Catalogue no. 11F0019M — No. 413
ISSN 1205-9153
ISBN 978-0-660-29054-6

Analytical Studies Branch Research Paper Series

The Long-term Effects of Employer-sponsored Pension Plans on Non-workplace Returns on Investments

by Derek Messacar and René Morissette

Release date: January 14, 2019

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.. not available for a specific reference period
... not applicable
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0^s value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p} preliminary
^{r} revised
x suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E} use with caution
F too unreliable to be published
* significantly different from reference category ($p < 0.05$)

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Social Analysis and Modelling Division
Statistics Canada

11F0019M No. 413
2019001
ISSN 1205-9153
ISBN 978-0-660-29054-6

January 2019

Analytical Studies Branch
Research Paper Series

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Table of contents

Abstract

What is the effect of having an employer-sponsored pension plan (EPP) on financial performance in non-workplace investments? This paper offers new insight into this unresolved empirical issue, using administrative data on over 345,000 taxfilers from Canada. The paper makes two key contributions. First, an approach for inferring relative returns on investments is developed. The approach is based on a longitudinal analysis of saving flow-of-funds and wealth data related to the use of the tax-free savings account (TFSA). The analysis shows that asset balances are substantially heterogeneous across individuals with equivalent saving histories. Second, having an EPP is shown to raise the average return on investment in other tax-preferred saving plans, albeit by a very modest amount of approximately 0.50% to 1.25% over five years since the TFSA was introduced. This result is robust to augmenting the analysis to an instrumental variables approach that exploits variation in the availability of EPPs across cohorts by sex and industry of employment, which controls for the possibility that observed and unobserved differences between individuals with and without EPPs—such as the level of education or financial literacy—may confound the results.

Keywords: Employer-sponsored pension plan; tax-free savings account; return on investment; financial competence; administrative tax data; instrumental variables.

Executive summary

This paper investigates the interconnections between employer-sponsored pension plan (EPP) coverage and returns on investments in non-workplace saving vehicles.

Specifically, the paper makes two contributions. First, an approach for inferring relative investment performance across taxfilers is developed. The approach is based on an analysis of longitudinal tax data. The analysis centres on the use of the tax-free savings account (TFSA).

Second, the causal effect of EPP coverage on taxfilers' relative investment performance in TFSAs is assessed. The theoretical prediction for the sign of this effect is ambiguous. Taxfilers who know they struggle to save adequately on their own may opt into EPP coverage. The investment portfolio choices, implicit suggestions, advice and default options inherent in many employer-sponsored plans can reduce the costs and challenges of saving adequately on one's own. EPPs may act as a substitute for financial knowledge. However, belonging to an EPP may prompt individuals to be cognizant of their saving and to start thinking about their future retirement well-being earlier in life. This may result in greater efforts to improve financial knowledge. The results of this analysis indicate that having an EPP boosts relative investment performance. Specifically, having EPP coverage several years prior to the introduction of the TFSA is associated with an average increase in the rate of return on TFSA investments of approximately 0.5% to 1.25% over five years since the TFSA was introduced. Although this effect is statistically significant, its magnitude is economically very modest. The analysis controls for the possibility that observed and unobserved differences between individuals with and without EPPs—such as the level of education or financial literacy—may confound the results.

The results of this study inform discourse on the relationship between sponsored saving and financial performance.

1 Introduction

What is the relationship between having an employer-sponsored pension plan (EPP) and the financial performance of non-workplace investments? Economic theory provides ambiguous predictions for this relationship. For example, belonging to an EPP can help workers overcome problems of procrastination or inertia and prompt them to start thinking about their saving and financial prosperity earlier in life (Madrian and Shea 2001; O'Neill 2007). This could, in turn, lead to greater efforts to improve financial literacy. Carroll et al. (2009) showed that compelling individuals to make active decisions about saving increases wealth accumulation, especially when individuals are sufficiently financially literate to make informed decisions on their own. To the extent that EPP members are confident in their overall retirement prosperity, coverage may boost financial performance by enabling them to take more risks. This could lead to greater relative returns on investments (RROIs) compared with non-members. However, investment portfolio choices, implicit suggestions or advice, and default options that are often associated with employer-sponsorship can reduce the costs and challenges of saving adequately and serve as a substitute for financial knowledge.

The goal of this paper is to assess the relationship between EPP coverage and investment performance to provide new empirical insight into these important issues. In particular, the paper makes two key contributions. First, an approach for calculating RROIs across individuals is developed. The approach uses longitudinal administrative data on over 345,000 taxfilers from Canada. It analyzes the data on the flows of funds into and out of a tax-preferred saving vehicle, as well as the values of assets held in those accounts. Specifically, the analysis centres on the use of the tax-free savings account (TFSA), a plan that was introduced in the 2008 Canadian federal budget and that came into effect on January 1, 2009. Contributions to TFSAs are made on an after-tax basis, but investment income accrues tax-free and withdrawals are not subject to tax. These plans are comparable with, for example, the Roth individual retirement account (IRA) in the United States. However, TFSA holders may withdraw at any time—not only in retirement—without penalty.

A unique administrative feature of these plans is that the Canada Revenue Agency (CRA) collects information not only on individuals' annual contributions and withdrawals but also on their asset balances as reported directly by the issuing financial institutions. Hence, information on flows of funds and wealth are jointly observed for TFSAs in the tax data. This breadth of information is not available in Canadian administrative data for any other taxable or tax-preferred saving vehicle. The results of this analysis indicate that individuals with equivalent saving histories have heterogeneous asset balances. In addition, such differences correlate with other covariates in a way that suggests the differences are not strictly random. For example, savers with higher RROIs tend to be older, to be women and to have positive income from investments and capital gains.

The second contribution of this paper is to estimate the effect of EPP coverage on the RROI in a quasi-experimental design. Specifically, the analysis exploits variation in EPP participation rates across cohorts by sex and industry of employment—these variables being directly observed in the tax data since 2000—as instrumental variables (IVs) for EPP coverage to credibly identify the effect of interest. The IV approach controls for the possibility that observed and unobserved differences between individuals with and without EPPs—such as the level of education or financial literacy—may confound the results. This assumes participation rates vary exogenously from workers' perspective because of changes over time in the supply of EPPs across industries and workforce compositions. According to the results of this analysis, EPP coverage has a statistically significant but economically very modest positive effect on investment performance, raising the

average rate of return in other tax-preferred saving plans by approximately 0.50% to 1.25% over five years since the TFSA was introduced.[1]

This paper relates to several interconnected literatures, the first of which is on the determinants of financial investment performance and its effect on saving. For example, several other studies have looked at heterogeneity in returns to wealth, such as the use of sophisticated products for saving. These include Curcuru et al. (2005) and Campbell (2006). More generally, a large literature in economics on returns to wealth is largely motivated by the disproportionate growth of wealth at the top of the distribution in the United States over the past few decades. Earlier studies considered the roles of labour income and human capital in explaining the evolution of wealth distributions (Aiyagari 1994; Huggett 1996; Castaneda, Díaz-Giménez and Ríos-Rull 1998, 2003). More recent studies have focused on the effects of heterogeneous returns to financial and physical capital (Benhabib, Bisin and Zhu 2011; Gabaix et al. 2016; Benhabib and Bisin 2016). While these models possibly explain the rapid changes in wealth inequality similar to those observed in the data, they require such assumptions as returns being persistent over time or correlated with wealth (Fagereng et al. 2016). This raises the question of to what extent returns to wealth are systematic in practice. For example, using data from the Health and Retirement Survey in the United States, Venti and Wise (1998) showed that variation in wealth is substantial even after lifetime earned income and personal circumstances are controlled for. They also highlighted that both choice (i.e., different tastes for saving) and chance impact wealth accumulation. However, directly addressing this issue is often confounded by such problems as measurement error and low response rates in survey data (Fagereng et al. 2016). This paper provides novel insight into this issue, using administrative income tax data from Canada.

Second, this paper relates to the literature in public finance on the effects of EPPs on private saving outcomes. This research predominantly estimates the extent to which employer pension contributions crowd out saving in other taxable and tax-preferred accounts (Poterba, Venti and Wise 1994, 1995; Engen, Gale and Scholz 1994, 1996; Alessie, Kapteyn and Klijn 1997; Engen and Gale 2000; Euwals 2000; Benjamin 2003; Engelhardt and Kumar 2011; Beshears et al. 2014; Chetty et al. 2014; Messacar 2015, 2017a). As Bernheim (2002) explained, the findings from this work are controversial and mixed for several reasons including the lack of reliable data and credible estimation strategies. This is the first known study to consider the effect of EPPs on saving returns rather than saving rates.

This paper proceeds as follows. The next section summarizes key features of the institutional setting to provide context for the analysis. Section 3 describes the dataset and sample selection. Section 4 reviews the methodology for calculating the RROI from flow-of-funds and asset data from TFSAs. Section 5 presents the empirical results of the effect of EPPs on financial competence. Lastly, Section 6 concludes.

2 Institutional setting

Three common vehicles with tax advantage are available to Canadian taxfilers. First, the registered pension plan (RPP) is an employer-sponsored plan; it can be a defined benefit, defined contribution or hybrid arrangement. The employee's share of contributions to these plans is tax-deductible, and the employer's share is non-taxable. In the T1 administrative data, total RPP saving is observed indirectly through a variable called the pension adjustment (PA). For defined contribution plans, the PA is simply the sum of employer and employee contributions made in the

1. Although the magnitude of the positive effect of EPPs on the RROI is economically modest, small differences can have large long-term effects. For example, an individual who saves $5,000 annually (which was the annual contribution limit when the TFSA was introduced) for 20 years at a 4% rate of return compounded annually earns about $48,890 in cumulative interest. If this rate of return were one percentage point higher, at 5%, the cumulative interest would amount to $65,330, a non-trivial difference in the future value of accumulated wealth.

reference year. For defined benefit plans, the PA converts the pension benefit accrued over the past year of service into a present value amount, using standard actuarial assumptions. Since the PA is reported directly to employees each year, it provides them with a transparent and easy-to-understand method of knowing roughly how much they saved in an EPP over the past year.[2]

Second, the registered retirement savings plan (RRSP) is a defined contribution plan that individuals set up and maintain through financial institutions. These plans offer front-loaded incentives to save. Contributions are tax-deductible, and income is taxed at the time of withdrawing. While an RRSP encourages saving for retirement in the form of a tax deduction, funds can be withdrawn from an RRSP at any time without penalty. This differs from comparable plans in other countries. For example, the IRA imposes a direct penalty of 10% on withdrawals made by account holders under the age of 59.5. As Mawani and Paquette (2011) showed, the RRSP is often used for precautionary saving income-smoothing purposes.

Third, the TFSA was introduced in the 2008 Canadian federal budget and came into effect on January 1, 2009. Similar to the Roth IRA in the United States, the TFSA offers a back-loaded incentive to save. Contributions are made with after-tax income, but the investment income accrues tax-free and income withdrawn is not subject to tax. As such, this income does not crowd out eligibility or benefit amounts for public pensions, such as the Old Age Security. Messacar (2017*b*) showed that both the RRSP and TFSA are widely used saving vehicles by Canadian taxfilers. However, short-term—non-retirement—saving is likely more prevalent within the TFSA, as evidenced by the higher propensity to withdraw funds after only a few years. As discussed earlier, a unique feature of the TFSA is that financial institutions report the value of contributions, withdrawals and asset balances annually directly to the CRA. The asset balance is based on an assessment of fair market value (FMV). This provides a unique opportunity to observe both flow-of-funds and wealth information. This is not possible for any other saving plan without relying on household surveys.

3 Data and sample selection

This study is based on an analysis of Statistics Canada's Longitudinal Administrative Databank (LAD), spanning the years 2000 to 2013. The LAD is a panel file comprising a 20% sample of personal income tax records submitted annually to the CRA. The data provide a wide array of variables related to demographics, income, taxes and transfers, and saving in tax-preferred (registered) accounts. In addition, the dataset is augmented annually to ensure accurate cross-sectional representation.

The LAD contains detailed information about TFSA use—annual contributions, withdrawals and the FMV of the total assets held in the accounts as of December 31 of the reference year. The FMV is defined as "the dollar amount that may reasonably be expected to be exchanged between a willing buyer and a willing seller for a property" (Statistics Canada 2015, p. 149). This value is reported directly to CRA by financial institutions. This means it is independent of taxfilers' personal assessments of their financial situations, investment performance and well-being.

The following sample restrictions are imposed. First, the period is limited to the tax years 2000 to 2013 inclusive. This spans from the earliest year for which data on the worker's industry of employment—of particular importance for the empirical analysis—are available to the last year for which data were available at the time this research began. Second, because the RROI is inferred from TFSA contribution and withdrawal histories and asset balances, the sample includes only taxfilers who are observed using this saving vehicle at least once. Third, taxfilers had to be at least age 25 in 2000 and younger than age 55 in 2013. As such, the analysis centres on taxfilers

2. Refer to Morissette and Ostrovsky (2006) for a further discussion of the PA.

who were old enough to be employed but were (typically) under the age of early retirement. Fourth, taxfilers had to be observed, and observed to be employed, in every year from 2000 to 2008. The focus on employed taxfilers enables the assessment of how EPP coverage affects the RROI. Restricting to a balanced panel ensures that inter-temporal comparisons of results are not affected by attrition. These issues are discussed in more detail later in the paper. Approximately 90% of observations satisfy these requirements; hence the final sample is quite representative of all TFSA users.

This study analyzes saving outcomes for over 345,000 taxfilers. Table 1 presents descriptive statistics for the sample. Taxfilers were around age 47 on average, of whom 56% were women and 44% were men, 77% were married or in common-law relationships, 40% were unionized, and 55% belonged to an EPP.

Table 1
Descriptive statistics

	Study sample	All workers with EPP coverage	All workers
		years	
Demographics			
Age	47.0	46.4	46.2
		percent	
Women	56.5	51.1	49.7
Men	43.5	48.9	50.3
Married	76.8	77.4	76.5
Industry of employment (NAICS code)			
Agriculture, forestry, fishing, hunting (1)	1.1	0.2	1.5
Mining, quarrying, and oil and gas extraction; Utilities; Construction (2)	7.3	7.8	8.7
Manufacturing (3)	10.8	11.5	11.7
Wholesale trade; Retail trade; Transportation and warehousing (4)	16.7	13.4	18.9
Information and cultural industries; Finance and insurance; Real estate and rental and leasing; Professional, scientific and technical services; Management of companies and enterprises; Administrative and support, waste management and remediation services (5)	22.7	16.7	20.5
Educational services; Health care and social assistance (6)	20.0	25.6	17.9
Arts, entertainment and recreation; Accommodation and food services (7)	3.9	1.4	5.3
Other services (except public administration) (8)	3.4	1.7	3.8
Public administration (9)	14.2	21.8	11.7
Job characteristics			
Unionized	40.3	61.5	36.5
Has employer-sponsored pension plan	54.8	100.0	45.9
Income sources			
Has labour earnings	99.3	99.8	98.7
Has investment income	37.5	23.9	20.3
Has capital gains	15.5	9.4	7.5
Has Employment Insurance income	9.1	9.4	12.0
Has social assistance income	0.6	0.4	1.9
Has total income	99.7	99.9	99.6
		2013 constant dollars	
Conditional income levels			
Labour earnings	72,700	74,150	60,300
Investment income	1,450	900	1,150
Capital gains	4,750	2,850	4,350
Employment Insurance income	6,100	5,850	6,250
Social assistance income	6,050	4,900	6,250
Total income	81,850	78,900	66,400
Tax-free savings accounts			
Net contributions	2,250	900	800
Fair market value	11,600	4,050	3,450
		percent	
Allowances			
Has medical expense allowances	17.2	15.6	15.9

Notes: The demographic for "married" includes both those who are legally married and those in common-law relationships. To each industry of employment corresponds a one-digit North American Industry Classification System (NAICS) code. Having an employer-sponsored pension plan (EPP) is defined as having a positive pension adjustment in the reference year. The "conditional" income statistics are conditional on these values being positive. Total income refers to the Canada Revenue Agency definition of income before taxes, defined in Statistics Canada, 2015, *Longitudinal Administrative Data Dictionary 2013*. The income values are rounded to the nearest $50.
Source: Statistics Canada, Longitudinal Administrative Databank.

Because the sample is restricted to individuals who used a TFSA at least once, income levels are fairly high. For example, the average value of labour earnings in 2013 was $72,700. Further, approximately 38% of individuals in this sample had investment income and 16% had capital gains. In contrast, less than 1% received social assistance income. Thus, the sample restrictions tend to centre the analysis on taxfilers who are relatively affluent. For example, the table also shows that average total income among this study's sample was $81,850 in 2013, compared with an average of $66,400 in the full population.

Despite the income differences, the sample is well-balanced across demographic characteristics such as age, marital status, industry of employment, union status and (to a slightly lesser extent) EPP coverage. Because of the selection criteria imposed, this study's sample has comparatively high net contributions to and asset balances in TFSAs compared with the full population.

Given that the empirical analysis exploits variation in EPP coverage rates, the table also performs a balancing test between this study's sample and all EPP members. In this case, demographic and income characteristics are fairly similar, except that this study's sample has relatively high investment income and capital gains. The most notable difference is the unionization rate, which is simply the result of EPP members being more likely to be unionized. The extent to which the results of this study generalize to a wider population is left to future research. Nevertheless, this study is among the first to consider the relationship between EPPs, returns on investments and retirement saving, as well as to propose a novel empirical approach to that end.

4 Calculating the relative return on investment

The RROI in non-workplace saving is based on an analysis of the administrative data for TFSA flows of funds and asset values. Specifically, the 2013 TFSA FMV of each taxfiler is compared with the average FMV of all taxfilers who had identical contribution and withdrawal histories from the inception of this saving vehicle. Denote by A_{it} the total FMV of assets, C_{it} the total value of contributions and W_{it} the total value of withdrawals of individual i in year t, aggregated over all TFSAs held. The statistical model estimated is

$$A_{i,2013} = \alpha + \sum_{t=2009}^{2013} \left\{ \beta^t C_{it} - \delta^t W_{it} \right\} + \theta_{i,2013} \tag{1}$$

The estimates $\hat{\beta}^t$ and $\hat{\delta}^t$ (the caret denotes an estimated value) in Equation (1) reflect the average effects of each $1 contributed to ($\hat{\beta}^t$) and withdrawn from ($\hat{\delta}^t$) a TFSA in year t on the FMV of assets in the terminal year within the sample. The effect of each $1 saved is permitted to vary by year. This is especially relevant because the TFSA was introduced around the time of the global economic recession of 2008–2009. In addition, the method does not impose any assumptions about the average population-wide rate of return, instead using a flexible parametric approach.

To obtain a measure of relative financial performance, the (standard normalized) residual from Equation (1) is calculated, as follows:

$$\Theta_{i,2013} \equiv \frac{\hat{\theta}_{i,2013} - \mathrm{E}\left[\hat{\theta}_{i,2013}\right]}{\sqrt{\mathrm{Var}\left[\hat{\theta}_{i,2013}\right]}} \tag{2}$$

Hence, $\Theta_{i,2013}$ is an individual-specific relative performance measure that—by construction—is not explained by contribution and withdrawal histories. To control for outlier observations from the prediction regression, $\hat{\theta}_{i,2013}$ is truncated at the 0.1 and 99.9 percentiles. The choice of truncation thresholds has no bearing on the results of this study. Four main factors likely explain differences in the RROI across individuals:

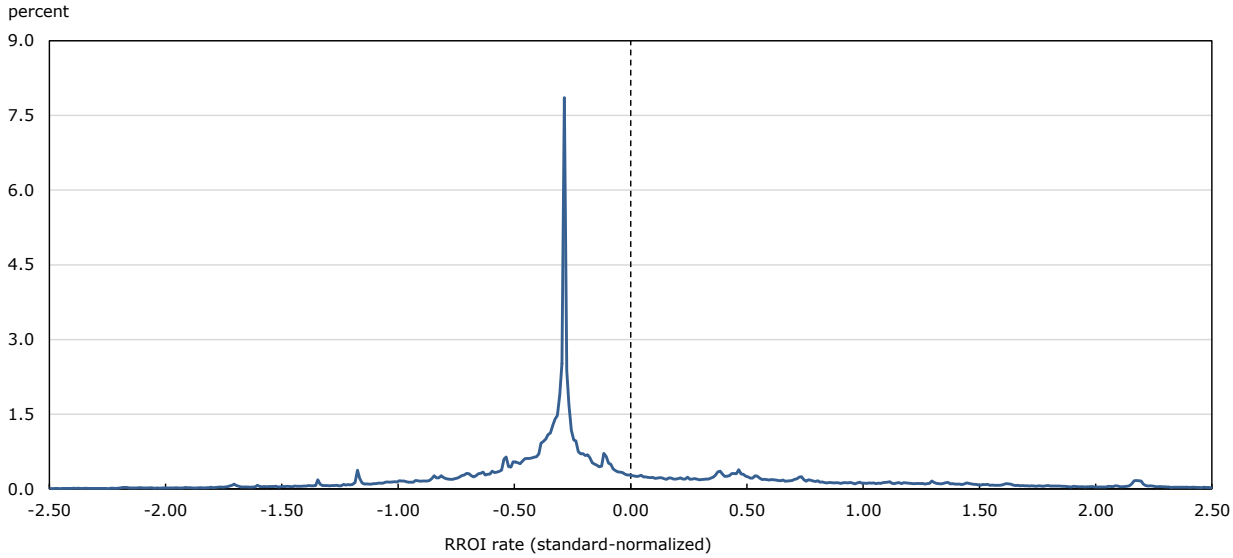
(1) differences in the assessment of FMV across institutions;
(2) idiosyncratic variation in the returns to wealth;
(3) differences in investors' financial competence;
(4) differences in investors' risk-taking behaviour.

Formally, this can be modelled as $\Theta_{it} \equiv f\left(X_{it}, Z_{it}, \epsilon_{it}\right)$, where X_{it} represents the observed variables, Z_{it} the unobserved variables and ϵ_{it} the idiosyncratic variables. The issue of variation in financial institutions' assessments is safely ignored in this scenario. The Canadian financial sector comprises mostly a small number of large institutions—which are in good positions to assess the values of assets—compared with other countries.

Financial competence refers to the "extent to which individuals' financial choices align with those they would make if they properly understood their opportunity sets" (Ambuehl, Bernheim and Lusardi 2014, p. 1). This can include knowledge of optimal strategies (e.g., diversification) and sophisticated products for saving. Savers are permitted to hold a wide range of investments in TFSAs including cash, Guaranteed Investment Certificates, bonds, stocks and mutual funds. Use of financial advice and planners can also affect the relative performance of investments, although the extent to which advice is a substitute for financial knowledge and literacy is not always clear. Several studies have found that the two are complements (United States Government Accountability Office [GAO] 2011; Collins 2012), perhaps because advice without knowledge can lead to over-investment in products managed by the advisers. Risk preferences directly affect relative performance: the average rate of return on investments increases with the level of risk.

Chart 1 plots the distribution of $\Theta_{i,2013}$ over a domain of five standard deviations. This analysis has two distinguishing features. First, the distribution spikes where a small fraction of the sample—approximately 8%—has asset values that are about equal to the sum of contributions minus withdrawals. For robustness, the analysis considers how the main results of this study vary with the exclusion of those savers. Second, the remainder of savers demonstrate significant heterogeneity.

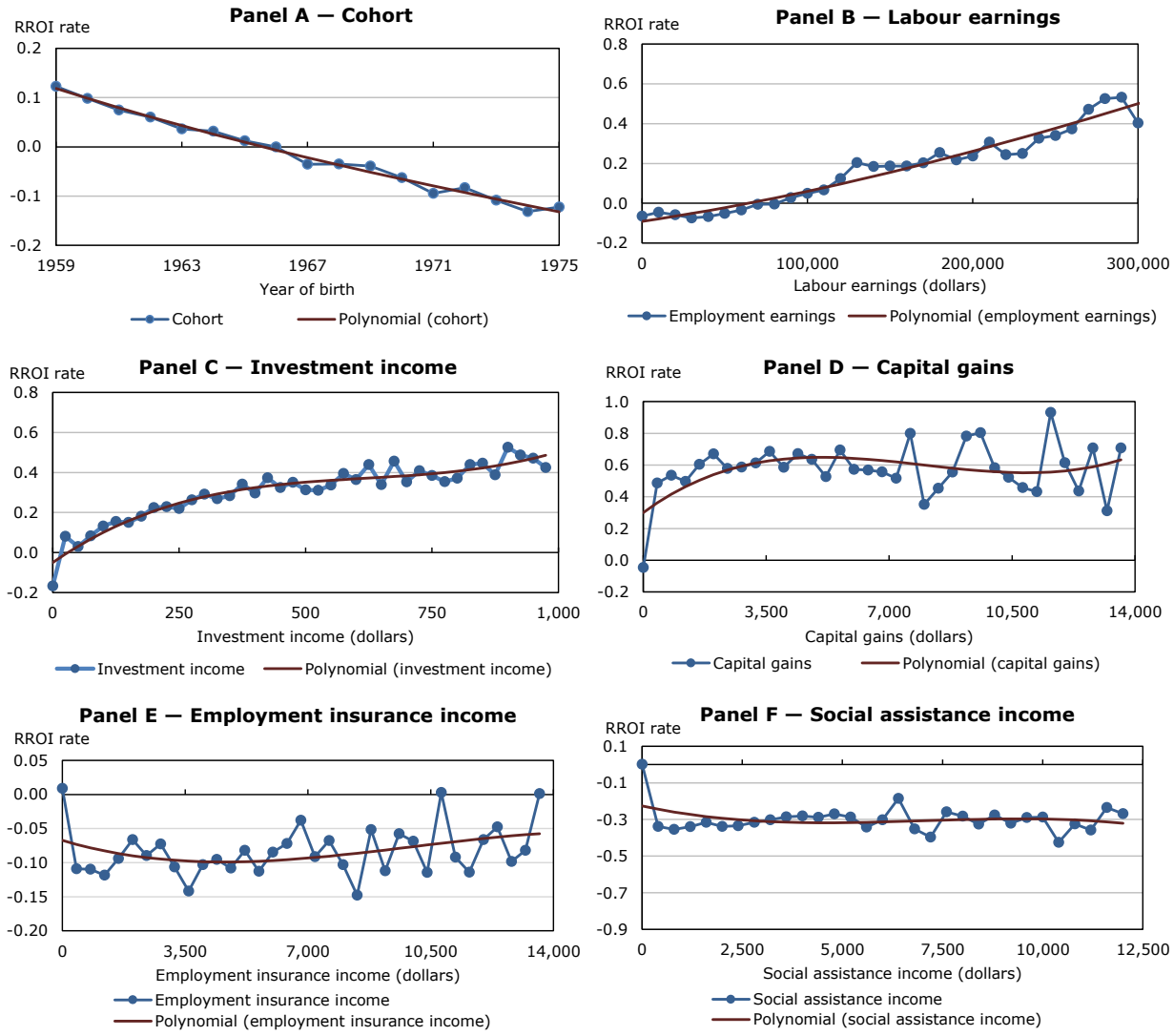
Chart 1
Distribution of the RROI rate



Note: This chart plots the distribution of the relative return on investment (RROI) rate, calculated from Equations (1) and (2).
Source: Statistics Canada, Longitudinal Administrative Databank.

To explore how other factors affect $\Theta_{i,2013}$, Chart 2 plots the average value of the RROI across age groups (by year of birth) and various measures of income. This analysis indicates that the RROI increases with age, labour earnings and investment income and is higher for those with capital gains than for those without capital gains. In contrast, the RROI is lower for those with Employment Insurance (EI) and social assistance incomes than for those without these sources of income. Individuals in financial need appear to under-succeed in their investments.

Chart 2
Effects of age and income on the relative return on investment (RROI) rate



Notes: This chart plots the relationships of age (by year of birth) and various sources of income with the relative return on investment (RROI) rate. Each dot corresponds to the average value of the RROI within an age group or an income bin. The bin widths are as follows: $10,000 for labour earnings; $25 for investment income; $400 for capital gains, Employment Insurance income and social assistance income.
Source: Statistics Canada, Longitudinal Administrative Databank.

A limitation of this analysis is that the importance of various determinants of the RROI cannot be separately identified. In particular, financial competence and risk preferences jointly affect the RROI but cannot be separately discerned. The tax data provide detailed information on taxfilers' total contributions to, withdrawals from and assets held in TFSAs each year, given that this information is reported to the central tax authority. However, specific details about the taxfilers' stock market participation, investment choices or portfolio shares are unobserved. The empirical analysis controls directly for taxfilers' levels of investment income and capital gains to absorb differences across individuals in portfolio characteristics outside of TFSAs and overall stock market participation. However, a direct inspection of the effects of EPPs on risk-taking behaviour versus financial competence is outside the scope of this study and represents a promising topic for future research.

5 Effect of employer-sponsored pension plans on the relative return on investment

This section presents results of the investigation into how the RROI depends on EPP coverage. As stated earlier, the theory provides an ambiguous prediction of how this relationship should look. For example, employer sponsorship may be a substitute for financial competence. Suggestions, advice, defaults and other "nudge" mechanisms implicit in many EPPs may result in workers using other financial services less and not investing in their own financial knowledge adequately. However, EPPs may complement financial knowledge, to the extent that these programs prompt workers to start thinking about their retirement saving earlier in life, recognize the benefits of saving and otherwise plan for the future. Workers who know they have reliable EPPs might be more inclined to take on riskier investments, in turn affecting their relative investment performance.

The statistical model estimates how—for different values of t—pension coverage, EPP_{it}, for individual i in year t affects the RROI $\Theta_{i,2013}$. The regression equation is

$$\Theta_{i,2013} = \omega + \pi EPP_{it} + X'_{i,2013}\gamma + \mu_{i,2013} \quad (3)$$

where EPP_{it} is an indicator of pension coverage (which takes the value of "1" if yes and "0" otherwise), $X_{i,2013}$ is a vector of observed covariates and $\mu_{i,2013}$ is the error term. Since $\Theta_{i,2013}$ is computed according to the value of assets in 2013, the covariates are based on those observed in the same year. This vector comprises the following:

- cohort fixed effects;
- sex;
- marital status;
- province or territory of residence;
- earnings;
- union status;
- industry of employment (based on the North American Industry Classification System [NAICS] at the two-digit level);
- investment income;
- capital gains;
- EI income;
- social assistance;
- total income
- medical expense allowances.

The parameter of interest, π, is the effect of EPP coverage on the RROI; the model gives $\hat{\pi} > 0$ if the two are substitutes and $\hat{\pi} > 0$ if they are complements.

5.1 Identification strategies

Estimating Equation (3) by ordinary least squares (OLS) is confounded by the possibility that workers sort into firms with EPP coverage according to their underlying preferences for saving (Ippolito 1997). For example, workers who desire to not invest in financial knowledge—and who are, as a result, more likely to yield low returns on their investments—but who value their future retirement prosperity will be more inclined to obtain an EPP. This causes downward bias of the OLS estimator ($\hat{\pi} < \pi$). Two methods are employed to overcome this issue: (1) exploit the balanced panel nature of the data and (2) use an IV for EPP coverage.

The longitudinal feature of the data is exploited using an indicator of whether each worker had EPP coverage at a specific time in the past. This approach addresses the issue of endogeneity by analyzing the model in a dynamic context and inferring causality from the order of operation. Given that the TFSA was introduced in 2009, the indicator of pension coverage used is from 2008 or earlier. Specifically, Equation (3) is estimated several times, each using a separate indicator of pension coverage from several years from 2000 to 2008, i.e., $t \in \{2000, 2004, 2008\}$. The earliest year is set to 2000 because this corresponds to the first year for which data on the industry of employment—based on the NAICS code—are available. Repeating the analysis for the other years from 2000 to 2008 yields comparable results and is not shown for compactness.

A limitation of this approach is that it does not resolve individual-specific effects that may bias the estimator but that are time-invariant. The analysis employs an IV approach to resolve this issue, exploiting differences in the availability of EPPs across cohorts by sex and industry of employment. As Morissette and Drolet (2001) showed, the share of workers covered by EPPs in Canada has changed over the last several decades, and these trends are starkly different for men and women. Individuals from different cohorts, sexes and industries did not all face similar likelihoods of belonging to an EPP in the workplace—through no control of their own—because, to some extent, coverage of these provisions is set by employers. Many firms in Canada and other countries have moved away from supplying these benefits to reduce operating costs in response to not only changing demographics but also pressures from international competition in the wake of globalization. These factors vary by industry. The first-stage regression for this cohort-level analysis exploits such variation in a first-stage regression, as follows:

$$EPP_{it} = \upsilon + \{SEX \times INDUSTRY \times COHORT\}_{it}' \lambda + X_{i,2013}' \phi + \xi_{it} \quad (4)$$

where $\{SEX \times INDUSTRY \times COHORT\}_{it}$ is a vector of variables that represent a cohort running variable (continuous by year of birth) but interacted with a set of variables, indicating each sex-by-industry group.[3] The vector of covariates, $X_{i,2013}$, is the same as that defined above, such that the fixed effects for sex, cohort and industry of employment in 2013 continue to be included directly in both the first-stage and second-stage regressions. In contrast, the industry variable used to construct the excluded instruments are from the year $t \in \{2000, 2004, 2008\}$ on the basis that the incidence of being covered by an EPP in a given year is a function of the industry of employment in that same year.

The parameter vector λ is well identified in part from this lagged industry variable. The results of this analysis are robust to using cohort fixed effects instead of a cohort running variable. The latter approach was ultimately chosen because permitting the cohort variable to be continuous lends itself to an inspection of the instruments' validity. To this end, Table A.1 in Appendix A shows the share of the workforce covered by an EPP across cohorts, by (lagged) industry and sex. For both men and women, the likelihood of having a pension across industries and time is substantially heterogeneous. As expected, some industries—such as public administration, education services, health care and social assistance—tend to have high coverage rates. This likely arises because these industries are also highly unionized. In contrast, agriculture has the lowest incidence of EPP coverage for both sexes.

The table also shows the change in EPP coverage over time, as well as the difference between men and women in this change over time (i.e., the "difference-in-differences" in EPP coverage). In industries that initially had the largest gaps in coverage (e.g., mining, quarrying, oil and gas extraction; utilities; construction and manufacturing), women experienced the largest increases in

3. This specification includes both first-level and second-level interactions of sex and industry with the cohort running variable.

coverage relative to men. On balance, the disparity in EPP coverage between men and women appears to be diminishing across cohorts. To the extent that these trends are driven by factors independent of each individual worker's preference for having pension coverage and are instead a function of supply side factors, then Equation (4) is a valid first-stage regression for estimating the effect of EPPs on the RROI. (Since this analysis is restricted to TFSA users, the trends for these workers may differ from population-wide trends. As shown in Table A.2, this does not appear to be the case.)

The identification strategy proposed may be confounded by such factors as men and women moving into industries that are more likely to offer pensions at different rates. To address this possibility, the analysis was also repeated using a variant of Equation (4) that identifies solely off of variation in the incidence of workplace pension coverage across cohorts and lagged industries of employment. The results of this approach were very similar to the ones presented below. This suggests the identification strategy is exploiting the exogenous, supply-side-driven variation in lagged workplace pension coverage, as intended, and is not significantly confounded by changes in workers' underlying preferences for workplace pension coverage.

5.2 Results

The results of the OLS estimates of Equation (3) are shown in Table 2. The analysis is repeated several times using indicators of EPP coverage from 2008—corresponding to a 5-year lag relative to the year in which the RROI was constructed, in 2013—and from 2000—corresponding to a 13-year lag. The predicted "treatment effect" in the first row of data is the effect of interest $\hat{\pi}$. Standard errors are clustered by individual to control for heteroscedasticity in the errors. Statistical inferences are nearly identical to clustering by sex, cohort and lagged industry—this being the level of variation used in the identification. The individual-specific clustering "nests" the clustering at the sex, cohort, and lagged-industry level; hence results are reported using the former approach.

A first finding is that having EPP coverage leads to a higher RROI, indicated by the sign and significance of the treatment effect. On balance, EPP coverage leads to a 0.012 standard deviation increase in the RROI according to an average of the estimates across all columns. However, the magnitude of this effect is very modest. The standard deviation of the (unstandardized) RROI is approximately $4,950. Hence EPP coverage results in a monetary gain of approximately $60. The average FMV is nearly $11,600. This means that EPP coverage boosts the rate of return by around 0.51% over five years since the TFSA was introduced.

Table 2
Estimated effects of EPP coverage

	Ordinary least squares			Instrumental variables		
	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)
	coefficient estimates					
Treatment						
Had an EPP	0.007 †	0.014 ***	0.014 ***	-0.001	0.029 **	0.028 ***
Demographics						
Married	0.037 ***	0.036 ***	0.036 ***	0.037 ***	0.036 ***	0.036 ***
Job characteristics						
Unionized	-0.010 *	-0.011 **	-0.010 *	-0.007	-0.013 **	-0.011 *
Income						
Labour earnings	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***
Investment income	0.039 ***	0.039 ***	0.039 ***	0.038 ***	0.039 ***	0.039 ***
Capital gains	0.002 ***	0.002 ***	0.002 ***	0.002 ***	0.002 ***	0.002 ***
EI income	-0.002 **	-0.002 **	-0.002 **	-0.002 **	-0.002 *	-0.002 **
SA income	-0.019 ***	-0.019 ***	-0.019 ***	-0.019 ***	-0.019 ***	-0.019 ***
Total income	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***
Allowances						
Medical allowances	0.005 **	0.005 **	0.005 **	0.005 **	0.005 **	0.005 **
	statistics					
Statistics						
R-squared	0.031	0.031	0.031	0.031	0.031	0.031
Observations	345,143	345,143	345,143	345,143	345,143	345,143
F-statistic	…	…	…	253.8	553.1	997.4

… not applicable

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

† significantly different from reference category ($p < 0.10$)

Notes: Total income refers to the Canada Revenue Agency definition of income before taxes, defined in Statistics Canada, 2015, *Longitudinal Administrative Data Dictionary 2013* . The F-statistic of the excluded instrument is reported for the instrumental variables regressions. The effect of the employer-sponsored pension plan (EPP) coverage on the relative return on investment rate is based on results from both the ordinary least squares and instrumental variables estimators, along with the coefficient estimates for selected covariates. (The others listed in text are included in the model but are not reported for compactness). The instrumental variables regressions identify the treatment effect by exploiting the differential trends in EPP eligibility across cohorts, by sex and industry of employment. Standard errors are clustered by individual. EI: employment insurance; SA: social assistance.

Source: Statistics Canada, Longitudinal Administrative Databank.

The second finding is that the estimated treatment increases with the lag. That is, having EPP coverage earlier raises the RROI to a greater extent. For those who had a pension 8 or 13 years prior, the implied increase in the rate of return is 0.60% over this time period. For those who had coverage 5 years prior, the corresponding implied rate of return is 0.30%. Third, the effects of the reported covariates are consistent with expectations. This supports the validity of the return on investment measure. In particular, the RROI increases with labour earnings, investment income, capital gains and total income, but it tends to decrease with EI and social assistance income. This is consistent with the inspection of these relationships shown in Chart 2, as discussed earlier.

To address concerns that the dynamic OLS estimator does not resolve issues of endogeneity resulting from time-invariant unobserved factors, Table 2 reports the results of the IV analysis from Equation (3). The analysis exploits differences in EPP eligibility across cohorts by sex and industry of employment. Despite this augmentation of the analysis, the results are qualitatively similar to the findings obtained from the OLS estimator, notwithstanding the fact that the treatment effect is insignificantly different from zero for the first few lags. In this case, the average of the

effect of EPPs across all columns is 0.019, which corresponds to an implied gain in the RROI of approximately 0.81%, and the maximum premium is 1.24%, over the relevant period of study. Moreover, the predicted effects of the covariates are nearly identical in the OLS and IV regressions. The F-statistics from the tests of excluded instruments suggest that the cohort-level analysis performs well in explaining variation in EPP coverage across groups.[4]

EPP coverage appears to boost the RROI by as much as approximately 0.50% to 1.25% over the longer term, i.e., spanning five years since the TFSA was introduced. To assess the robustness of these results, Table 3 presents estimation results from three variants of the baseline OLS and IV analyses. In particular, Panel A implements the model excluding all sources of income except labour earnings, given that investment income and capital gains are likely correlated with TFSA use. Panels B and C estimate the model including a sequence of lagged variables for labour earnings and total income, where the number of lags in these variables is equal to the lag used in the identification in each case. Consequently, the effect of EPP coverage on the RROI is conditional on histories of labour earnings or total income received by workers over the relevant period. The results from these robustness checks are all consistent with the baseline findings. Controlling for histories of labour earnings or total income tends to dampen the effect slightly, but the fact that EPP coverage increases the RROI by a statistically significant but economically modest amount remains unchanged. Table A.3 of Appendix A shows that the baseline results are very similar, excluding the mass of individuals with RROIs close to the mode. The distribution of the RROI in this case is presented in Chart A.1.

4. A test of the validity of the IV estimator is carried out in Appendix B. Specifically, a concern for the identification is that past industry of employment is correlated in some way with the RROI for unobserved reasons. To test this hypothesis, a set of lagged industry indicators was regressed on the RROI for individuals **not** covered by an EPP at all from 2000 to 2013. These individuals could not have experienced any indirect effect of past industry of employment on the RROI through its effect on EPP coverage. The results, shown in Table B.1, suggest that the industry of employment has a negligible effect on the RROI, especially for sufficiently large lags.

Table 3
Robustness checks of the estimated effects of EPP coverage

	Ordinary least squares			Instrumental variables		
	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)
	coefficient estimates					
Panel A – Earnings only						
Treatment						
Had an EPP	-0.006	0.009 *	0.016 ***	-0.012	0.022 *	0.024 **
	statistics					
Statistics						
R-squared	0.019	0.019	0.019	0.019	0.019	0.019
Observations	345,143	345,143	345,143	345,143	345,143	345,143
F-statistic	…	…	…	255.2	555.1	999.2
	coefficient estimates					
Panel B – Includes lagged labour earnings						
Treatment						
Had an EPP	0.004	0.011 **	0.012 ***	-0.011	0.018 †	0.017 *
	statistics					
Statistics						
R-squared	0.032	0.033	0.034	0.032	0.033	0.034
Observations	345,143	345,143	345,143	345,143	345,143	345,143
F-statistic	…	…	…	251.9	538.6	965.7
	coefficient estimates					
Panel C – Includes lagged total income						
Treatment						
Had an EPP	0.007 †	0.014 ***	0.014 ***	-0.007	0.020 †	0.018 *
	statistics					
Statistics						
R-squared	0.033	0.033	0.034	0.033	0.033	0.034
Observations	345,143	345,143	345,143	345,143	345,143	345,143
F-statistic	…	…	…	253.5	543.3	972.8

… not applicable

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

*** significantly different from reference category ($p < 0.001$)

† significantly different from reference category ($p < 0.10$)

Notes: Panel A implements the model excluding the variables for investment income, capital gains, Employment Insurance income, social assistance income and total income. Panels B and C implement the model controlling for lagged labour earnings and total income, where the number of variable lags is equal to the number of lags used in the identification. Total income refers to the Canada Revenue Agency definition of income before taxes, defined in Statistics Canada, 2015, *Longitudinal Administrative Data Dictionary 2013* . The effect of the employer-sponsored pension plan (EPP) coverage on the relative return on investment rate is based on results from both the ordinary least squares and instrumental variables estimators, along with the coefficient estimates for selected covariates (the others listed in text are included in the model but are not reported for compactness). The instrumental variables regressions identify the treatment effect by exploiting the differential trends in EPP eligibility across cohorts, by sex and industry of employment. Standard errors are clustered by individual.

Source: Statistics Canada, Longitudinal Administrative Databank.

6 Conclusion

This paper provides new insight into the relationship between employer-sponsored pension plan (EPP) coverage and investment performance in a non-workplace tax-preferred savings account. In particular, the paper uses administrative data on over 345,000 taxfilers from Canada to make two key contributions. First, a method was proposed for inferring the relative return on investment (RROI) according to an analysis of returns to wealth data across individuals with identical saving histories. The results of this analysis show that investment performance is substantially heterogeneous across individuals. Second, having an EPP at some time in the past was found to raise performance in non-workplace saving by approximately 0.50% to 1.25% over five years since the tax-free savings account (TFSA) was introduced. This could arise because

1. EPPs serve as a complement to financial knowledge by prompting individuals to start thinking about saving earlier in life;
2. having an EPP enables individuals to invest in riskier assets and doing so may have higher expected returns.

The findings are robust to augmenting the analysis using an instrumental variable approach that exploits variation in the availability of EPPs across cohorts by sex and industry of employment to control for the possibility that observed and unobserved differences between individuals with and without EPPs may confound the results. However, this result is based on an analysis of returns on investments within TFSAs, which may be a "marginal" saving vehicle for some workers. Given that the TFSA was recently introduced, in 2009, and that contribution limits to these plans were around $5,000 per year over the relevant period of analysis, TFSAs could be used for last dollars of saving and RROIs could differ systematically for the first dollars saved. For example, TFSAs may attract higher-risk investments. To some extent, this issue is mitigated by conditioning the analysis only on TFSA users and expressing returns on investments as a relative measure. However, the RROI estimated herein may be an upper bound on the RROI on all saving. The extent to which the results of this study generalize to returns on a broad portfolio of investments remains an important topic for future research.

Taken together, the findings suggest that the gradual decline in EPP coverage in some industries over the past several decades could have led to a corresponding decline in non-workplace risk-taking or investment performance and, as a result, may have even contributed to the aggregate decline in private saving rates. The extent to which new policies and programs that "nudge" individuals in the direction of saving more (Madrian and Shea 2001; Choi et al. 2003; Bernheim, Fradkin and Popov 2015) subsequently spill over to improve financial knowledge remains to be determined. Such interventions often permit individuals to remain passive rather than requiring active choice and attention (Chetty et al. 2014). Evidence on the effectiveness of financial literacy training in improving saving outcomes is mixed (Lusardi and Mitchell 2014). However, the results of this study are consistent with the notion that programs aimed at directly improving saving outcomes—for example, by simplifying the process of making complex financial decisions (Beshears et al. 2013)—are desirable.

Appendix A

Table A.1
EPP coverage in 2013 by cohort, sex and industry of employment from the sample of TFSA users, LAD data

	Cohort (year of birth)																	Difference, 1975 minus 1959	Difference-in-differences, women minus men
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975		
	percent																		
Panel A – Women																			
NAICS code																			
1	7.7	8.2	9.4	7.7	9.5	4.2	13.2	7.0	8.5	9.4	10.0	7.3	7.6	9.7	8.5	7.2	9.4	1.7	3.9
2	35.5	33.7	35.6	31.8	39.6	37.1	36.1	30.1	36.7	32.7	33.7	33.3	35.7	35.1	37.2	32.8	38.2	2.7	6.0
3	41.0	44.6	44.8	43.8	44.2	44.7	43.6	43.9	42.6	43.0	41.3	44.5	45.4	48.4	48.6	45.0	48.9	7.9	11.6
4	35.2	34.3	35.6	34.5	33.9	36.6	35.5	35.8	34.8	34.4	36.4	35.5	35.2	36.6	35.1	34.7	36.2	0.9	3.5
5	48.3	50.4	50.2	47.9	48.4	47.7	48.4	48.0	48.7	48.3	47.8	46.4	47.8	46.3	47.3	49.2	46.9	-1.4	-0.1
6	72.6	72.6	69.6	71.1	71.1	71.7	69.6	69.5	68.3	67.4	66.1	66.7	67.6	64.8	67.1	68.3	68.9	-3.8	-0.3
7	17.0	16.3	14.1	13.5	14.0	13.4	11.7	16.1	15.2	15.6	16.3	12.7	14.6	14.7	15.0	12.4	15.3	-1.7	-4.5
8	27.3	25.6	26.4	28.3	22.7	24.5	22.8	21.8	23.9	23.9	24.8	22.9	24.9	20.5	21.1	25.2	23.7	-3.5	-3.7
9	88.6	90.9	89.4	90.5	90.9	89.0	90.1	89.4	88.7	91.0	87.7	87.7	89.7	87.4	89.5	89.2	87.5	-1.1	-4.6
Panel B – Men																			
NAICS code																			
1	10.0	11.7	9.3	12.7	11.3	8.4	8.8	8.3	9.1	11.5	9.3	13.1	12.3	12.7	10.0	14.3	7.8	-2.2	…
2	54.0	52.9	53.3	54.5	52.2	52.2	52.5	52.0	50.1	49.5	52.4	52.3	49.1	48.4	50.3	48.7	50.7	-3.3	…
3	57.6	57.1	57.8	56.1	55.6	58.1	55.7	55.1	53.9	54.7	54.9	57.3	57.7	57.8	58.1	55.0	54.0	-3.7	…
4	45.7	44.7	44.4	43.4	42.3	44.2	44.1	44.5	43.6	41.4	42.4	40.1	42.9	41.9	42.8	44.1	43.2	-2.6	…
5	44.4	43.5	43.4	43.3	44.1	43.2	45.2	44.6	43.3	44.2	45.7	45.0	45.7	44.0	47.5	46.2	43.2	-1.2	…
6	79.2	77.9	77.7	77.3	77.5	74.6	76.7	76.4	75.3	72.4	71.5	72.8	73.2	74.7	76.6	73.0	75.7	-3.5	…
7	18.2	18.1	19.1	17.9	19.6	20.7	18.1	23.1	23.1	15.6	20.9	21.4	24.5	22.9	21.3	16.3	21.0	2.8	…
8	26.1	27.0	30.4	31.6	25.8	24.9	27.8	26.8	26.0	25.8	21.9	25.9	23.7	25.1	31.7	27.9	26.2	0.1	…
9	90.4	92.0	92.6	92.0	92.8	91.6	93.1	93.8	93.1	93.7	92.7	94.3	94.0	93.6	94.6	94.4	93.9	3.6	…

… not applicable

Notes: This table shows the likelihood of belonging to an employer-sponsored pension plan (EPP) by sex, cohort (year of birth) and industry of employment (one-digit North American Industrial Classification System [NAICS] code). The NAICS codes are as follows: 1: Agriculture, forestry, fishing and hunting; 2: Mining, quarrying, oil and gas extraction; utilities; construction; 3: Manufacturing; 4: Wholesale trade; retail trade; transportation and warehousing; 5: Information and cultural industries; finance and insurance; real estate and rental and leasing; professional, scientific and technical services; management of companies and enterprises; administrative and support, waste management and remediation services; 6: Educational services; health care and social assistance; 7: Arts, entertainment, recreation; accommodation and food services; 8: Other services (except public administration); 9: Public administration. The "difference" value is the calculated difference between the 1975 and 1959 cohorts, by sex and NAICS code. The "difference-in-differences" value is the corresponding difference between men and women for each cohort-level difference. TFSA: tax-free savings account.

Source: Statistics Canada, Longitudinal Administrative Databank (LAD).

Table A.2
EPP coverage in 2013 by cohort, sex and industry of employment from the full-sample LAD data

	Cohort (year of birth)																	Difference, 1975 minus 1959	Difference-in-differences, women minus men
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975		
	percent																		
Panel A – Women																			
NAICS code																			
1	6.7	7.1	9.2	8.2	7.5	2.9	7.0	7.6	10.4	7.3	6.8	5.4	5.5	8.1	7.7	5.9	8.0	1.4	6.0
2	30.8	31.7	31.7	28.9	31.9	31.3	31.8	30.1	29.4	30.2	27.7	28.7	29.3	24.2	29.9	26.7	29.3	-1.5	3.8
3	37.2	38.7	39.9	38.4	38.2	40.1	38.1	38.1	36.9	38.2	36.4	37.6	35.7	39.4	37.3	38.0	37.6	0.5	5.1
4	31.8	31.2	32.3	30.0	31.1	31.8	30.6	29.8	30.2	29.6	29.7	28.2	30.0	30.0	29.1	27.0	28.0	-3.8	1.8
5	42.4	42.7	42.6	41.6	40.7	40.3	40.6	40.1	39.7	38.0	38.1	37.6	38.1	37.7	37.7	37.3	37.8	-4.6	-2.3
6	67.8	67.8	67.0	67.3	66.8	66.4	64.6	63.8	63.5	62.2	61.8	61.6	62.3	60.9	61.0	61.9	60.9	-6.9	2.1
7	11.7	11.3	10.9	9.9	10.6	10.1	9.2	11.9	10.9	10.5	10.8	9.7	9.4	10.1	10.3	8.9	8.2	-3.5	1.4
8	23.9	22.9	22.1	23.1	20.4	20.2	19.2	18.9	19.8	20.3	18.3	18.5	18.2	18.7	17.4	18.4	17.9	-6.0	-3.2
9	85.4	86.9	86.6	87.3	86.8	84.7	85.4	84.9	84.1	83.6	83.3	82.6	81.9	82.2	82.6	82.2	81.7	-3.7	-3.1
Panel B – Men																			
NAICS code																			
1	9.5	8.3	7.9	9.5	8.4	6.2	7.8	7.4	9.6	7.2	5.9	6.7	6.5	6.8	6.9	6.4	4.9	-4.6	…
2	47.0	45.1	45.2	46.0	46.4	45.3	44.0	44.5	43.0	42.6	43.2	42.1	41.9	41.0	40.8	40.7	41.7	-5.3	…
3	51.0	50.9	51.5	50.2	49.0	49.0	48.6	48.2	46.5	46.1	46.6	45.4	47.1	46.3	46.3	45.2	46.3	-4.7	…
4	37.5	37.0	36.8	36.1	34.2	35.9	34.7	34.3	34.6	32.9	32.9	32.2	32.9	32.1	33.0	31.8	31.9	-5.6	…
5	36.4	35.4	37.1	34.8	35.4	34.6	35.8	34.3	34.3	33.9	35.3	35.2	35.2	34.9	35.0	34.7	34.1	-2.3	…
6	75.5	75.1	73.8	74.0	73.9	72.7	72.8	72.7	70.6	69.4	68.8	68.5	69.2	70.0	69.5	68.2	66.5	-9.0	…
7	15.5	16.4	15.2	13.4	14.2	14.0	13.9	15.5	13.8	13.1	14.3	13.7	15.1	15.4	13.4	13.1	10.6	-4.9	…
8	22.7	21.8	22.8	23.1	20.9	21.8	20.3	21.7	20.4	20.7	20.9	20.5	20.3	19.2	19.8	20.2	19.9	-2.8	…
9	87.0	86.8	87.6	87.1	88.4	87.1	88.0	86.8	85.5	86.8	86.7	87.3	87.2	85.7	86.8	87.5	86.4	-0.6	…

… not applicable

Notes: This table shows the likelihood of belonging to an employer-sponsored pension plan (EPP) by sex, cohort (year of birth) and industry of employment (one-digit North American Industrial Classification System [NAICS] code). The NAICS codes are as follows: 1: Agriculture, forestry, fishing and hunting; 2: Mining, quarrying, oil and gas extraction; utilities; construction; 3: Manufacturing; 4: Wholesale trade; retail trade; transportation and warehousing; 5: Information and cultural industries; finance and insurance; real estate and rental and leasing; professional, scientific and technical services; management of companies and enterprises; administrative and support, waste management and remediation services; 6: Educational services; health care and social assistanc; 7: Arts, entertainment, recreation; accommodation and food services; 8: Other services (except public administration); 9: Public administration. The "difference" value is the calculated difference between the 1975 and 1959 cohorts, by sex and NAICS code. The "difference-in-differences" value is the corresponding difference between men and women for each cohort-level difference.
Source: Statistics Canada, Longitudinal Administrative Databank (LAD).

Table A.3
Estimated effects of EPP coverage, excluding the mass near the mode

	Ordinary least squares			Instrumental variables		
	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)
	coefficient estimates					
Treatment						
Had an EPP	0.006	0.019 ***	0.023 ***	-0.004	0.032 ***	0.031 ***
Demographics						
Married	0.040 ***	0.039 ***	0.039 ***	0.039 ***	0.039 ***	0.039 ***
Job characteristics						
Unionized	-0.010 †	-0.012 *	-0.011 *	-0.007	-0.014 **	-0.012 *
Income						
Labour earnings	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***
Investment income	0.037 ***	0.037 ***	0.037 ***	0.037 ***	0.037 ***	0.037 ***
Capital gains	0.002 ***	0.002 ***	0.002 ***	0.002 ***	0.002 ***	0.002 ***
EI income	-0.003 **	-0.003 **	-0.003 **	-0.003 **	-0.003 **	-0.003 **
SA income	-0.027 ***	-0.027 ***	-0.027 ***	-0.027 ***	-0.026 ***	-0.027 ***
Total income	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***	0.001 ***
Allowances						
Medical allowances	0.005 **	0.005 **	0.005 **	0.004 **	0.005 **	0.005 **
	statistics					
Statistics						
R-squared	0.029	0.029	0.029	0.029	0.029	0.029
Observations	29,074	29,074	29,074	29,074	29,074	29,074
F-statistic	…	…	…	211.1	462.7	834.8

… not applicable

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

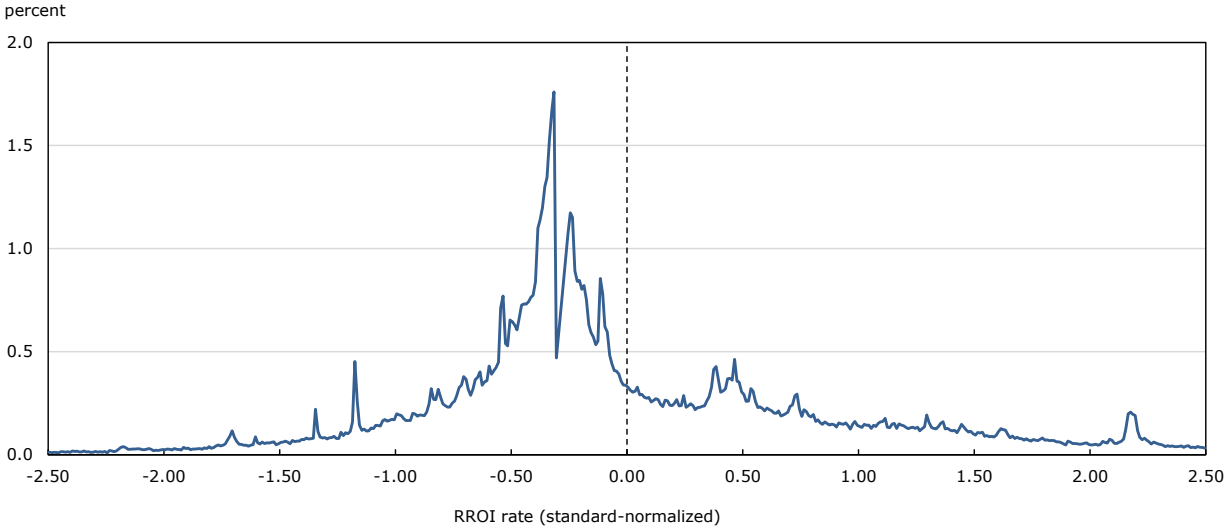
*** significantly different from reference category ($p < 0.001$)

† significantly different from reference category ($p < 0.10$)

Notes: Total income refers to the Canada Revenue Agency definition of income before taxes, defined in Statistics Canada, 2015, *Longitudinal Administrative Data Dictionary 2013* . The effect of employer-sponsored pension plan (EPP) coverage on the relative return on investment rate is presented according to results from the ordinary least squares and instrumental variables estimators, along with the coefficient estimates for selected covariates. (The others listed in text are included in the model but are not reported for compactness.) The instrumental variables regressions identify the treatment effect by exploiting the differential trends in EPP eligibility across cohorts, by sex and industry of employment. Standard errors are clustered by individual. EI: Employment Insurance; SA: social assistance.

Source: Statistics Canada, Longitudinal Administrative Databank.

Chart A.1
Distribution of the RROI rate, excluding the mass near the mode



Note: This chart plots the distribution of the relative return on investment (RROI) rate calculated from Equations (1) and (2) and excluding individuals within 0.05 standard deviations of the mode of the distribution (54,389 individuals or approximately 15.8% of the initial sample).
Source: Statistics Canada, Longitudinal Administrative Databank.

Appendix B

A potential concern with the instrumental variable approach is that industry of employment in the past—the lagged industry indicator used as an excluded instrument for identification—may be determined endogenously with the relative return on investment (RROI) for unobserved reasons and does not satisfy the exclusion restriction. To address this concern, the following "placebo" test is performed. The set of lagged industry indicators, using the two-digit code of the North American Industry Classification System, is regressed directly on the RROI:

$$\Theta_{i,2013} = \iota + INDUSTRY_{it}'\zeta + X_{i,2013}'\psi + \tau_{i,2013} \quad \text{(B1)}$$

This model is re-estimated separately for each $t \in \{2000, 2004, 2008\}$, as before. The analysis is also restricted to individuals who were **not** covered by an employer-sponsored pension plan (EPP) at all from 2000 to 2013. This helps to ensure that any effect of the lagged industry of employment on the RROI is direct and not arising indirectly through the effect on past EPP coverage.

The results of this analysis are shown in Table B.1. Consistent with expectations, the past industry of employment indicators have insignificant direct effects on the RROI, especially for the larger lags. The restricted F-test statistics estimate the extent to which the industry indicators jointly explain the RROI, and in no case are these variables relevant. Hence, any effect of the lagged industry of employment indicators on financial knowledge likely operates indirectly through the effect on EPP coverage.

Table B.1
Placebo test of the effects of the lagged industry of employment indicators on the relative return on investment rate

	2008 (5-year lag)	2004 (9-year lag)	2000 (13-year lag)
		coefficient estimates	
Industry of employment (NAICS code)			
Mining, quarrying, and oil and gas extraction (21)	-0.116 *	0.022	0.031
Utilities (22)	-0.281	0.005	0.000
Construction (23)	-0.041	0.037	0.055 †
Manufacturing (31)	-0.046	-0.005	-0.031
Manufacturing (32)	-0.091 *	-0.025	-0.008
Manufacturing (33)	-0.102 **	-0.002	-0.015
Wholesale trade (41)	-0.053	0.003	-0.027
Retail trade (44)	-0.050	0.012	0.010
Retail trade (45)	0.024	0.032	0.019
Transportation and warehousing (48)	-0.098 *	0.009	-0.013
Transportation and warehousing (49)	-0.075	-0.003	-0.023
Information and cultural industries (51)	-0.053	0.029	-0.028
Finance and insurance (52)	-0.086 †	-0.011	-0.028
Real estate and rental and leasing (53)	-0.090 *	-0.003	-0.027
Professional, scientific and technical services (54)	-0.046	0.035	0.009
Management of companies and enterprises (55)	-0.092 †	0.006	-0.060
Administrative and support, waste management and remediation services (56)	-0.072 *	-0.007	-0.043
Educational services (61)	-0.060	-0.008	-0.013
Health care and social assistance (62)	-0.064 †	0.018	-0.001
Arts, entertainment and recreation (71)	-0.076	-0.018	-0.024
Accommodation and food services (72)	-0.068 †	-0.003	-0.026
Other services (except public administration) (81)	-0.042	0.026	0.002
Public administration (91)	-0.029	0.076 †	0.031
		statistics	
Statistics			
R-squared	0.037	0.037	0.037
Observations	80,092	80,092	80,092
F-statistic (all)	18.7	18.6	18.8
F-statistic (restricted)	0.1	0.7	1.6

* significantly different from reference category ($p < 0.05$)

** significantly different from reference category ($p < 0.01$)

† significantly different from reference category ($p < 0.10$)

Notes: The placebo test of the direct effect of industry of employment on the relative return on investment rate is presented here, according to the two-digit North American Industrial Classification System (NAICS) code. The F-statistic labelled "all" corresponds to the joint significance test of all the covariates included, since the additional covariates are also included in these regressions but are not shown for compactness. The F-statistic labelled "restricted" pertains to the restricted F-test of the joint significance of only the industry of employment variables, and is the relevant statistic for the placebo test described in text. Standard errors are clustered by individual.

Source: Statistics Canada, Longitudinal Administrative Databank.

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