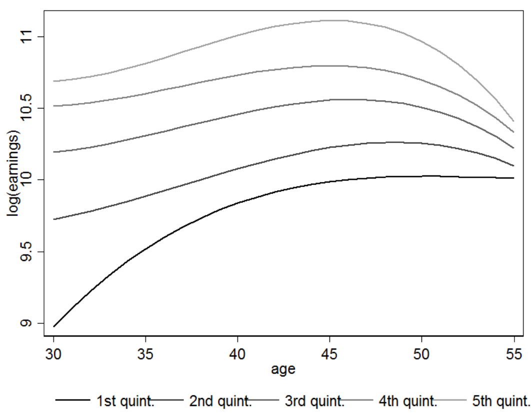
(a) Women - Quebec - single- no child



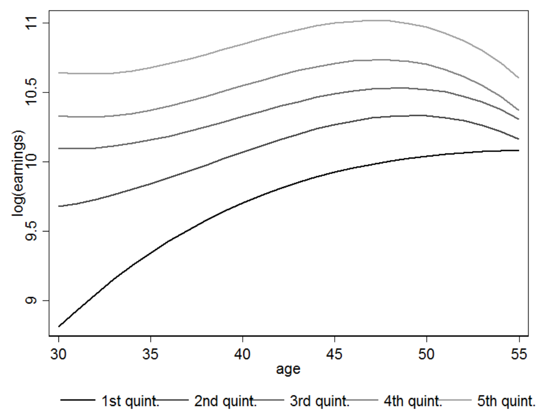
(b) Women - Quebec - couple- no child



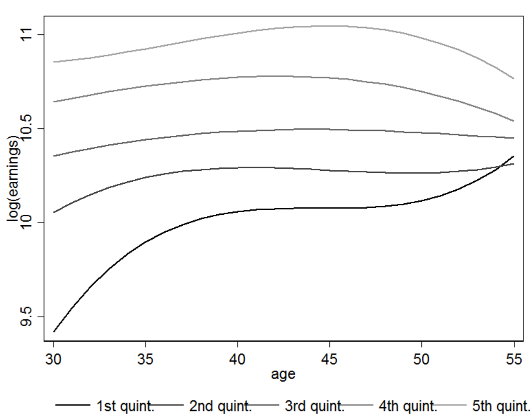
(c) Women - Quebec - single- with child



(d) Women - Quebec - couple- with child



(e) Women - Ontario - single- no child



(f) Women - Ontario - couple- no child

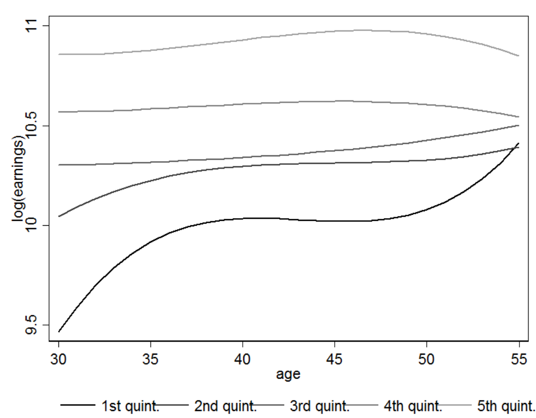
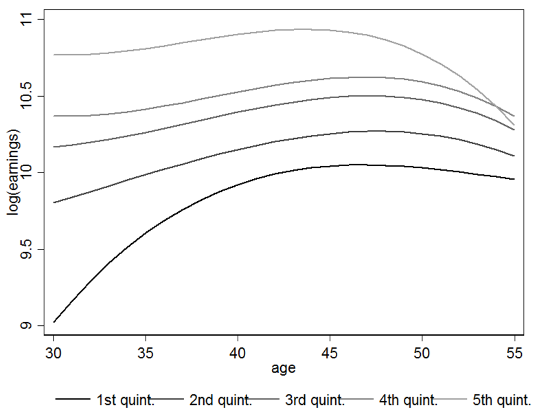
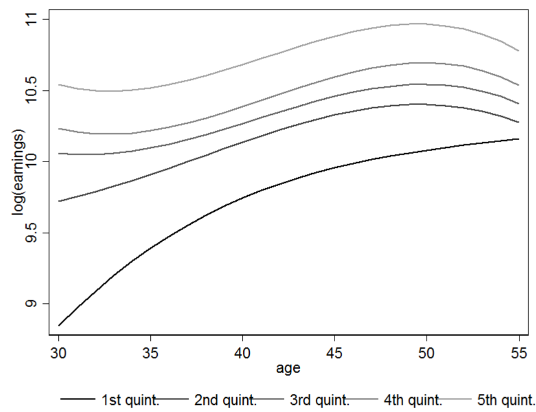


Figure 3 (continued) – Predicted earnings ($ 2010) by province group, family status at 30 y/o and earnings quintile at 30 y/o

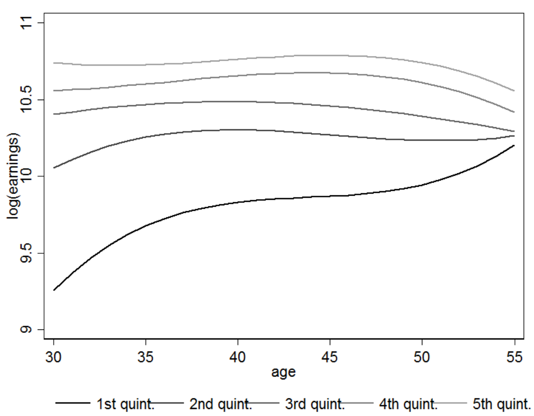
(g) Women - Ontario - single- with child



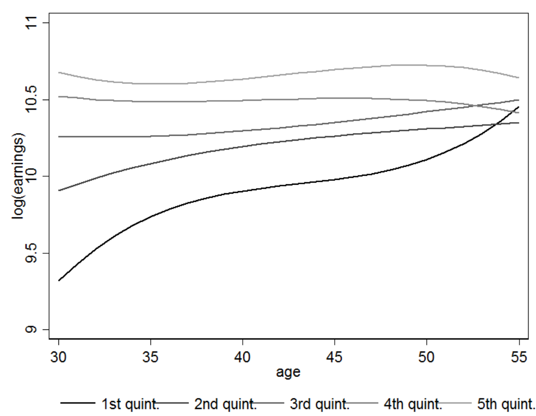
(h) Women - Ontario - couple- with child



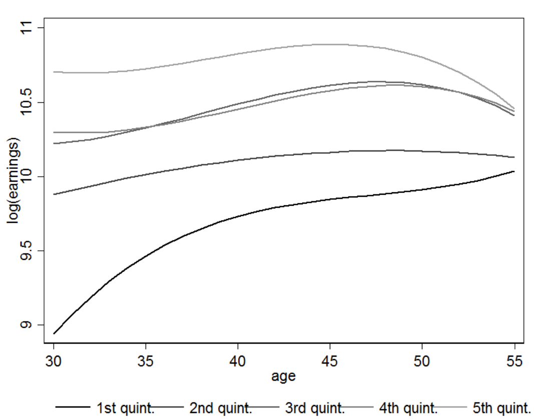
(i) Women - British Columbia - single- no child



(j) Women - British Columbia - couple- no child



(k) Women - British Columbia - single- with child



(l) Women - British Columbia - couple- with child

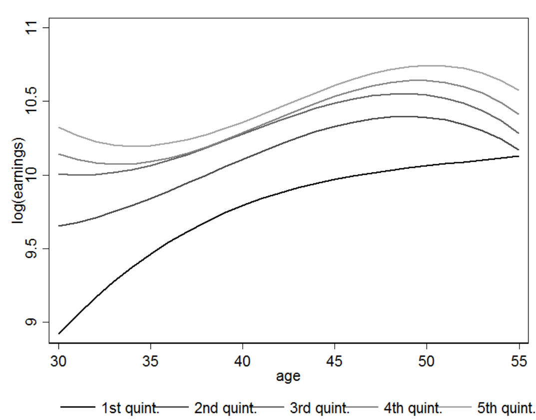
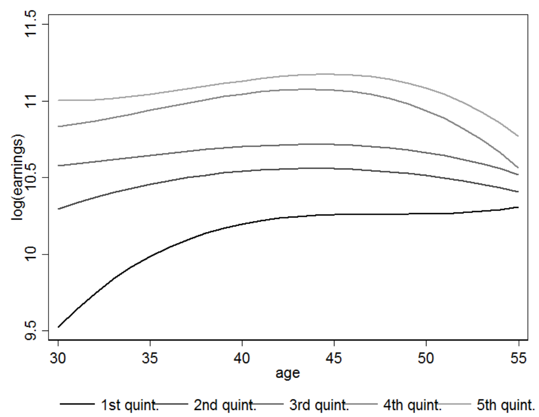
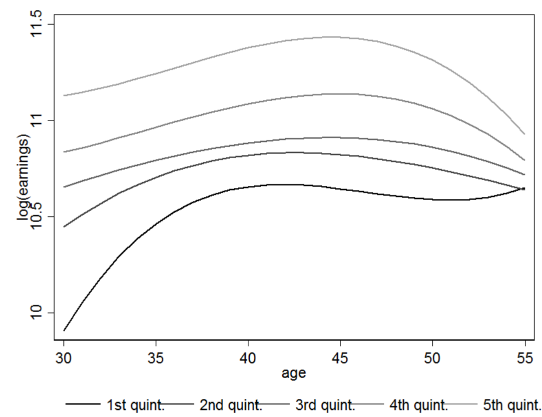


Figure 3 (continued) – Predicted earnings ($ 2010) by province group, family status at 30 y/o and earnings quintile at 30 y/o

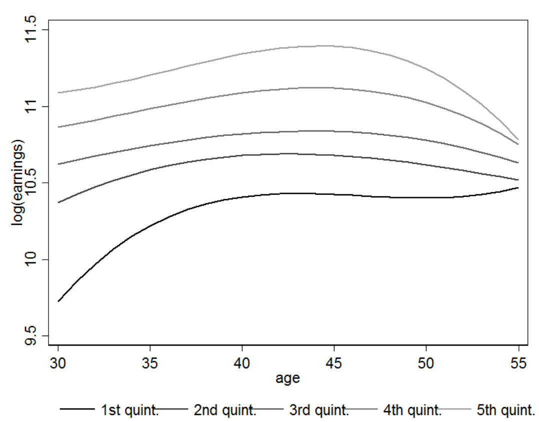
(m) Men - Quebec - single- no child



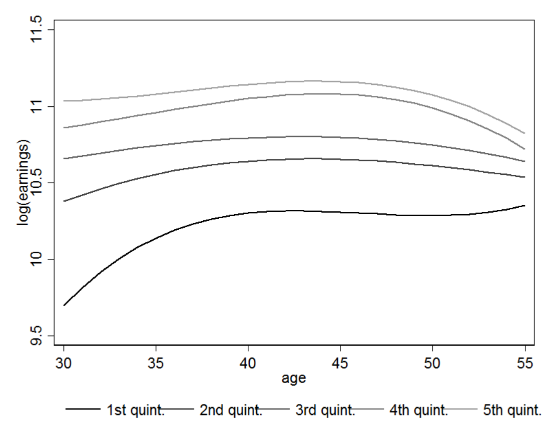
(n) Men - Quebec - couple- no child



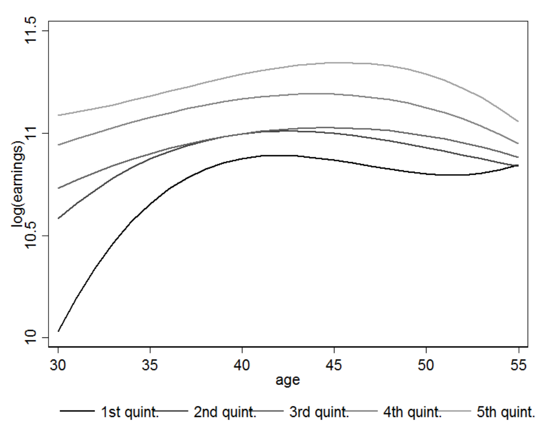
(o) Men - Quebec - couple- with child



(p) Men - Ontario - single- no child



(q) Men - Ontario - couple- no child



(r) Men - Ontario - couple- with child

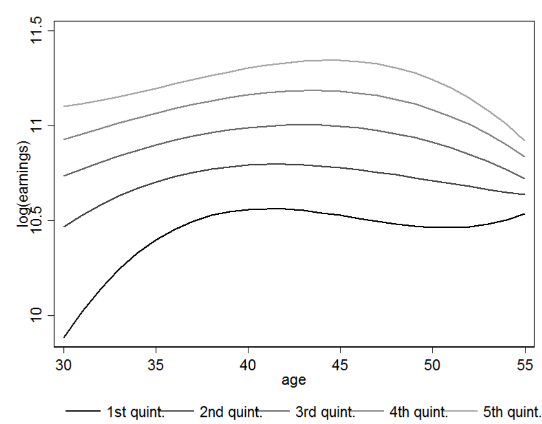
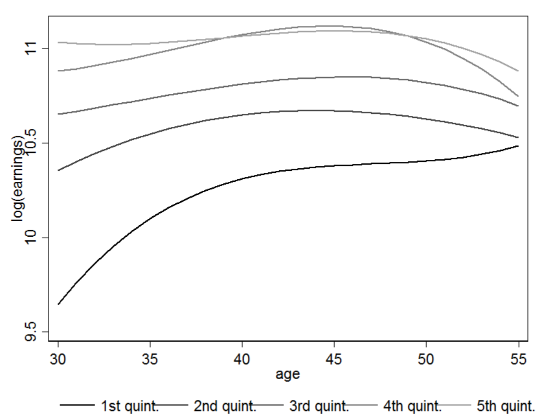
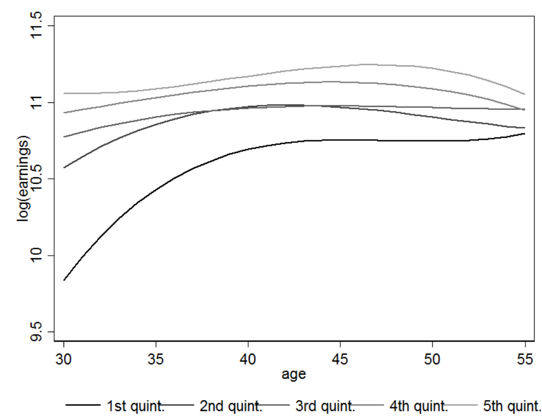


Figure 3 (continued) – Predicted earnings ($ 2010) by province group, family status at 30 y/o and earnings quintile at 30 y/o

(s) Men - British Columbia - single- no child



(t) Men - British Columbia - couple- no child



(u) Men - British Columbia - couple- with child

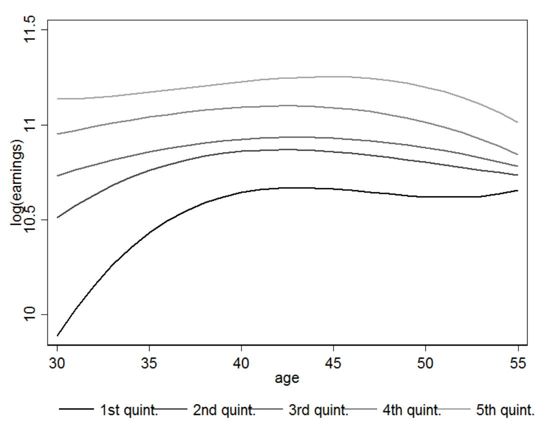


Table 2: Estimated persistence (ρ) variance of persistent shocks (σ^2_ϵ) and of transitory shocks (σ^2_μ) by family status and earnings quintile at 30 y/o of residuals from within individual regressions with year fixed effects - p-values in square brackets

Women-Quebec

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.9586	0.9486	0.9381	0.9087	0.9115	0.9723	0.9538	0.9397	0.8885	0.8988
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}^2_\epsilon$	0.0338	0.0347	0.0326	0.0430	0.0481	0.0218	0.0320	0.0317	0.0512	0.0558
	[0.022]	[0.030]	[0.002]	[0.329]	[0.405]	[0.370]	[0.139]	[0.006]	[0.609]	[0.307]
$\hat{\sigma}^2_\mu$	0.1630	0.1282	0.1097	0.1647	0.2072	0.1922	0.1008	0.1361	0.1392	0.2051
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N. obs.	43735	58970	65215	69565	61745	34950	47745	60885	69180	62210
N. indiv.	2005	2540	2620	2735	2510	1625	2080	2510	2760	2565
	Single-with child at 30 y/o					Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.9460	0.9443	0.8945	0.9305	0.8762	0.9485	0.9412	0.9330	0.9270	0.9176
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}^2_\epsilon$	0.0439	0.0385	0.0422	0.0213	0.0487	0.0437	0.0379	0.0397	0.0261	0.0443
	[0.411]	[0.397]	[0.582]	[0.766]	[0.838]	[0.004]	[0.008]	[0.016]	[0.066]	[0.168]
$\hat{\sigma}^2_\mu$	0.1760	0.1567	0.1581	0.1454	0.1994	0.2106	0.1647	0.1546	0.1899	0.2097
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Men-Quebec

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.955	0.950	0.932	0.930	0.921	0.953	0.951	0.950	0.910	0.917
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}^2_\epsilon$	0.036	0.030	0.032	0.036	0.042	0.032	0.028	0.023	0.051	0.055
	[0.007]	[0.052]	[0.007]	[0.381]	[0.682]	[0.062]	[0.020]	[0.062]	[0.633]	[0.389]
$\hat{\sigma}^2_\mu$	0.195	0.129	0.145	0.173	0.206	0.196	0.117	0.113	0.134	0.233
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N. obs.	124675	109275	97960	71175	46380	67835	75755	86110	73950	54530
N. indiv.	5705	4685	4005	2900	1950	2845	2990	3315	2905	2215
	Couple-with child at 30 y/o									
	q1	q2	q3	q4	q5					
$\hat{\rho}$	0.958	0.951	0.941	0.923	0.926					
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]					
$\hat{\sigma}^2_\epsilon$	0.025	0.027	0.023	0.041	0.041					
	[0.003]	[0.000]	[0.000]	[0.122]	[0.000]					
$\hat{\sigma}^2_\mu$	0.165	0.125	0.097	0.125	0.201					
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]					
N. obs.	122320	171895	215615	206895	174670					
N. indiv.	4920	6545	7970	7795	6730					

Table 2 (continued) - Estimated persistence (ρ) variance of persistent shocks (σ_ϵ^2) and of transitory shocks (σ_μ^2) by family status and earnings quintile at 30 y/o of residuals from within individual regressions with year fixed effects - p-values in square brackets

Women-Ontario										
	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.977	0.959	0.948	0.901	0.918	0.953	0.963	0.935	0.911	0.938
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}_\epsilon^2$	0.022	0.035	0.030	0.061	0.064	0.043	0.039	0.041	0.061	0.040
	[0.655]	[0.401]	[0.150]	[0.234]	[0.112]	[0.244]	[0.093]	[0.034]	[0.303]	[0.230]
$\hat{\sigma}_\mu^2$	0.165	0.135	0.098	0.096	0.177	0.119	0.116	0.084	0.088	0.127
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]	[0.006]	[0.000]
N. obs.	39210	62975	74045	84270	93940	34365	61175	80595	103725	124035
N. indiv.	2195	3160	3390	3710	4280	1890	2995	3640	4495	5495
	Single-with child at 30 y/o					Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.920	0.917	0.921	0.872	0.841	0.937	0.937	0.928	0.927	0.920
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}_\epsilon^2$	0.060	0.041	0.035	0.071	0.099	0.048	0.047	0.044	0.043	0.044
	[0.501]	[0.846]	[0.696]	[0.829]	[0.672]	[0.003]	[0.141]	[0.022]	[0.000]	[0.002]
$\hat{\sigma}_\mu^2$	0.279	0.215	0.129	0.130	0.058	0.205	0.132	0.107	0.121	0.155
	[0.000]	[0.000]	[0.006]	[0.175]	[0.871]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N. obs.	43715	36000	31570	26205	17335	195315	202830	234905	235245	230180
N. indiv.	2620	1845	1475	1165	795	9780	9180	10175	10000	9670

Men-Ontario										
	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.946	0.958	0.942	0.884	0.921	0.959	0.959	0.939	0.941	0.922
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}_\epsilon^2$	0.045	0.034	0.028	0.068	0.055	0.043	0.034	0.039	0.033	0.057
	[0.010]	[0.005]	[0.095]	[0.043]	[0.217]	[0.094]	[0.063]	[0.331]	[0.010]	[0.195]
$\hat{\sigma}_\mu^2$	0.179	0.124	0.103	0.123	0.129	0.151	0.093	0.092	0.100	0.175
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.010]	[0.000]	[0.000]	[0.000]
N. obs.	111900	112320	109665	103695	89370	72660	87285	104640	119325	114510
N. indiv.	6490	5695	5135	4780	4140	3570	3945	4450	5060	5010
	Couple-with child at 30 y/o									
	q1	q2	q3	q4	q5					
$\hat{\rho}$	0.950	0.940	0.929	0.911	0.908					
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]					
$\hat{\sigma}_\epsilon^2$	0.038	0.039	0.036	0.053	0.062					
	[0.001]	[0.055]	[0.000]	[0.000]	[0.000]					
$\hat{\sigma}_\mu^2$	0.196	0.137	0.123	0.109	0.164					
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]					
N. obs.	102255	159135	229695	305435	326810					
N. indiv.	5070	6930	9400	12480	13640					

Table 2 (continued) - Estimated persistence (ρ) variance of persistent shocks (σ^2_ϵ) and of transitory shocks (σ^2_μ) by family status and earnings quintile at 30 y/o of residuals from within individual regressions with year fixed effects - p-values in square brackets

Women-British-Columbia

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.923	0.967	0.935	0.933	0.888	0.959	0.952	0.892	0.905	0.932
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}^2_\epsilon$	0.060	0.020	0.037	0.029	0.081	0.043	0.044	0.054	0.087	0.038
	[0.827]	[0.846]	[0.781]	[0.222]	[0.441]	[0.869]	[0.554]	[0.621]	[0.567]	[0.208]
$\hat{\sigma}^2_\mu$	0.061	0.107	0.132	0.153	0.115	0.176	0.178	0.109	0.099	0.131
	[0.872]	[0.086]	[0.005]	[0.000]	[0.015]	[0.000]	[0.000]	[0.064]	[0.298]	[0.012]
N. obs.	15455	21695	22110	30170	38210	13020	20875	23240	31285	44715
N. indiv.	935	1255	1205	1490	1880	805	1150	1205	1540	2185
	Single-with child at 30 y/o					Couple-with child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.813	0.984	0.930	0.915	0.923	0.931	0.926	0.932	0.902	0.945
	[0.000]	[0.064]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}^2_\epsilon$	0.164	0.003	0.057	0.029	0.019	0.056	0.052	0.051	0.065	0.030
	[0.801]	[0.998]	[0.763]	[0.905]	[0.775]	[0.288]	[0.446]	[0.357]	[0.268]	[0.136]
$\hat{\sigma}^2_\mu$	0.000	0.134	0.105	0.154	0.148	0.213	0.139	0.141	0.112	0.132
	[1.000]	[0.378]	[0.813]	[0.042]	[0.466]	[0.000]	[0.000]	[0.000]	[0.003]	[0.000]
N. obs.	16510	12995	8745	6915	6135	66160	57435	51210	56165	69660
N. indiv.	1080	755	480	365	305	3685	3025	2585	2710	3245

Men-British Columbia

	Single-no child at 30 y/o					Couple-no child at 30 y/o				
	q1	q2	q3	q4	q5	q1	q2	q3	q4	q5
$\hat{\rho}$	0.961	0.921	0.926	0.934	0.918	0.969	0.939	0.939	0.934	0.918
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$\hat{\sigma}^2_\epsilon$	0.034	0.036	0.034	0.043	0.039	0.020	0.042	0.020	0.029	0.042
	[0.525]	[0.777]	[0.772]	[0.406]	[0.142]	[0.734]	[0.671]	[0.677]	[0.651]	[0.702]
$\hat{\sigma}^2_\mu$	0.174	0.185	0.098	0.112	0.168	0.189	0.117	0.079	0.118	0.120
	[0.000]	[0.000]	[0.115]	[0.003]	[0.000]	[0.002]	[0.000]	[0.029]	[0.042]	[0.005]
N. obs.	40860	38460	32480	34615	42340	25490	27350	26930	32580	41995
N. indiv.	2650	2265	1830	1805	2120	1430	1430	1330	1575	2005
	Couple-with child at 30 y/o									
	q1	q2	q3	q4	q5					
$\hat{\rho}$	0.947	0.959	0.929	0.919	0.922					
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]					
$\hat{\sigma}^2_\epsilon$	0.035	0.022	0.037	0.033	0.031					
	[0.593]	[0.166]	[0.549]	[0.517]	[0.023]					
$\hat{\sigma}^2_\mu$	0.199	0.146	0.112	0.112	0.128					
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]					
N. obs.	35935	46855	52610	69935	116405					
N. indiv.	1960	2350	2575	3345	5425					

Table 3: Private retirement income models - Standard errors in parentheses

	Women					
	First step: Logit estimation			**Second step: OLS estimation**		
	Quebec	Ontario	BC	Quebec	Ontario	BC
$log(avg.earnings)$	0.467	0.389	0.332	0.388	0.355	0.307
	(0.015)	(0.013)	(0.022)	(0.010)	(0.008)	(0.013)
$log(CQPP)$	1.100	1.030	1.086	0.738	0.544	0.579
	(0.031)	(0.025)	(0.042)	(0.021)	(0.017)	(0.027)
couple	-0.116	-0.096	0.030	-0.172	-0.278	-0.269
	(0.031)	(0.025)	(0.042)	(0.019)	(0.015)	(0.024)
constant	-13.565	-12.239	-12.232	-1.404	0.739	0.868
	(0.243)	(0.198)	(0.335)	(0.163)	(0.132)	(0.213)
std. dev. of residuals				1.070	1.079	1.017
N. obs.	25245	40125	13860	14455	25180	8695
	Men					
	First step: Logit estimation			**Second step: OLS estimation**		
	Quebec	Ontario	BC	Quebec	Ontario	BC
$log(avg.earnings)$	1.096	0.977	0.895	1.072	0.959	0.860
	(0.022)	(0.018)	(0.030)	(0.012)	(0.009)	(0.015)
$log(CQPP)$	-0.012	0.255	0.289	-0.060	-0.277	-0.232
	(0.040)	(0.036)	(0.061)	(0.025)	(0.020)	(0.034)
couple	0.048	0.189	0.240	-0.007	-0.073	-0.011
	(0.033)	(0.031)	(0.048)	(0.020)	(0.016)	(0.026)
constant	-10.764	-11.985	-11.525	-1.829	1.605	2.143
	(0.313)	(0.304)	(0.490)	(0.224)	(0.196)	(0.306)
std. dev. of residuals				1.066	0.973	0.956
N. obs.	29820	42410	15260	20240	30905	10850

Table 4: Proportion of simulations favouring TEE over EET by earnings quintile at age 30 and province

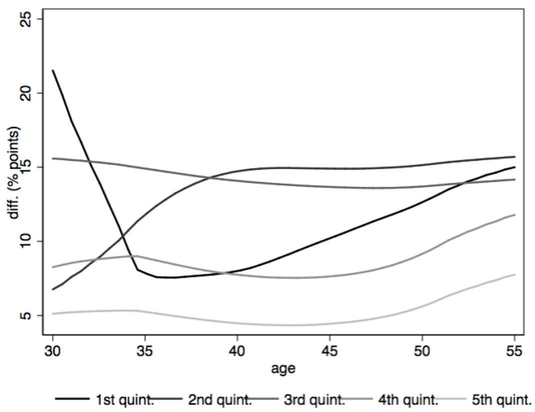
Earnings quintile	**Quebec**	**Ontario**	**BC**
1	0.73	0.79	0.77
2	0.73	0.75	0.71
3	0.65	0.70	0.66
4	0.60	0.61	0.59
5	0.59	0.55	0.57

Table 5: Proportion of simulations favouring TEE over EET by earnings quintile at age 30 and family status at age 30

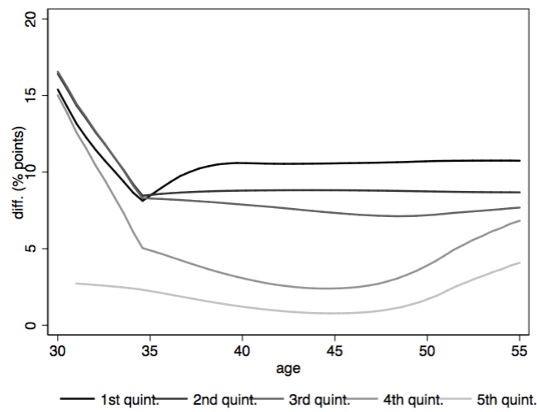
Earnings quintile	**Single-no child**	**Couple-no child**	**Single with children**	**Couple with children**
1	0.88	0.74	0.92	0.59
2	0.88	0.67	0.81	0.59
3	0.86	0.67	0.52	0.56
4	0.81	0.60	0.47	0.47
5	0.77	0.50	0.53	0.44

Figure 4: Predicted difference between EMTRs on EET withdrawals and on EET contributions (in % points), by province, gender, family status at 30 y/o and earnings quintile at 30 y/o

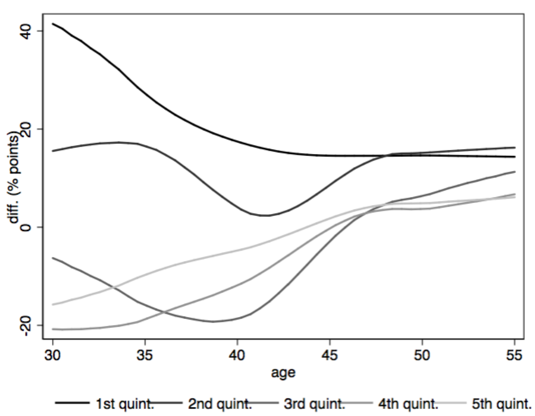
(a) Women - Quebec - single- no child



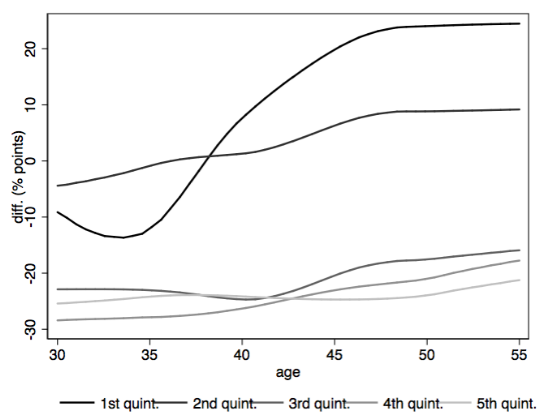
(b) Women - Quebec - couple- no child



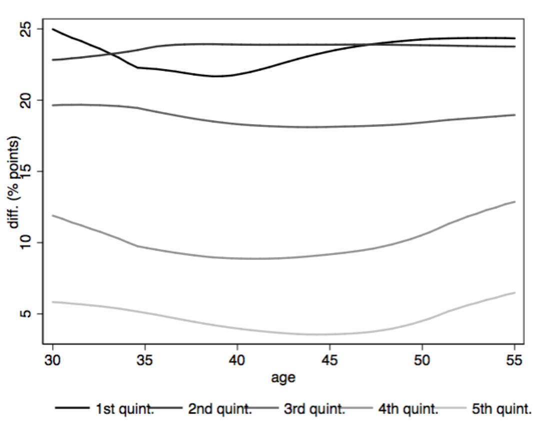
(c) Women - Quebec - single- with child



(d) Women - Quebec - couple- with child



(e) Women - Ontario - single- no child



(f) Women - Ontario - couple- no child

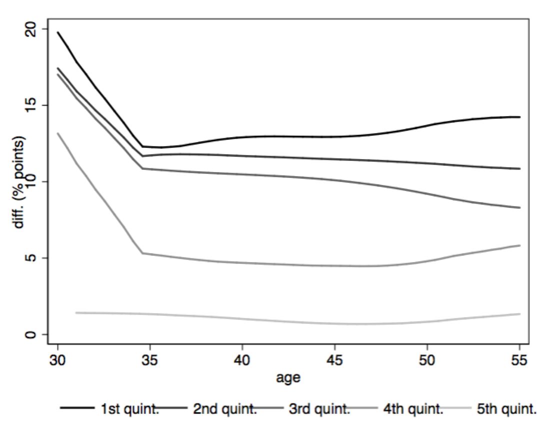
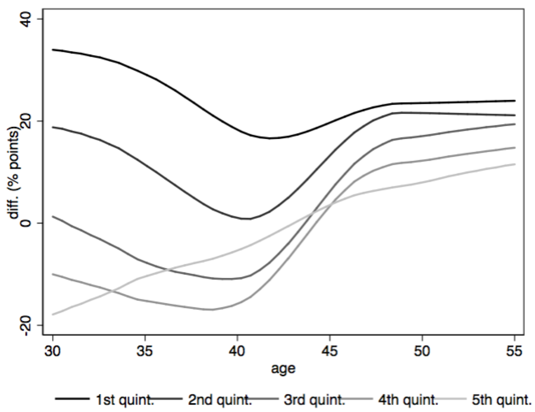
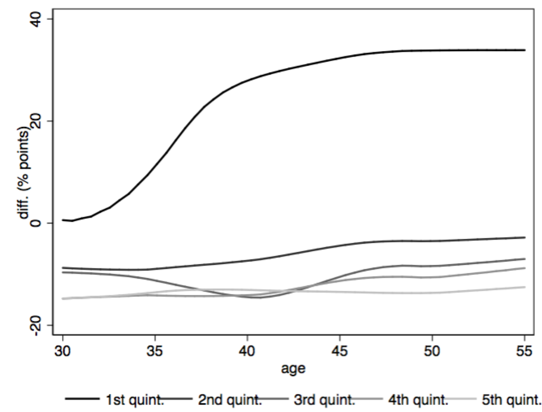


Figure 4 (continued) – Predicted difference between EMTRs on EET withdrawals and on EET contributions (in % points), by province, gender, family status at 30 y/o and earnings quintile at 30 y/o

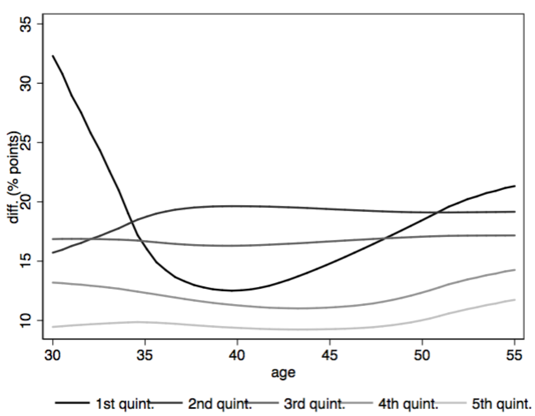
(g) Women - Ontario - single- with child



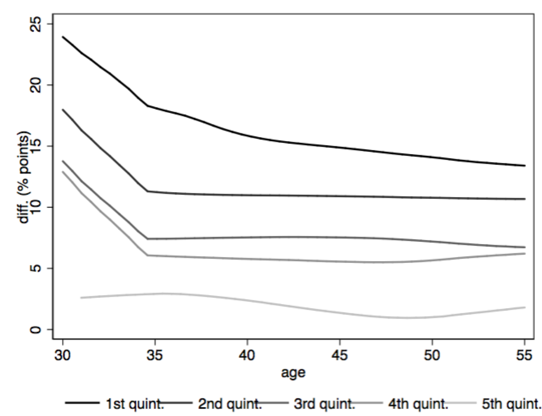
(h) Women - Ontario - couple- with child



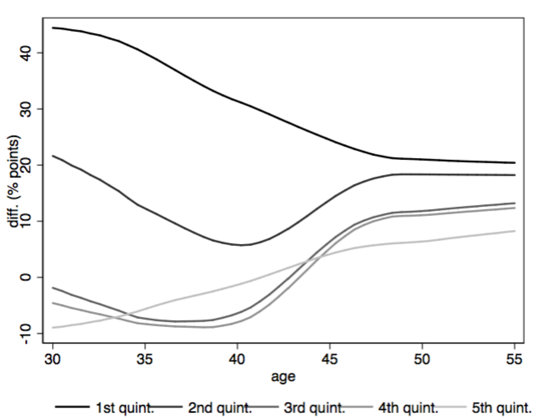
(i) Women - British Columbia - single- no child



(j) Women - British Columbia - couple- no child



(k) Women - British Columbia - single- with child



(l) Women - British Columbia - couple- with child

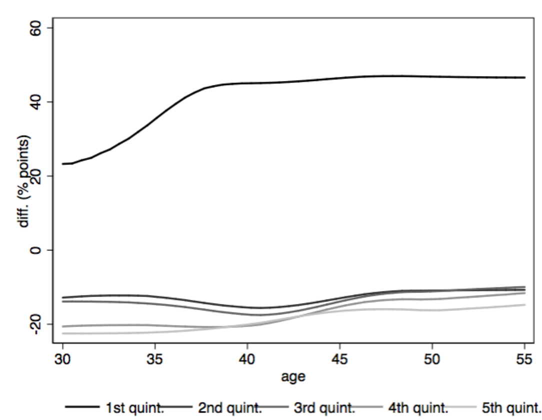
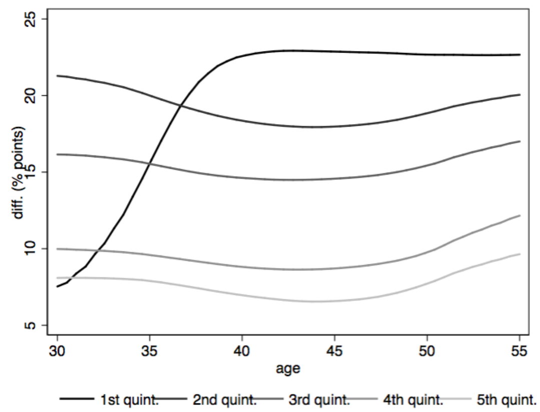
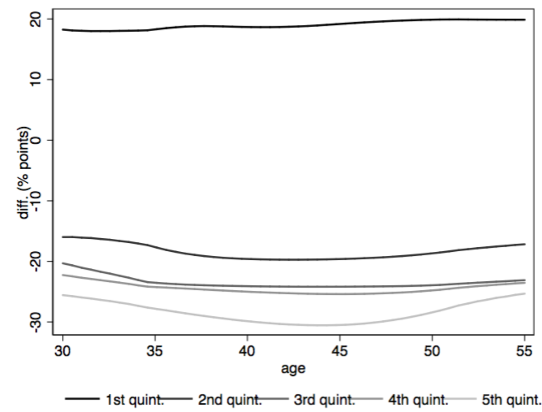


Figure 4 (continued) – Predicted difference between EMTRs on EET withdrawals and on EET contributions (in % points), by province, gender, family status at 30 y/o and earnings quintile at 30 y/o

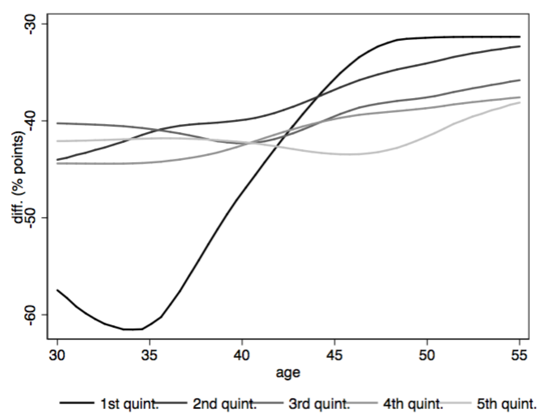
(m) Men - Quebec - single- no child



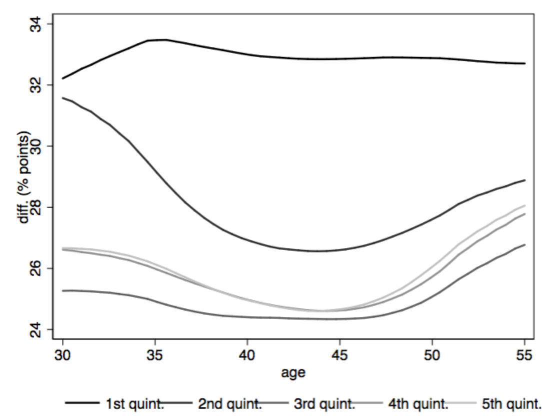
(n) Men - Quebec - couple- no child



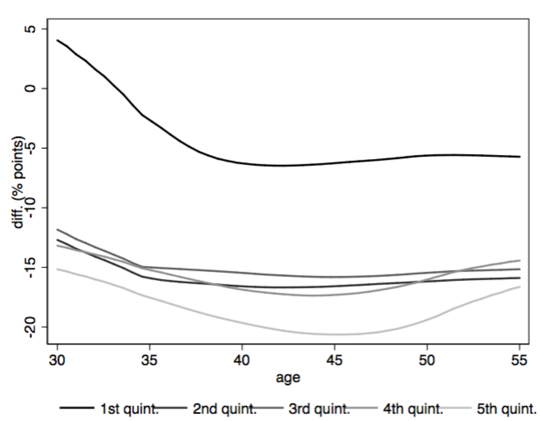
(o) Men - Quebec - couple- with child



(p) Men - Ontario - single- no child



(q) Men - Ontario - couple- no child



(r) Men - Ontario - couple- with child

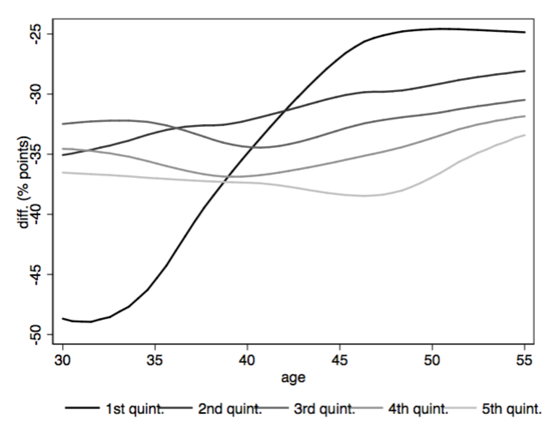
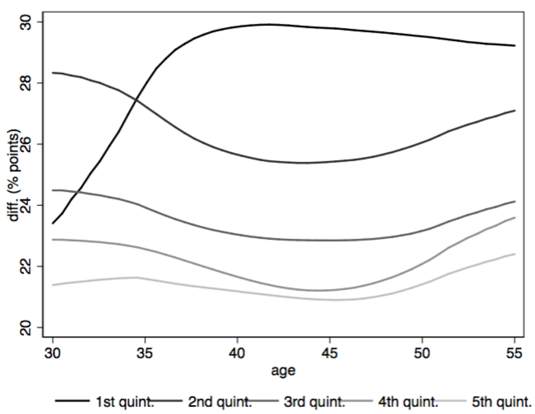
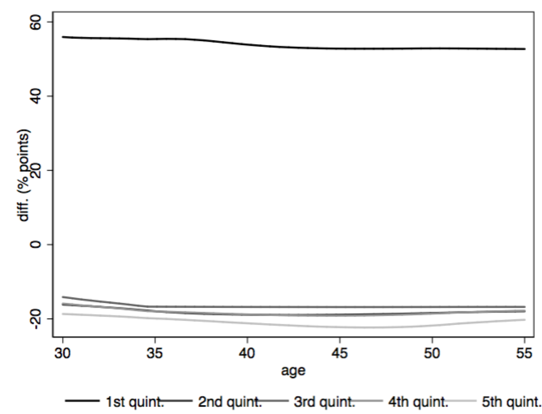


Figure 4 (continued) – Predicted difference between EMTRs on EET withdrawals and on EET contributions (in % points), by province, gender, family status at 30 y/o and earnings quintile at 30 y/o

(s) Men - British Columbia - single- no child



(t) Men - British Columbia - couple- no child



(u) Men - British Columbia - couple- with child

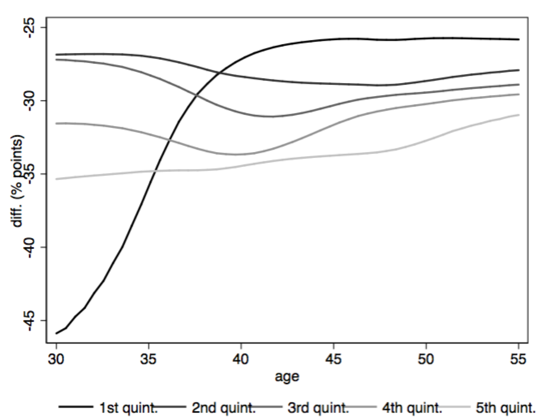
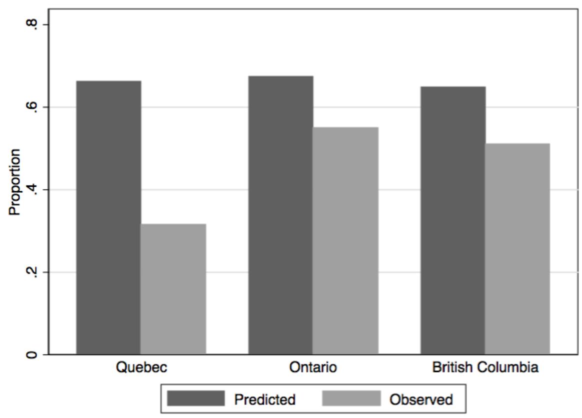
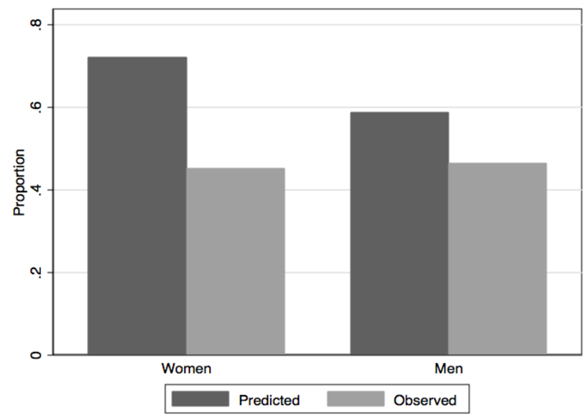


Figure 5: Proportion of simulations for which TEE is predicted to be the optimal choice versus proportion of observations choosing TEE in the LAD

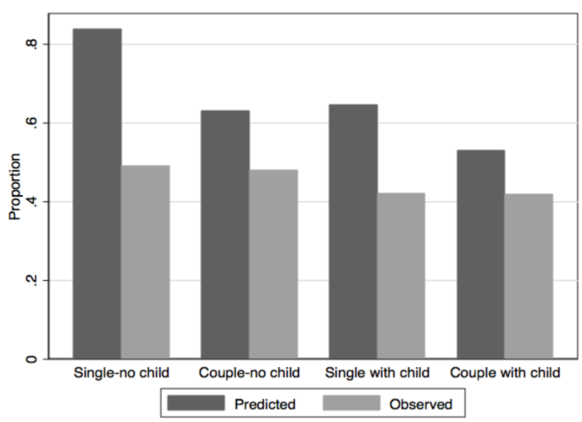
(a) Proportions by province



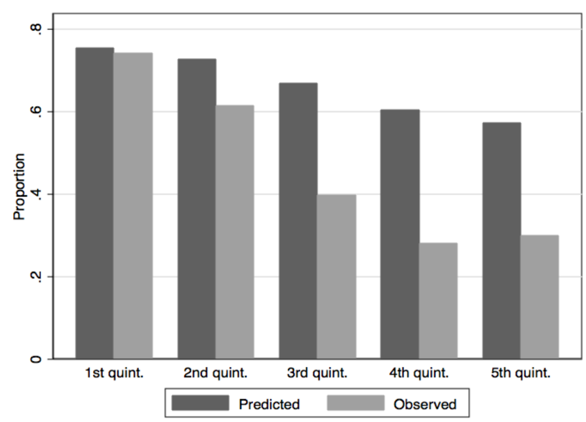
(b) Proportions by gender



(c) Proportions by family status



(d) Proportions by earnings quintile



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