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TARGETING RISK LOVERS? TAXATION OF PRIVATE PENSION SAVINGS, RISK PREFERENCES, AND GENDER

by

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ABSTRACT

Many countries need to stimulate savings, and especially voluntary pension planning, to meet the demands of an ageing population. This is especially true for the female population as women are expected to live longer while simultaneously having accumulated lower pension wealth. Sweden has been a front-runner in introducing tax-deferred designated pension accounts to stimulate private pension saving, along with self-directed individual public pension accounts. However, a particular feature of these tax-deferred designated pension accounts was that savings were taxed through a presumptive return. In this Article, we show that with heterogeneous risk preferences, this tax policy makes designated pensions unattractive for risk-averse individuals. Using data on self-directed choices and designated pension savings, we empirically confirm our result. In particular, we show that as women are on average more risk averse compared to men, this tax policy had negative effects for women. This Article thus sheds light on the importance of accounting for risk preferences in policymaking addressed towards stimulating adequate pension planning. The Article additionally sheds light on the overall negative consequences of a presumptive tax design such as, e.g., the Dutch "Box-III" tax system.

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I. Introduction

In the design of tax policies, regulators often focus on simplicity and tax neutrality across comparable objects for a given expected tax revenue. However, both the neutrality and the simplicity aspect only consider the expected outcome and not the full alteration of the incentive scheme when risk is incorporated. Ignoring risk in the design of taxes, however, is likely to have adverse and unintended effects.

By studying a special case of taxation in Sweden, we can analyse and quantify the "costs" of ignoring risk when forming tax policies. Following a large tax reform in 1991, the government introduced a specific tax-incentive system to stimulate voluntary private pension saving. The basic idea was to allow deductions from taxable earnings for contributions to tax-deferred retirement savings accounts, i.e., designated pension savings accounts. More important, a unique feature of the tax policy was a decision to tax the returns at a presumptive rate and not on the actual rate.[1] Consequently, contributions are taxed yearly

1. Tax policies are a popular area for economic research, but the specific topic of taxes and risk alteration is less investigated, although not ignored. Already in 1944 Domar and Musgrave established that the risk sharing that prevails from losses being tax deductible is an attractive feature for investors. *See* Evsey D. Domar & Richard A. Musgrave, *Proportional Income Taxation and Risk-Taking*, 58 Q.J. Econ. 388 (1944). Later, both Mossin and Stiglitz studied this but with expected utility. *See* Jan Mossin, *Taxation and Risk-Taking: An*

regardless of the actual outcome of the savings. As of January 2012, presumptive taxation was introduced as an option for all new savings in "Investment Savings Accounts" (ISK) that were a new form of designated pension savings introduced to stimulate pension savings.[2] The tax-incentive scheme with tax deductibility of savings for the designated pension savings accounts was lowered in 2015, and abolished in 2016,[3] but the presumptive taxation of ISK accounts and pension savings still applies.

In this Article, we show theoretically that presumptive taxation creates a wider outcome (in rate of return to savings) distribution, which causes more weight in the tails of the distribution. This makes the investments under a presumptive tax scheme unattractive for individuals with high levels of risk aversion, causing less risk tolerant individuals to refrain from adopting investment schemes taxed with presumptive returns. Previous studies have found that low-wage workers and women tend to adopt more conservative investment strategies;[4] this result suggests that applying a presumptive tax scheme may

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Expected Utility Approach, 35 ECONOMICA 74 (1968); J.E. Stiglitz, *The Effects of Income, Wealth, and Capital Gains Taxation on Risk-Taking*, 83 Q.J. ECON. 263 (1969). Agnar Sandmo extended the Mossin and Stiglitz results to include several assets along with welfare analysis. *See* A.B. Atkinson & A. Sandmo, *Welfare Implications of the Taxation of Savings*, 90 ECON. J. 529 (1980); Agnar Sandmo, *Portfolio Theory, Asset Demand and Taxation: Comparative Statics with Many Assets*, 44 REV. ECON. STUD. 369 (1977); *see also* Agnar Sandmo, *The Effects of Taxation on Saving and Risk Taking*, *in* 1 HANDBOOK OF PUBLIC ECONOMICS 265 (Alan J. Auerbach & Martin Feldstein eds., 1985).

2. *See* LAG OM INVESTERINGSSPARKONTO 2011 (Svensk författningssamling [SFS] 2011:1268).

3. *See* LAG OM ÄNDRING I INKOMSTSKATTELAGEN (1999:1229) 2014 (Svensk författningssamling [SFS] 2014:1468); LAG OM ÄNDRING I INKOMSTSKATTELAGEN (1999:1229) 2015 (Svensk författningssamling [SFS] 2015:775).

4. *See* Julie Agnew et al., *Portfolio Choice and Trading in a Large 401(k) Plan*, 93 AM. ECON. REV. 193 (2003); Vickie L. Bajtelsmit & Jack L. VanDerhei, *Risk Aversion and Pension Investment Choices*, *in* POSITIONING PENSIONS FOR THE TWENTY-FIRST CENTURY 45 (Michael S. Gordon et al. eds., 1997); Rachel Croson & Uri Gneezy, *Gender Differences in Preferences*, 47 J. ECON. LITERATURE 448 (2009); Catherine C. Eckel & Phillip J. Grossman, *Men, Women and Risk Aversion: Experimental Evidence*, *in* 1 HANDBOOK OF EXPERIMENTAL ECONOMICS RESULTS 1061 (Charles R. Plott & Vernon L. Smith eds., 2008); Richard P. Hinz et al., *Are Women Conservative Investors? Gender Differences in*

discourage those who may need tax-induced, voluntary pension savings the most.

We also test empirically if the tax incentive for designated pension savings is equally adopted along the distribution of risk preferences using Swedish register data. The data contains deposits to designated pension savings accounts along with vital, register-based data on important economic background variables. In addition, to elicit a measure for risk preferences, we use unique data on portfolio choices in individual pension accounts nationally introduced in 2000, following a Swedish pension reform.[5] Since the reform of the pension system covered the entire work force of approximately 4.4 million individuals, the study does not suffer from selection bias, sometimes plaguing other research on, e.g., self-directing in occupational pension schemes.

The empirical analysis first confirms that women and individuals, believed to have lower familiarity with or to have low levels of assets, also are more conservative investors. To find our measure of risk preferences, we use a two-step estimation to derive a measure of

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Participant-Directed Pension Investments, *in* Positioning Pensions for the Twenty-First Century, *supra*, at 91; Nancy Ammon Jianakoplos & Alexandra Bernasek, *Are Women More Risk Averse?*, 36 Econ. Inquiry 620 (1998); Jenny Säve-Söderbergh, *Könsskillnader i val och avkastning—en forsknings och kunskapsöversiktöver individuella placeringsval inom premiepensionen och tjänstepensionen*, *in* Jämställdhet i socialförsäkringen?, SOU 2014:74, at 235 (2014); Jenny Säve-Söderbergh, *Self-Directed Pensions: Gender, Risk, and Portfolio Choices*, 114 Scandinavian J. Econ. 705 (2012) [hereinafter Säve-Söderbergh, *Self-Directed Pensions*]; Annika E. Sundén & Brian J. Surette, *Gender Differences in the Allocation of Assets in Retirement Savings Plans*, 88 Am. Econ. Rev. 207 (1998).

5. This reform has attracted considerable attention in the literature, and the measure of risk preferences have been used in several papers. *See* David Cesarini et al., *Genetic Variation in Financial Decision-Making*, 65 J. Fin. 1725 (2010); Henrik Cronqvist & Richard H. Thaler, *Design Choices in Privatized Social-Security Systems: Learning from the Swedish Experience*, 94 Am. Econ. Rev. 424 (2004); Henrik Cronqvist et al., *When Nudges Are Forever: Inertia in the Swedish Premium Pension Plan*, 108 AEA Papers & Proc. 153 (2018); Stefan Engström & Anna Westerberg, *Which Individuals Make Active Investment Decisions in the New Swedish Pension System?*, 2 J. Pension Econ. & Fin. 225 (2003); Ted Martin Hedesström et al., *Identifying Heuristic Choice Rules in the Swedish Premium Pension Scheme*, 5 J. Behav. Fin. 32 (2004); Säve-Söderbergh, *Self-Directed Pensions*, *supra* note 4.

risk-taking that is not explained by typical socio-economic factors. This measure of risk-taking is then used to estimate the association between risk-taking and the use of designated pension saving with presumptive taxation. Following this, we then find that the tendency to use designated pension savings is clustered in groups that are more risk tolerant, even when controlling for economic background and other risk exposure.

In sum, this Article shows, theoretically and empirically, that a presumptive tax system deteriorates the situation of exactly those individuals who may already be in danger of obtaining insufficient savings and pension incomes. The adverse effect can be divided in two components. First, the possibility of self-directing pension contributions creates a lower pension wealth, with lower expected returns for those who are not willing to take on large risk exposure. Second, an unintended effect of the tax incentive is that those groups with a low level of risk tolerance also lack incentives for voluntary designated pension savings, along with having lower expected returns on their individual accounts. These two proposed effects create a worsened situation for those who may be in the largest need of providing for their future pensions. In particular, we show an adverse gendered effect on future pension incomes. Women in Sweden had 68% of men's pension income in 2018. While this gender gap is expected to diminish in the future, it is predicted to remain at around 80% for women and men born in the 1980s.[6]

Finally, few countries, except Sweden, tax pension savings this way. However, taxation through presumptive returns is used in the Netherlands to tax capital income, i.e., the Dutch "Box-III"-tax.[7] Presumptive taxation has also received a lot of attention as an interesting solution among regulators,[8] but then with no account given to the effects of

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6. Gabriella Sjögren Lindquist & Jenny Säve-Söderbergh, *Kvinnors och mäns livsval relaterade till ojämlikhet i pensioner—problembild och lösningar*, Ekonomisk Debatt, no. 4, 2018, at 54.

7. The Dutch Box-III tax is a capital income tax for all personally held assets, like deposits, stocks, bonds, and real estate, set at a presumptive rate of 4%, which is taxed yearly at 30%. For an evaluation, see Sijbren Cnossen & Lans Bovenberg, *The Dutch Presumptive Capital Income Tax: Find or Failure?*, *in* Public Finance and Public Policy in the New Century 241 (Sijbren Cnossen & Hans-Werner Sinn eds., 2003).

8. Sven-Olof Lodin, *Kapital- och fastighetsbeskattningen—idag och i morgon* (Underlag till Globaliseringsrådets skattegrupp 2008).

heterogeneous risk preferences. Thus, our results from analysing the taxation of designated pension savings in Sweden can be directly used to draw conclusions about systems like the Dutch Box-III tax system and highlights how it potentially can lead to larger income differences, as Roine and Waldenström show that capital income constitutes a large share of total income differences.[9]

The Article is organized as follows. In Part II we describe the tax policy for pension savings. Part III outlines the model. In Part IV we give a summary of the data. In Part V we present the empirical analysis and results are given in Part VI. Finally, Part VII concludes.

II. The Design of the Tax Policy

This Article exploits a reform from 2000 to elicit measures of individual risk-taking for a large majority of the Swedish population and relates this to the use of designated pension savings under presumptive taxation. Consequently, as the study analyses choices made in 2000–2001, we describe only the tax system relevant for those years below.

In 1991, Sweden underwent a major tax reform in order to reduce distortions created by the old tax system and a desire to create neutrality between different sources of income. The system strived to create an equal tax treatment for similar types of investments. As a consequence of an ageing population, the government also created a tax set to promote designated pension savings.

Sweden has a dual income structure where labour and capital income are taxed under separate schemes. Savings are taxed under essentially three different forms: as "general"-savings, as designated pension savings, or as "endowment insurance"-savings. Table 1 presents the tax rules for the different types of savings that were relevant in 2000–2001.

The first form of savings is general savings, like a bank account or shares in mutual funds. This type of savings is taxed at a level of 30% on their actual rate of return. While deposits are not tax deductible, losses on general savings can be used to lower current labour income tax. For losses made on stocks, 70% of the losses are deductible, while

9. *See* Jesper Roine & Daniel Waldenström, *The Evolution of Top Incomes in an Egalitarian Society: Sweden, 1903–2004*, 92 J. Pub. Econ. 366 (2006).

100% of the losses on interest-bearing instruments are deductible against other labour income.

Designated pension savings can be invested under two types of investment options. The first is a traditional insurance, and the second is a pure investment portfolio that can consist of either a portfolio of mutual funds or a fixed portfolio consisting of any type of security. Both types can be annualized at the earliest when the investor reaches 55 years of age.

In contrast to general savings, deposits into designated pension savings can be used to lower current labour income tax. The tax rule that applied in 2000–2001 allowed a deposit into designated pension savings of SEK 18,200 ($1,950) to be deducted from the labour-income base for taxation for labour incomes in the interval of 0 to SEK 364,000 ($39,140).[10] For labour income above SEK 364,000 but below SEK 728,000 ($78,280), a deduction equal to 5% of income above SEK 364,000 could be made for designated pension savings, along with the SEK 18,200. For labour income exceeding SEK 728,000, the maximum deduction is 5% of SEK 728,000, which is equal to SEK 36,400. The annuities from the designated pension savings are taxed as income when annualized.[11]

Of importance for this Article, designated pension savings are taxed under a special capital gains tax based on a presumptive return. Instead of taxing realized gains, a tax based on the average market interest rate on Swedish government bonds (with a remaining maturity of at least five years), *Statslåneräntan*, is used. Therefore, regardless of the investment resulting in a gain or loss, the value of the savings is assumed to have grown at the same rate as the interest on government debt. The presumptive return is then taxed yearly at a rate of 15%.

The third type of savings is "endowment insurance" savings, *kapitalförsäkring*, and is taxed according to the same principle as designated pension savings. This is an investment that has to be locked for

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10. With the exchange rate of approximately SEK9.30/USD, which was current for April 2019 (for the year of the empirical data the Swedish Krona depreciated from slightly below 8 to 8.50, but we chose to use current values).

11. This could be beneficial if taxes are much lower when the agent reaches retirement age, but it will not be analyzed further in this Article. A more thorough discussion on why we chose not to model this artifact is found in Part III.

a minimum of five years and exists in two forms. First, a traditional insurance with a fixed minimum return that cannot exceed 3%, a limit set by the Finance Inspection Board, *Finansinspektionen*. The second is a unit link savings, which is invested in mutual funds. The presumptive return on these investment types is taxed at a rate of 27%.

In sum, one important difference between the taxation of designated pension savings (including endowment insurance) and general savings is that taxes are only paid when actual gains occur for the general savings, while for designated pension savings a presumptive growth tax is paid also in the case of a loss.

III. Theory

In this Part, we show how the taxation of a presumptive return for designated pension savings, and similarly endowment insurance, affects investors' utility and the implications for choosing the optimal pension investment strategy. We initially show the effect of presumptive taxation when ignoring risk. Subsequently, we incorporate the effect of differences in risk preferences and stochastic investment returns. Both analyses are performed under a buy-and-hold assumption for simplicity.[12] Finally, we incorporate effects on general savings, which come from risk-sharing given by the design of the tax system where capital losses are tax deductible while capital gains are not.[13] Note that in Sweden, the risk sharing between the government and investors is not one-to-one as only 70% of losses can be deducted against labour income.[14]

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12. This should be a rather innocent assumption as most investors do not rebalance frequently. Further, Kritzman shows that an individual's timing ability has to be better than the market in order to benefit from rebalancing. *See* Mark P. Kritzman, Puzzles of Finance (2000). Anderson further shows that investor performance deteriorates with degree of activity. *See* Anders Anderson, *All Guts, No Glory: Trading and Diversification Among Online Investors*, 13 Eur. Fin. Mgmt. 448 (2007).

13. For analysis of such risk-sharing, see the seminal papers by Evsey D. Domar and Richard A. Musgrave, *supra* note 1.

14. 70% of losses up to 100,000 SEK yields a 30% tax deduction per person, above 100,000 SEK the tax deduction is 21%. 100% of paid interest rates are eligible for the same tax deduction rule as for losses.

A. A Comparison of the Designated Pension Savings Tax with the General Savings Tax Based on Expected Returns

Typically, policy making, investment advice, and investment discussions regarding pension savings are based solely on expected values. Here, we show how heterogeneous risk preferences combined with a presumptive taxation scheme only raise incentives to save for pensions for those with high risk tolerance.

The net growth of a one-unit investment with the designated pension savings tax is:

$$\frac{1}{1-t_c}\left(1+r-b\cdot t_p\right)^n\left(1-t_f\right), \qquad [1]$$

where t_c denotes the current income tax, r is the return on the investment, and b denotes the interest rate on long-term government debt, i.e., the fictitious return; t_p denotes the yearly tax on pension savings; t_f is the future income tax; and n is the number of years invested.

The first term in expression [1] comes from designated pension savings being deductible in the present, which means that you get "more bang for the buck" initially. The second term is the growth rate, and the third term is the income tax that the designated pension savings is subjected to in the future, as savings were deductible initially. Note that the relation in equation [1] shows that if we assume the future tax rate t_f to be equivalent to the current tax rate t_c, the two taxation terms cancels. This would be applicable especially for individuals who are not expected to have significantly higher incomes in the future compared to the current incomes.

The net growth rate of a one unit of investment with the general savings tax is:

$$(1+r)^n\left(1-t_g\right)+t_g \qquad [2]$$

where t_g denotes the general savings tax. Comparing the growth rates, i.e., the first term on the right-hand side, for designated pension savings and general savings, it is apparent that the growth rate is slower for designated pension savings due to the yearly taxation, $t_p b$. However, the value of the net return on general savings is reduced by taxation when realized.

The two forces that affect the difference between the designated pension savings tax and the general savings tax are the investment horizon and the risk premium, or equivalently the presumptive return

(i.e., the interest rate on long-term government debt). This follows from the assumption that future and current labour income taxes will be equal. From equations [1] and [2], it is also evident that the longer the horizon the costlier is the designated pension savings tax, due to compounding, relative to the general savings tax.

The differences between the two tax schemes in expected values are illustrated in Figure 1, where a 10% market return, a risk premium of 4%, and a general savings and labor income tax of 30% are used.[15] The graph illustrates that the general savings tax is better than the designated pension savings tax for very long investment horizons, while the difference is small for short investment horizons. This follows from the latent tax credit not being realized until the investment is realized. If we also relax the assumption of no rebalancing, the designated pension savings tax is more attractive since, at every rebalancing point, the tax is realized with general capital gains tax.

B. Including Heterogeneous Risk Preferences and Stochastic Returns

So far, we have shown that basing the analysis on a constant rate of return, which is often imputed from expected values, the designated pension savings tax is beneficial to investors if the investment horizon is short and/or the presumptive return is low. In this Part, we will expand the analysis to a more realistic case by including heterogeneous risk preferences and investment risk.

In order to judge which tax system is preferred with stochastic returns, we have to consider how an investor would rank expected utilities in different scenarios. First, we assume that investors rank investing strategies according to the highest expected utility such that:

$$A > B \text{ iff } E\left[U\left(A\right)\right] > E\left[U\left(B\right)\right]. \quad [3]$$

Calculating the expected utility for investments with stochastic return is, however, complicated for two reasons. First, plausible return

15. Based on data from Daniel Waldenström, *Swedish Stock and Bond Returns, 1856–2012*, *in* Volume II: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620–2012, at 223 (Rodney Edvinsson et al. eds., 2014) (link to data: http://www.historia.se/VolumeIICh6Stocksandbonds.xls).

distributions are often not possible to integrate. Second, the exact functional form for the utility function is not known.

Nevertheless, there is a simple method to distinguish strategies that are preferable for all possible concave utility functions. This analysis is based on the method of stochastic dominance, as used, for example by Levy and Sarnat.[16] They show that in order for investment strategy A to dominate investment strategy B for all risk averse agents, i.e., $E\,[U_i\,(A)] > E\,[U_i\,(B)]\ \forall\ i$ where $U_i\,(\cdot)$ is concave, the following must hold,

$$\int_{-\infty}^{r} [B(t) - A(t)]\,dt \geq 0\ \forall\ r \qquad [4]$$

where $A(t)$ and $B(t)$ are cumulative distributions for investment strategy A and B. This condition is named second order stochastic dominance (SSD) and is used to evaluate the efficiency among different outcomes for risk-averse agents.

The easiest way to understand the condition is to study a graph of the cumulative distributions of investment options under different tax schemes. Figure 2 illustrates a comparison between the cumulative distribution of investments under the designated pension savings tax scheme and the cumulative distribution of untaxed investments. This is shown using the average interest rate for government debt between 1993 and 2005 of 6.2%.[17] Undoubtedly, the untaxed return dominates the outcomes with the designated pension savings tax over one period. Specifically, the cumulative distribution of outcomes without tax lies to the right of the cumulative distribution of outcomes with the designated pension savings tax for all possible probabilities. That is, for all chosen probabilities the designated pension tax lowers the returns. In terms of the condition, the area between the cumulative distribution given a pension savings incentive tax and the cumulative distribution for the

16. Haim Levy & Marshall Sarnat, Portfolio and Investment Selection: Theory and Practice (1984).

17. For 1993 to 2001 the average Government borrowing rate is used, and for 2002–2005 the rate at the end of November is used, 8.58, 9.52, 10.16, 7.9, 6.47, 4.98, 4.88, 5.35, 4.97, 4.85, 4.71, 3.95, 3.26, which yields an average of 6.2%. Rates can be found at Riksgäldskontoret, https://www.riksgalden.se/globalassets/dokument_sve/statslaneranta/slr-historisk-statslaneranta.xlsx (last visited Aug. 23, 2020).

untaxed returns is positive throughout the support of their functions. For investments in endowment insurance, the net returns are shifted even more to the left due to the tax being higher at 27%.

Since the designated pension savings tax is path dependent even with a buy-and-hold strategy, we cannot evaluate a comparison between the designated pension savings tax and the general savings tax over many periods. But, as the untaxed returns were shown to dominate the designated pension savings tax in any given period, the cumulative return will also dominate. Therefore, we can evaluate capital gains tax against untaxed returns as they serve as an upper bound for the designated pension savings tax.

Below we incorporate another feature of the tax system—loss deduction against other taxable income. As noted above, the tax system allowed 70% of the losses on stocks to be deductible, while 100% of the losses on interest-bearing instruments were deductible against other labour-income taxed in Sweden. The effect of losses being tax deductible makes the general savings tax act almost like a mean preserving spread, as defined by Rothschild and Stiglitz.[18] This happens as a consequence of probability masses from the tails of the return distribution being shifted towards the middle of the distribution. This will, however, not be symmetrical for two reasons. First, since investment opportunities will in general have positive expected returns and taxes are only paid for gains, the shift of the distribution weights will be towards a point to the left of the middle of the distribution. Second, since losses are not deductible to a 100%, the shift of the distribution is asymmetric. Because of this, the general savings tax does not lead to a mean preserving shrinkage of the probability distribution in general. Therefore, we cannot use Rothschild and Stiglitz to conclude that general savings taxes are preferred to having no taxes due to a risk-reducing property.[19]

Using the second order stochastic dominance principle to compare the general savings tax to the untaxed returns, we find that untaxed returns are actually not preferable to all risk-averse agents; see Figure 3.

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18. Michael Rothschild & Joseph E. Stiglitz, *Increasing Risk: I. A Definition*, 2 J. Econ. Theory 225 (1970). Already in 1944, Domar and Musgrave investigated the effect on investments from this risk-sharing between investors and government. *See* Domar & Musgrave, *supra* note 1. Later, Mossin and Stiglitz each have taken the analyses into the expected utility framework. *See* Mossin, *supra* note 1; Stiglitz, *supra* note 1.

19. Rothschild & Stiglitz, *supra* note 18.

The reason for this is that for negative returns the condition in equation [4] is not fulfilled as the area between the returns with a 70% deductibility of losses and the no-tax return is negative. Note that the area of the overall difference is positive due to the asymmetric shift of probability mass, which implies that the mean is also higher for the no-tax returns. For policymakers this is therefore an important problem as the effect of the tax system will clearly depend on the shape of the individual utility functions.[20]

Below we also calculate the expected utility in order to obtain more information about the value of the risk reduction from deductible losses. Based on the literature, we focus on two cases of plausible utility functions. The first is a log-utility function representing investors with low risk aversion. The second is a power utility with a coefficient of relative risk aversion, γ, larger than one that represents investors with high level of risk aversion. The expected utility calculation is as follows:

$$E_t\left[U\left(x_{t+1}\right)\right]=\int_{-\infty}^{\infty}\frac{1}{\sqrt{2\pi\sigma^2}}\exp\left\{-\frac{\left(x_{t+1}-\mu\right)^2}{2\sigma^2}\right\}U\left(x_{t+1}\right)\mathrm{d}x_{t+1}$$

where,

$$U\left(x\right)=\begin{cases}\dfrac{x^{1-\gamma}}{1-\gamma} & if \quad \gamma\neq 1\ \left(power-utility\right)\\ ln\left(x\right) & if \quad \gamma=1\ \left(log-utility\right)\end{cases} \qquad [5]$$

For the case of several periods, the utility of final wealth for designated pension savings is path dependent and a very unattractive mathematical problem:

$$E\left[U\left(R_{t,T}^{p}\right)\right]=\int_{-\infty}^{\infty}\cdots\int_{-\infty}^{\infty}f\left(r_{t+1}\right)\cdots f\left(r_{t+T}\right)U\left[\left(e^{t+1}-b_{t+1}t_p\right)\cdots\right.$$

$$\left.\left(e^{t+T}-b_{t+T}t_p\right)\right]\mathrm{d}r_{t+1}\cdots\mathrm{d}r_{t+T} \qquad [6]$$

20. If expected returns on risky assets were zero and losses fully deductible, all risk averse investors would in fact prefer to be taxed rather than to capture total return before tax.

In Table 2 we compare the expected utility for the different tax regimes against the untaxed return. This is done using the log-utility for low risk aversion and the power utility with a coefficient of relative risk aversion set to 3 for high risk aversion.[21] Following Table 2, we find that when we calculate the normally distributed returns net of the different tax systems (general savings taxes and designated pension savings tax) the power utility falls with 2.2% for the endowment insurance tax compared to the untaxed returns for one period. For the designated pension savings tax, the equivalent fall is 1.2%. If losses are not deductible, the utility falls with 5.3%, but for the actual case of Sweden, with losses that are deductible with 70%, the utility increases with 3.3%. Performing the same analysis for log-utility, the untaxed return has the largest utility and falls by 5.5% for the designated pension savings tax and falls about double for the endowment insurance tax. If losses are deductible, the log-utility falls with 9.2%, and, finally, with no loss-deduction the utility falls with 37.7%. It is thus clear that with low risk aversion the designated pension savings tax is preferable to the general savings tax and that the opposite is true for investors with high risk aversion. For the two-period case, tax deductible losses are relatively less favourable to untaxed returns (falls to 3.2%), whereas the difference for the designated pension savings tax is more than twice as large (increases to 2.5% lower than untaxed returns).

Given the complexity in calculating the expected utility for the pension savings taxes, we turn next to a comparison of the long-term utility of untaxed returns versus general savings with tax-deductible losses. Since we know that a designated pension savings tax always results in lower utility than untaxed returns, we can use the untaxed returns as an upper bound for the expected utility of the pension savings tax. Note that the upper bound is close to a designated pension savings tax for a very short horizon but is extremely conservative for long horizons. Figure 4 shows that when the investment horizon is as long as 20 years, the power utility of the untaxed return is almost as high as the utility of the taxed returns when 70% of the losses are tax deductible. Following

21. Note that this is a relatively low level of relative risk aversion. The famous equity-premium puzzle by Mehra and Prescott suggests a level of risk aversion close to 30 in order to explain the equity premium. *See* Rajnish Mehra & Edward C. Prescott, *The Equity Premium: A Puzzle*, 15 J. Monetary Econ. 145 (1985).

this, for investors with high risk aversion the designated pension savings tax scheme is seldom a preferred savings alternative.

IV. Data

The data on risk-taking is gathered from portfolio choices in the individual accounts introduced in Sweden following a large pension reform in 2000. In 1998, Sweden passed pension legislation that specified a gradual transition from a public defined-benefit plan, which was fully phased out in 2018, to a defined-contribution plan.[22] One part of this reform was to introduce fully funded individual accounts for approximately 14% of public pension contributions, the "premium pension."[23] From the year 2000, all eligible[24] investors were allowed to self-direct these contributions by selecting a maximum of 5 funds out of a total of 450 to 600 mutual funds. Following these choices, we derive a measure of individual risk-taking.

Prior to self-directing the contributions, each individual received a fairly comprehensive catalogue[25] containing many facts about types of funds, fund managers, trading procedures, and some advice on fund

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22. Selén and Ståhlberg explain the transition from an unfunded pension system to a defined contribution pension system in Sweden with the age structure of the population and the age of the median voter. *See* Jan Selén & Ann-Charlotte Ståhlberg, *Why Sweden's Pension Reform Was Able to Be Successfully Implemented*, 23 Eur. J. Pol. Econ. 1175 (2007).

23. Since 2000, there are four sources of retirement income in Sweden. The first two sources are included in the "national pension system" and from 18.5% of a person's pension eligible income, 16 percentage points (or 86 %) is paid into an individual's income pension and 2.5 percentage points (14%) goes to the premium pension. The third source is a union/collective pension/occupational pension, while the fourth source is private pension savings. *See Sweden—Old-Age Pension*, Eur. Comm'n, https://ec.europa.eu/social/main.jsp?catId=1130&langId=en&intPageId=4814 (last visited July 5, 2020).

24. To be eligible for fund selection, labor income must exceed a minimum level in the three preceding years, approximately equivalent to two average monthly salaries per year (SEK 36,000 in 1995, SEK 36,800 in 1996, SEK 37,000 in 1997, and SEK 37,100 in 1998).

25. All information was also available on the Swedish Premium Pensions Agency's (PPM) web page; today, both the nonfinancial defined contribution (NDC) and financial defined contribution (FDC) pensions are

selection with respect to age and risk. A risk measure was also calculated such that each fund was indexed according to risk. This is also the risk measure that we use to derive individual risk-taking. For each fund, the risk measure was defined as the average standard deviation for the three preceding years.[26] The Swedish Premium Pensions Agency then categorized the risk measure into five levels of risk: 0–2, very low risk; 3–7, low risk; 8–17, medium risk; 18–24, high risk; and 25 or higher, very high risk.[27]

In order to obtain a measure of risk-taking, we calculate for each individual the share of funds chosen that had a risk measure at 25 or above, i.e., the share of very high-risk funds. Note that out of the selectable funds approximately 20% were very high-risk funds. The cut-off level is deliberately set to this high level to ensure that we look at preferences for funds most likely to be judged as highly risky.

The data on individual designated pension savings, along with other income and background characteristics, is gathered from the Swedish Household Survey on Income (HINK) in 1999,[28] created by Statistics Sweden, which includes 38,237 individuals. Out of these, 18,124 were eligible to make a fund selection.[29] The HINK data contains yearly deposits made into designated pension savings following information from filed tax returns to the Swedish Tax Agency. Thus, the designated pension savings deposit filed is only the annual contribution and not the

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administrated by Swedish Pensions Agency. *See* PENSIONSMYNDIGHETEN, https://www.pensionsmyndigheten.se/ (last visited July 5, 2020).

26. Not all funds had a risk measure given by PPM as they did not exist prior to 2000. Therefore, in order to include such funds, risk levels have been imputed for each fund by assigning the average value of the risk in the guide for similar types of fund.

27. *See* PENSIONSMYNDIGHETEN, *supra* note 25.

28. *See* STATISTISKA CENTRALBYRÅN, http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START__HE__HE0103__HE0103A/ (last visited Aug 23, 2020).

29. As the quality of the data is uncertain when it comes to assets and inventories associated with unincorporated businesses, farms, and commercial real estate, the conventional practice when using HINK data is to exclude households owning declared wealth in these asset categories. The number of people excluded from the analysis is 1728 individuals with declared wealth in unincorporated businesses, 751 who farm, and 72 who receive income from commercial real estate. All results remain robust to the inclusion of these individuals.

actual size of pension savings. This deposit is also the amount that can be deducted from labour income. Note that all tax returns are filed individually in Sweden, but for tax purposes couples are assigned an equal percentage of its value.

Of the eligible participants, 11,102 individuals made a selection, and 7,122 chose not to select a fund and obtained the default fund. Since the risk-profile of the default fund was determined after the fund choices had been made, non-selectors could not have been certain of the level of risk in the default fund, thus the latter group is excluded from the analysis.

Table 3 presents summary statistics of our main variables of analysis. First, about 46% of the sample deducted some amount for designated pension savings. The average amount deducted is approximately SEK 3,000 (app. US $320). Second, notably women are more likely to have made deductible designated pension savings. Yet, men have deducted higher levels of designated pension savings. Furthermore, various age groups have used the option of deductible pension savings differently.

V. Empirical Model

The intention is to explore the joint relationship between the use of designated pension savings and risk-taking. So, the basic association we want to estimate is:

$$DPS_i = f\,(INCOME_i, WEALTH_i, EDU_i, AGE_i, RISK{-}TAKING_i) + \varepsilon_i \qquad [7]$$

where *DPS* is either the binomial choice of yes/no or the deducted level of designated pension savings (or equivalently the deposited level). The designated pension savings decision is modelled as a function of different types of assets, each indicating to what extent an investor can afford to privately save for a pension income: *INCOME* includes labour earnings and social transfers and net wealth; *WEALTH*, which is collected by the Swedish Tax Agency, is defined as financial assets (savings deposits, premium bonds, market value of bond funds, mixed funds, stock funds, stocks (A-listed, OTC-listed, and other listings)), real estate, and debt. Education and age are assumed to indicate familiarity with pension planning. The latter also captures the necessity of private pension planning.

Finally, the designated pension savings decision is a function of risk-tolerance, *RISK-TAKING*. Risk-taking, however, is not exogenous to, e.g., wealth, and is a decision dependent on similar characteristics as is the choice for designated pension savings. Therefore, we cannot use the high-risk share chosen for the premium pension. Instead we run a two-step estimation where equation [7] is our second pass regression.

Our method is to first model the risk-taking decision for the premium pension by assuming that:

$$HIGHRISK_{\alpha,i} = g(FIN.SOPH._i, NETWEALTH_i, FEMALE_i, MARRIED_i, OTHERRISK_i, AGEi) + \gamma_i \quad [8]$$

$HIGHRISK_{\alpha,i}$ is the share of high risk assets relative to total assets chosen in the premium pension system. The high-risk share is modelled as a function of attributes capturing familiarity with financial markets or financial sophistication, $FIN.SOPH._i$, which include earnings (empirical support suggests low-wage workers tending to be more conservative investors[30]) and education. Other characteristics determining the choice of risk tolerance are gender and marital status.[31] The risk-taking decision is also dependent on risk exposure in other assets, $OTHERRISK_i$. We therefore include the share of financial assets invested in risky assets or mixed assets.[32] Additionally, we include the risk or variability associated with alternative pension incomes from the occupational pension. We then acknowledge that some individuals have contribution-based funded occupational pension scheme, which is a riskier alternative to having a defined benefit plan, both in terms of idiosyncratic risk, as well as systematic risk, due to the correlation between

30. *See* Agnew et al., *supra* note 4; Bajtelsmit & VanDerhei, *supra* note 4; Hinz et al., *supra* note 4.

31. *See, e.g.*, Säve-Söderbergh, *Self-Directed Pensions*, *supra* note 4; Sundén & Surette, *supra* note 4.

32. The division is: (i) Safe Assets: savings deposits, interest rates on savings accounts, premium bonds and the market value of savings in bond funds, interest rate on securities; (ii) Mixed Assets: the market value of savings in mixed funds, asset values stated in the income-tax return form as "other valuables" (which are personal inventories such as cars, foreign securities etc.); (iii) Risky Assets: the market value of stocks (A-listed, OTC-listed and other listings), the market value of savings in stock funds, dividend payments, other securities.

the funded occupational scheme and other portfolio savings. Finally, we include the age to capture the influence from investment horizon on the risk-taking decision. γ_i is an *iid* distributed error term capturing other factors influencing the risk-taking decision.

To find a proxy for risk-taking, we derive regression estimates using equation [8], from which we predict the level of risk-taking for each individual that is explained by the above attributes, $PRED.RISK_i$. Then we find the difference between the actual high-risk share taken and the predicted high-risk share to get a measure of risk that is not explained by the above economic/socio-economic attributes. Hence, we have that:

$$UNEXPL.RISK_i = HIGHRISK_i - PRED.RISK_i \quad [9]$$

Finally, we then use the *UNEXPL.RISK* as a proxy for risk tolerance, to estimate the association between designated pension savings and risk-taking as defined in equation [7].

In the analysis we also account for the possible selection of active versus inactive investors as this may confound the level of high-risk assets chosen for the premium pension. The choice of being an active investor versus choosing the default fund may not be random. Therefore, we estimate a Heckman selection model, which accounts for the selection into being an active investor, to find $PRED.RISK_i$. The decision to be an active investor is modelled on the basis of previous findings on active investors.[33] Included regressors are familiarity with financial markets (age, education, income, financial assets, lacking financial assets) and some reform-specific attributes (region, year). Identification variables for the choice to be active are wealth risk exposure, occupational pension risk, the level of financial wealth out of net wealth, and some reform-specific attributes.

VI. Empirical Results

As a first test of the association between the designated pension savings choice and risk-taking, Figure 5 illustrates a comparison between the distribution of the choice of very high-risk shares between those that chose to have deductible pension savings to those who did not.

33. *See* Engström & Westerberg, *supra* note 5; Brigitte C. Madrian & Dennis F. Shea, *The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior*, 116 Q.J. Econ. 1149 (2001).

The figure confirms our hypothesized association between designated pension schemes with presumptive return taxation and risk-taking as the cumulative distribution is thicker in the lower end of the risk distribution for those who have chosen not to have designated pension savings. In addition, a non-parametric Kolmogorov-Smirnov test for the equality of the two distributions is rejected (p-value=0.01).

Table 4 presents our regression results for the choice of very high-risk assets. As expected, a larger familiarity with financial markets and a larger risk exposure in financial assets are associated with higher risk-taking. While age is positively related to risk-taking, having a larger uncertainty in alternative pension flows decreases risk-taking. Moreover, females have lower shares of very high-risk assets as compared to men. Marital status, however, has a negative impact on the share of very high-risk assets, a result that is contrary to the expectation that a spouse's income may act as a substitute for a low-risk asset.

The result of the Heckman-selection model yields essentially the same results; see columns 2 and 3. There is some non-randomness identified, indicating that there has been a selection of more risk-averse individuals among active investors. Active investors are more likely to be familiar with financial markets, have higher labour income, and larger financial wealth.

From the model displayed in column 3, we obtain the predicted risks. To get a measure of the share of very high-risk assets not explained by socio-economic factors we then deduct the actual risk. This measure is then used in equation [7].

Our main results are presented in Table 5. Following our theoretical results, the empirical estimates show a negative relationship between risk aversion and choosing designated pension savings. Individuals who are more risk-tolerant are more likely to save in designated pensions, although not at the highest levels of risk-taking.[34] Note that this is the risk taking that cannot be explained by basic socio-economic characteristics. The probability to choose designated pension savings is also clearly related to affordability and familiarity with pension planning. Both labour income and wealth increase the probability to privately save for a pension, but less so for very high levels of labour income and wealth. This is a plausible pattern given the fixed deductibility structure for higher income. We are also able to confirm our model's result

34. We have also done the estimations using the average level of risk-taking in the PPM portfolio and obtain the similar results.

of a short investment horizon influencing the willingness to use deductible pension savings positively. The willingness to use the deductible pensions increases with age but at a decreasing rate.

The second and third columns in Table 5 show the same regression models but using the amount deducted for designated pension savings. For this, we divide the sample into the two groups that have different threshold values for the maximum allowed deduction. Again, we find that risk tolerance is positively related to the level of deductible pension savings, although decreasingly so for incomes below the first threshold. [35]

An interesting relation is that there is a U-shaped relationship between labour income and the amount deducted for individuals only being able to deduct the maximum amount of SEK 18,200. Potentially this reflects the fact that a deductible amount of SEK 18,200 is relatively higher for individuals with lower incomes than for richer, and thus an increased possibility for individuals with higher earnings to actually save money to invest in pension wealth. For individuals with incomes above the threshold, the relationship between labour income and deducted amount is hump-shaped. Also, net wealth has a hump-shaped association to designated pension savings for both labour income groups. For the amount deducted, age is not hump-shaped but instead somewhat increasing for older individuals. Yet, if we exclude the squared term the age coefficients are positive and significant.[36]

Finally, Figure 6 confirms our theoretical results by illustrating the cumulative distributions of the unexplained risk levels for individuals that have chosen designated pension saving or not. Similar to Figure 5, we find a difference in the two distributions where individuals who have chosen to save in designated pension savings are more risk tolerant. A non-parametric Kolmogorov-Smirnov test also rejects the equality of the two distributions (p-value=0.000). Finally, in Figure 7 we show the cumulative distributions of the unexplained risk levels

35. One concern may be a high correlation between the unexplained risk and the residuals in model [7]. This appears to be no problem since the correlation is only 0.001 or 0.003.

36. In an alternative model, we measure risk-taking with the share of risky assets out of financial wealth, see *infra* Appendix, Table I. We again confirm the results of risk-taking and private pension savings. Individuals who are more prone to take risks (not explained by socio-economic factors) are more likely to choose deductible private pensions, although not for the highest levels.

corrected for selection. Again, a non-parametric Kolmogorov-Smirnov test rejects the equality of the two distributions (p-value=0.000). Note that in comparison to Figure 5 in which the actual share of high-risk funds is used, we find a larger difference between the two groups with the risk-taking not explained by socio-economic variables.

VII. Conclusions

Many countries need to reform their pensions systems in order to meet the demands of an ageing society. Since Sweden has been one of the front-runners in reforming its pension system much can be learned from the Swedish experience.[37] The application of individual public pension accounts in such a large scale is unique, and the combined effect of having presumptive taxation and self-directed pension accounts has increased the role of investor's interest and ability to make active investment decision, as well as heterogeneous risk preferences. We have shown that neglecting risk preferences when designing tax policies intended to promote designated pension savings may have unintended consequences for individuals with a low risk tolerance. This is particularly true for women, a group facing a larger vulnerability to poverty as pensioners.

Many individuals also earn pension rights from occupational pensions. Individual accounts are becoming a more popular solution also in the design of these schemes. Therefore, a large share of pension incomes will not only be determined by incentives to work but by the individual's capacity to invest. Additionally, the capacity to invest will affect the incentive to voluntarily save for their retirement or not. The intention behind introducing the individual accounts as a part of the public pension system was for the pension system to be risk-balancing.[38] The investment allocation was thought to balance pension income risk induced by demographic changes, economic growth, and specific shocks within the industry in which the individual works. However, we show that the problem is that the same individuals who are expected to get a

37. *See, e.g.*, Peter A. Diamond, Economic Globalisation and Swedish Pensions (2009).

38. Svårnavigerat? Premiepensionssparande på rätt kurs, SOU 2005:87, https://www.regeringen.se/rattsliga-dokument/statens-offentliga-utredningar/2005/10/sou-200587/.

low return in their individual accounts also refrain from using the tax incentives created to promote pension savings.

Importantly, we can conclude that as suggested by the theoretical model, risk averse individuals are less likely to have chosen or to have deposited a smaller amount into designated pension savings. As women and low-educated are more risk averse compared to men and highly educated, this association implies that female investors are less favoured by the incentivized tax schemed policy, although the policy aimed at addressing those most expected to be vulnerable and lacking adequate pension savings.

Appendix

Figures

Figure 1: The graph shows how general savings is better than designated pension savings with long investment horizons due to the latent tax credit that is not realized until the investment is realized.

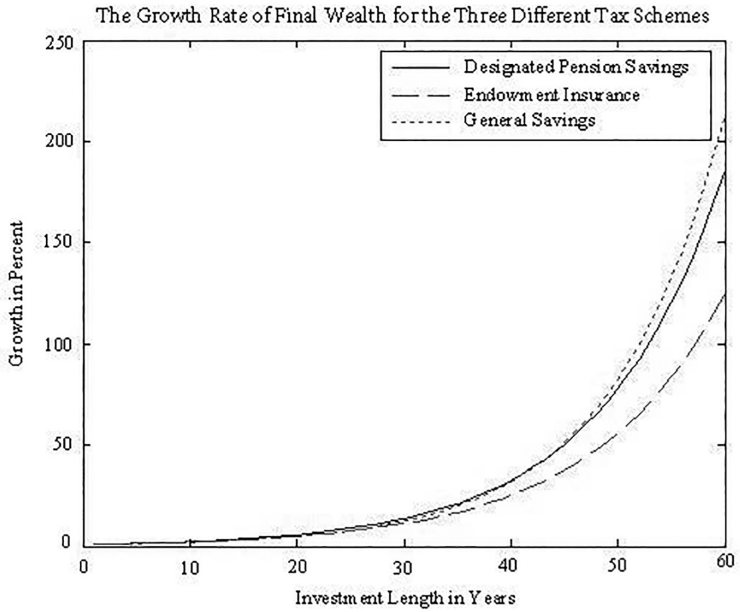


Figure 2: Graph of the cumulative distributions for the returns of an investment (normally distributed with expected return of 10% and standard deviation of 20%), which is either taxed with the designated pension savings tax or is not taxed at all.

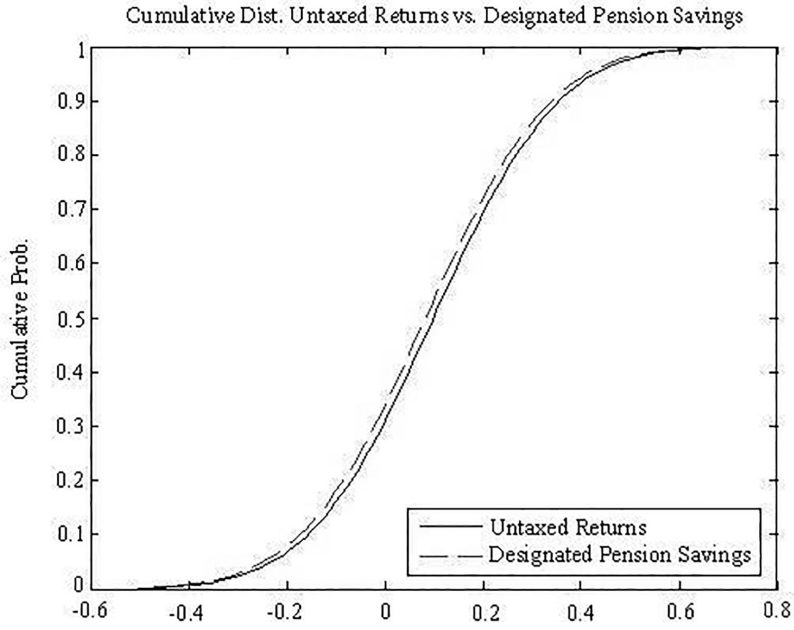


Figure 3: The cumulative distribution for investment returns with no taxes plotted against investment returns net of taxes when losses are deductible to 70%. The distribution is normal with a mean of 10% and a standard deviation of 20%.

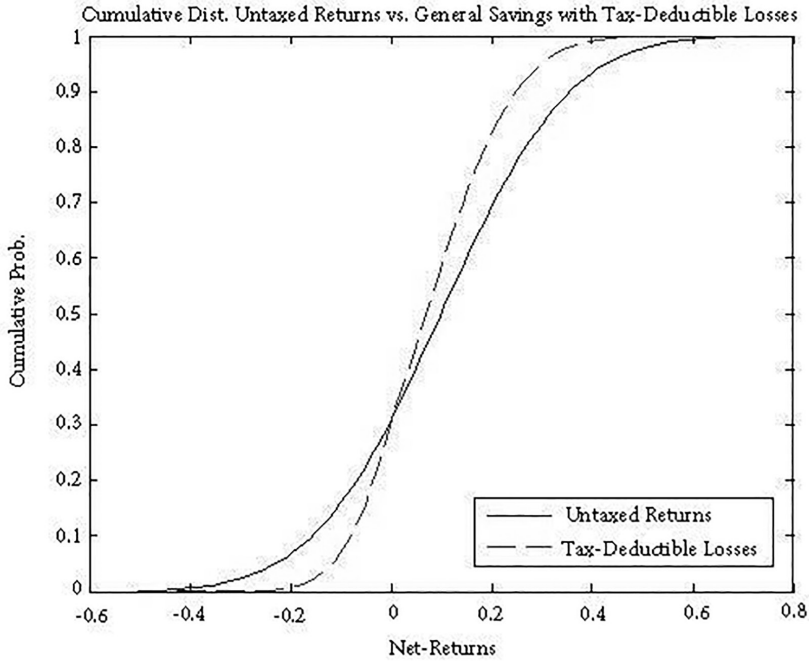


Figure 4: The graph shows the utility for the final value without taxes against the final value net of taxes when 70% of the losses are deductible against labor income. The untaxed final value serves as an upper bound for the utility of the designated pension savings tax as we have shown that it always has a lower utility than the untaxed return. We have also marked the expected utility for the designated pension savings tax for the first three years with *. For longer horizons we have extrapolated the expected utility for the designated pension savings tax using the correlation with the expected utility for general savings tax, marked with o.

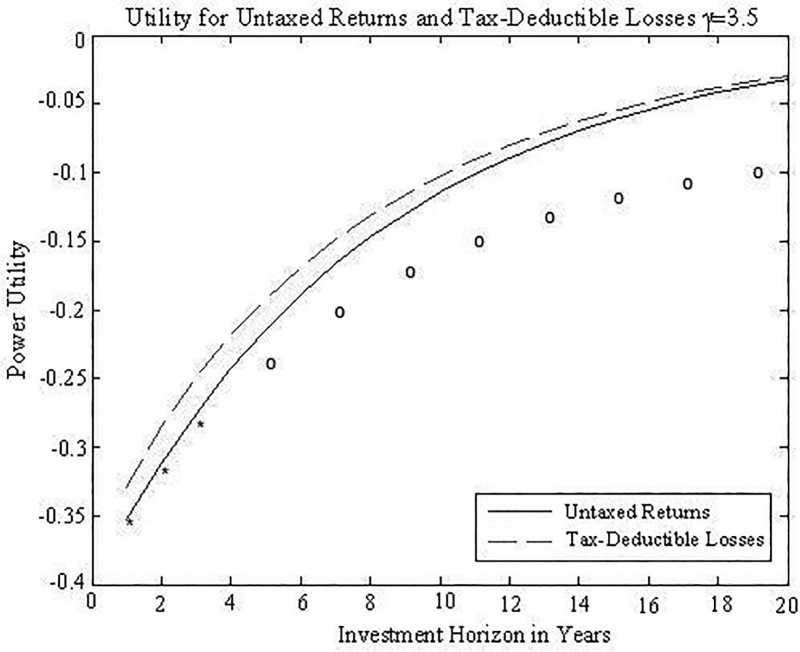


Figure 5: The cumulative distributions of the share of high-risk for individuals with designated pension savings and for those without.

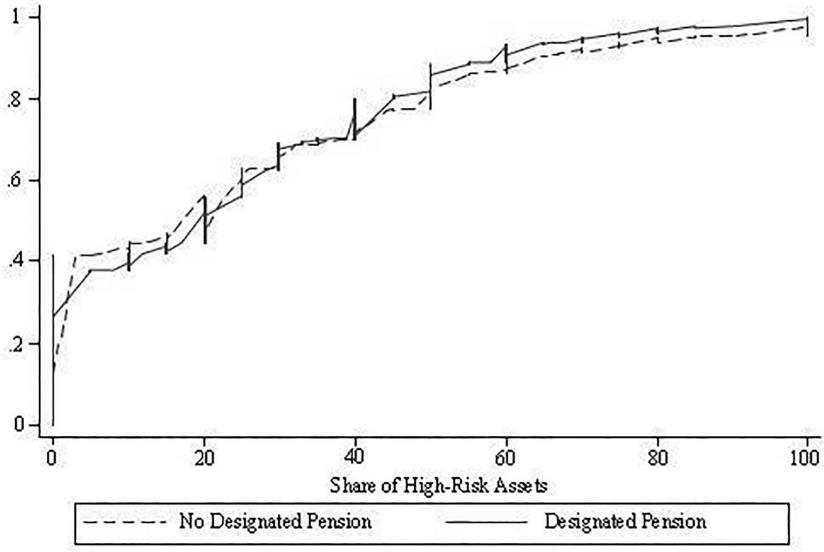


Figure 6: The cumulative distributions of risk-taking not explained by socio-economic background (or the share of high-risk funds chosen that is not explained by typical socio-economic background factors), for individuals with designated pension savings and for those without.

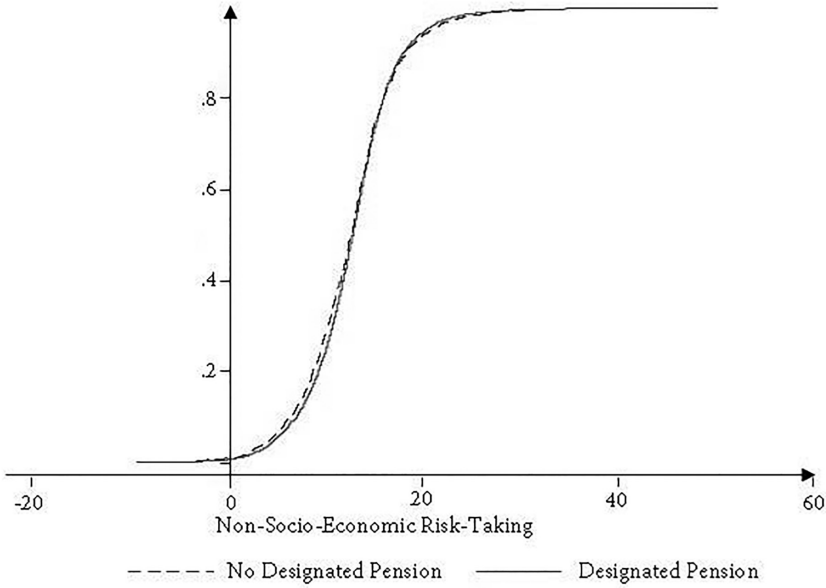
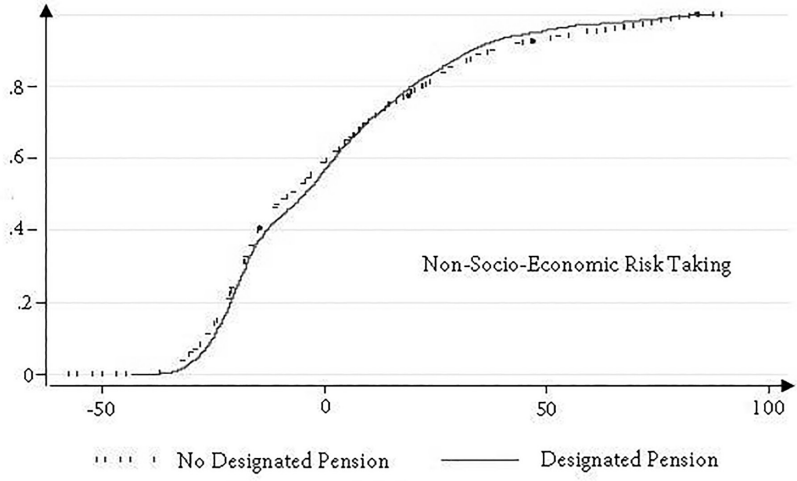


Figure 7: The cumulative distributions of risk taking not explained by socio-economic background (or the share of high-risk funds chosen that is not explained by typical socio-economic background factors), for individuals with designated pension savings and for those without, controlling for selection effects into being active investors.



Tables

Table 1. Tax Design

	Tax Rate	*Deductible Losses*	*Deductible Deposits*	*Return*
1. General Savings Tax	30%	Yes	No	actual
2. Designated Pension Savings Tax	15%	No	Yes (limited)	presumptive
3. Endowment Insurance Tax	27%	No	No	presumptive

Table 2. The Change in Expected Utility Given Different Tax Regimes

	Power Utility	Log Utility
	(High Risk Aversion)	*(Low Risk Aversion)*
The Change in Expected Utility from Having No Tax to Having:		
One Period:		
1. Endowment Insurance Tax	–2.2%	–10%
2. Designated Pension Savings	–1.2%	–5.5%
3. With Deductible Losses	3.3%	–9.2%
4. Without Deductible Losses	–5.3%	–37.7%
Two-Period:		
1. Endowment Insurance Tax	–4.5%	–10.1%
2. Designated Pension Savings	–2.5%	–5.6%
3. With Deductible Losses	3.2%	–16.2%
4. Without Deductible Losses	–7.76%	–30.7%

Note: The columns display the change in expected utility from having untaxed returns to having returns taxed by the different tax regimes. The power utility represents individuals with a high level of risk aversion, with the coefficient of relative risk aversion set to three. The log-utility represents individuals with a low level of risk aversion.

Table 3. Summary Statistics on the Usage of Deductible Designated Pension Savings

	Choosing Deductible Designated Pension Savings = Yes			Level of Designated Pension Deposits Deducted		
	All	**Men**	**Women**	**All**	**Men**	**Women**
All	46%	41%	50%	2954.2 (53.5)	2978.0 (86.0)	2931.8 (65.0)
Age:						
<25	14%	13%	15%	322	244	402
25–35	43%	41%	44%	1437	1514	1361
36–45	51%	56%	45%	2639	2615	2660
46–55	54%	48%	60%	4443	4566	4328
56–65	49%	42%	55%	5435	5416	5454

Table 3. (*Continued*)

	Choosing Deductible Designated Pension Savings = Yes			Level of Designated Pension Deposits Deducted		
	All	**Men**	**Women**	**All**	**Men**	**Women**
Labour Income (Th. SEK)						
0–150	30%	15%	35%	1406	653	1716
151–250	46%	36%	55%	223	1558	2753
251–350	58%	54%	65%	4345	3778	5525
351–450	63%	60%	74%	6620	6193	8195
451–550	63%	62%	71%	8514	8226	10234
>550	61%	59%	70%	11089	11290	9839
Share of High-risk Funds (24+)	43%	40%	47%	3236	3461	2971**
Share of Stocks of Financial Assets = 20%	39%	34%	43%	2063	2001	2120
Share of Stocks of Financial Assets = 21–79%	59%	54%	65%	5117	5221	5012
Share of Stocks of Financial Assets = 80%	51%	46%	56%	3197	3240	3157
Number of Obs.	11102	5381	5721	11102	5381	5721

Note: Standard deviations are given in parentheses. ***/**/* denote statistical significance at the 1/5/10 percent levels, respectively. The percentages refer to the percentage within each age/income/risk-taking/financial risk exposure group having used the option of deductible designated pension savings.

Table 4. Regression Results on Designated Pension Savings Behaviour and Risk

	OLS	Heckman	Heckman
	Very High-Risk Share	Pr (Active=1)	Very High-Risk Share
Education < 9 years	–1.313*	–0.143***	–0.881
	(0.695)	(0.026)	(0.731)
Education > 12 Years	2.108***	–0.023	2.159***
	(0.602)	(0.024)	(0.604)
Labor Income(10^{-4})	0.097***	0.012***	0.079***
	(0.023)	(0.001)	(0.024)
Net Wealth (10^{-5})	0.021***		0.020***
	(0.004)		(0.004)
Net Wealth SQ (10^{-9})	–0.048**		–0.004*
	(0.024)		(0.002)
Age	–0.909***	–0.004***	–1.004***
	(0.171)	(0.001)	(0.177)
Age SQ	0.006***		0.007**
	(0.002)		(0.002)
Female=1	–3.413***	0.103***	–3.572***
	(0.552)	(0.021)	(0.559)
Marr/Cohab=1	–0.574		–0.616
	(0.620)		(0.620)
Risky Share	5.551***		5.176***
	(0.634)		(0.662)
Mixed Share	2.365**		1.977**
	(0.963)		(0.983)
Occ. Pension Risk 1	–2.904***		–2.903***
	(0.667)		(0.667)
Occ. Pension Risk 2	–1.775**		–1.697**
	(0.724)		(0.724)
Undefined occ.p	–0.639		–0.278
	(0.940)		(0.957)
Financial Wealth		0.052*	
		(0.029)	
Financial Wealth Sq		–0.004*	
		(0.002)	
No Fin Wealth		–0.319***	
		(0.022)	
lamda			–3.373*
			(0.050)

Table 4. (*Continued*)

	OLS	Heckman	Heckman
	Very High-Risk Share	**Pr (Active=1)**	**Very High-Risk Share**
Reform-Spec.		Yes	
Controls			
Constant	49.726***	0.717***	54.027***
	(3.220)	(0.061)	(3.894)
WALD Chi2		822.07	822.07
Prob>Chi2		0.000	0.000
F-statistic	46.67		
Prob>F	0.000		
R-sq.	0.0557		
Adj. R-sq.	0.0545		
Numb. of Obs.	11102	17987	17987

Note: Standard deviations are given in parentheses. ***/**/* denote statistical significance at the 1/5/10 percent levels, respectively.

Table 5. Regression Results on Designated Pension Savings Behaviour Controlling for Unexplained Very High Risk-Taking Using Risk-Taking for the Premium Pension

		INC<364	364<INC<728		INC<364	364<INC<728
	DPS	Deducted DPS	Deducted DPS	DPS	Deducted DPS	Deducted DPS
	Dummy	Deposit	Deposit	Dummy	Deposit	Deposit
Non-socio-econ Risk	−0.0005	3.51**	17.18	0.0019***	7.18***	23.17*
	(0.0005)	(1.63)	(11.60)	(0.0006)	(2.03)	(13.951)
Non-socio-econ Risk SQ				−0.0001***	−0.154***	−0.268
				0.00002	(0.051)	(0.349)
Education < 9 years	−0.236***	−534.49***	−1247.65	−0.237***	−532.54***	−1264.11
	(0.035)	(114.57)	(1564.49)	(0.035)	(114.57)	(1564.98)
Education >12 years	0.083***	477.149***	1715.97**	0.085***	476.46***	1741.02**
	(0.029)	(101.91)	(722.36)	(0.029)	(101.86)	(723.26)
Labor Income(10^{-4})	0.029***	−80.82***	89.62***	0.029***	−85.63***	89.55***
	(0.002)	(22.06)	(30.47)	(0.002)	(22.11)	(30.48)

Table 5. (*Continued*)

		INC<364	364<INC<728		INC<364	364<INC<728
	DPS	**Deducted DPS**	**Deducted DPS**	**DPS**	**Deducted DPS**	**Deducted DPS**
	Dummy	**Deposit**	**Deposit**	**Dummy**	**Deposit**	**Deposit**
Labor Income SQ (10^{-9})	−0.000***	0.042***	−0.002**	−0.000***	0.042***	−0.002**
	(0.000)	(0.01)	(0.00)	(0.000)	(0.006)	(0.000)
Net Wealth (10^{-5})	0.002***	29.314***	14.51***	0.002***	29.44***	14.72***
	(0.000)	(1.097)	(3.09)	(0.000)	(1.10)	(3.10)
Net Wealth SQ (10^{-9})	−0.002***	−0.0002***	−0.003**	−0.002***	−0.0002***	−0.004**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.00)	(0.001)
Age	0.131***	−2.581	−56.55	0.125***	−11.21	−72.60
	(0.009)	(28.85)	(382.05)	(0.009)	(28.98)	(382.70)
Age SQ	−0.001***	1.077***	3.77	−0.001***	1.18***	3.99
	(0.000)	(0.35)	(4.24)	(0.000)	(0.356)	(4.25)

Constant	–3.411***	–293.43	–3489.81	–3.229***	26.14	–3064.18
	(0.172)	(518.93)	(8299.82)	(0.174)	(529.26)	(8320.08)
LR-Chi2(5)	1082.30			1127.76		
Prob>Chi2	0.000			0.000		
Pseudo R2	0.071			0.074		
F-statistic		265.21	15.55		239.82	14.04
Prob>F		0.000	0.000		0.000	0.000
R-sq.		0.190	0.134		0.191	0.134
Adj. R-sq.		0.189	0.125		0.190	0.125
Numb. of Obs.	11102	10186	916	11102	10186	916

Note: Standard deviations are given in parentheses. ***/**/* denote statistical significance at the 1/5/10 percent levels, respectively.

Table 6. Regression Results on Pension Savings Behaviour Using the Share of Very Risky Assets of Financial Assets as a Measure of Risk-Taking

		INC<364	364<INC<728		INC<364	364<INC<728
	DPS Dummy	**Deducted Amount**	**Deducted Amount**	**DPS Dummy**	**Deducted Amount**	**Deducted Amount**
Risk	0.140***	234.242*	610.14	1.406***	5145.579***	14894.103***
	(0.036)	(124.946)	(907.32)	(0.159)	(546.395)	(3602.156)
Risk SQ				−1.288***	−4991.483***	−1.48e+04***
				(0.157)	(540.722)	(3606.044)
Labor Income(10^{-4})	0.029***	−93.635***	91.46***	0.028***	−91.907***	92.882***
	(0.003)	(22.075)	(31.15)	(0.003)	(21.983)	(30.868)
Labor Income SQ (10^{-9})	−0.000***	0.005***	−0.00***	−0.000***	0.004***	−0.000***
	(0.000)	(0.001)	(0.00)	(0.000)	(0.001)	(0.000)
Net Wealth (10^{-5})	0.002***	29.859***	13.21***	0.001***	27.635***	11.363***
	(0.000)	(1.151)	(3.26)	(0.000)	(1.171)	(3.261)

Net Wealth SQ (10^{-9})	−0.000***	−0.000***	−0.000**	−0.000***	−0.000***	−0.000
	(0.000)	(0.000)	(0.00)	(0.000)	(0.000)	(0.000)
Age	0.151***	44.185	117.56	0.154***	55.356*	129.077
	(0.009)	(28.910)	(392.28)	(0.009)	(28.814)	(388.765)
Age SQ	−0.002***	0.433	1.65	−0.002***	0.287	1.382
	(0.000)	(0.353)	(4.358)	(0.000)	(0.352)	(4.319)
No Financial Assets	−0.373***	−747.592***	−3975.48***	−0.295***	−454.529***	−2790.171**
	(0.034)	(112.848)	(1242.11)	(0.035)	(116.772)	(1264.526)
Constant	−3.663***	−775.802	−5560.08	−3.786***	−1236.113**	−6685.388
	(0.174)	(520.632)	(8513.508)	(0.175)	(520.837)	(8441.512)
LR-Chi2(5)	1291.42			1358.56		
Prob>Chi2	0.000			0.000		
Pseudo R2	0.0863			0.0908		
b		315.16	16.94		291.98	17.20

Table 6. (*Continued*)

		INC<364	364<INC<728		INC<364	364<INC<728
	DPS Dummy	**Deducted Amount**	**Deducted Amount**	**DPS Dummy**	**Deducted Amount**	**Deducted Amount**
PROB>F		0.000	0.000		0.000	0.000
R-SQ.		0.2021	0.1353		0.2088	0.1518
ADJ. R-SQ.		0.2014	0.1273		0.2081	0.1429
NUMB. OF OBS.	10840	9965	875		9965	875

Note: Standard deviations are given in parentheses. ***/**/* denote statistical significance at the 1/5/10 percent levels, respectively.