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The Crowding-Out Effect of Mandatory Labour Market Pension Schemes on Private Savings

Evidence from Renters in Denmark

DP 11/2013-054

The crowding-out effect of mandatory labour market pension schemes on private savings: evidence from renters in Denmark

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November 2013

Abstract

We estimate the crowding-out effect of the Danish mandatory labour market pension reforms begun in 1993 on the level of total household savings for renters. The effect is identified via a large panel of individual administrative records utilising the differences in speed, timing and sectoral coverage of the implementation of the reform in the period 1997 to 2005. We find little substitutability between current mandatory labour market pension savings and private voluntary savings. Each euro paid into mandatory labour market pension accounts results in a reduction in private savings of approximately 0 to 30 cents, depending on age. This low rate of substitution is only, to a minor extent, explained by liquidity constraints. The results point to mandatory pension savings having a large effect on total household savings. Thus, pension reforms that introduce mandatory saving have macroeconomic implications.

JEL classification: D01, D91, H31

Keywords – Savings, Pension reform, micro panel data, first differences

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1. Introduction

The main source of pension saving in Denmark comes from mandatory pension contributions agreed collectively between labour market unions and employer organisations. For the majority of employees this system dates back to the beginning of the 1990s where relatively small contributions were agreed upon as part of the wage bargaining process between unions and employer organisations. The mandatory pension contributions have been increased on several occasions since then and are now a significant part of the remuneration package most employees receive. The size of these defined contributions varies among individuals according to their occupation and the specific collective agreement covering their work place. The contributions are mandatory in the sense that individuals are not allowed to opt-out of the pension scheme if their work place is covered by a central agreement. This system of individual mandatory pension accounts, where individual contributions are largely determined at the firm or industry level, is unique in international comparison, and its effect on individual saving behaviour has not been studied before.

This paper is concerned with the substitution between these mandatory pension schemes and private savings. In particular, we analyse the extent to which the Danish mandatory labour market pension schemes offset or crowd out private savings in other assets. The offset effect of mandatory pension contributions on other private savings has important implications for a range of policy issues. Specifically, for policy makers in countries contemplating reforming the pension system from an unfunded pay-as-you-go system to a funded defined contribution system, it is important to know the impact on total private savings and, hence, national savings. Likewise, it has implications for the usefulness of mandatory pension schemes in increasing national savings rates in general. In addition, general mandatory pension contributions can – as has been the case in Denmark – be used as a business cycle policy instrument, in which case, the dampening effect on the economy depends crucially on the offset effect on other private savings.

The mandatory pension accounts in place in Denmark share features with some voluntary IRAs (Individual Retirement Accounts) and the voluntary 401(k) pension schemes available in the US. As is the case for those, contributions into the Danish mandatory pension accounts are tax exempt and taxes are paid upon withdrawal at retirement. The mandatory accounts also enjoy preferred tax treatment on interest earnings, since these are currently taxed at 15 percent; lower than the range of 25 to 60 percent applicable to returns on other financial assets. Parallel to the mandatory pension accounts, individuals can open 'non-mandatory' pension accounts where contributions are voluntary. These accounts receive the same tax treatment as the mandatory pension accounts, and are, therefore, perfect substitutes for mandatory pension accounts. The central difference between the Danish mandatory pension accounts and, for example, 401(k)s is that, conditional on an individual's place of work, the contribution to the Danish mandatory pension account is fixed. Furthermore, for some individuals, there are year-on-year changes in the absolute size of the contribution – as well as in the contribution rate (i.e. contributions as a percentage of gross wages). We exploit these features to estimate the offset effect on other private savings of mandatory contributions.

The present paper is situated within two strands of related literature. First, there is the well-developed notion that changes in expected pension entitlements upon retirement, as, for example, resulting from a change in a general old-age pension provision scheme can affect other forms of private asset accumulation. Feldstein (1974, 1982) and, subsequently, Gale (1998) are prominent studies of the effect of changes in social security on private asset accumulation in the US. More recently Attanasio & Rohwedder (2003) looked at the same effect following a pension reform in the UK and Hurd, Michaud & Rohwedder (2012) investigate the issue in a cross-country setting.[1] Second, this paper touches upon the literature on the effectiveness of saving incentives in raising, in particular, savings for

[1] Other studies include Alessie, Kapteyn & Klijn (1997) and Euwals (2000) analysing the effect of defined benefit pensions on private savings in the Netherlands, Gustman & Steinmier (1999) on the effect of pension wealth on other wealth in the US, Japelli (1995), Attanasio & Brugiavini (2003) and Bottazzi, Japelli & Padula (2006) on the effect on private savings following pension reform in Italy; Kim & Klump (2008) on the effect of social security benefits on private saving.

retirement. A body of research has examined the effect of IRAs on total private saving (Poterba, Venti & Wise, 1996; Engen, Gale & Scholz, 1996; Hubbard & Skinner, 1996; Attanasio & DeLeire, 2002 and Chetty et al. 2012) with mixed results. Similar mixed evidence has come from research on the effect of 401(k) eligibility and contributions on private asset accumulation (Poterba, Venti & Wise, 1995; Pence, 2001 and Benjamin, 2003, Gelber, 2011).

For both changes in pension entitlements and the availability of tax-favoured saving accounts, it is difficult to infer the effect on the accumulation of other private assets from theory alone. In the case of public pension reforms that alter pension entitlements, a simple life-cycle framework without liquidity constraints and with perfect foresight suggests that a one euro change in the net present value of pension entitlements would result in a change in the optimal consumption path, such that the change in total net present value of current and future consumption would be one euro in the direction opposite to the change in pension entitlements. Thus, the size of the offset effect on current savings depends on the distance in time to retirement and, therefore, on age (Gale, 1998). However, if individuals are liquidity constrained or their precautionary saving motives are strong, pension entitlements would crowd out other private saving to a lesser extent than dictated by the simple model.[2] The offset effect might also depend on institutional settings if these are important in framing individuals' planning horizons. For instance, a more comprehensive welfare state might induce individuals to make less detailed retirement plans than a less inclusive public system.

Within the context of the life-cycle framework, IRAs and 401(k)s affect total private savings by altering the return on savings as a result of the preferred tax treatment of these accounts (Hubbard & Skinner, 1996). However, theoretically it is not clear whether the income or substitution effect would dominate, and thus, how individual saving should respond. Furthermore, it can be argued (outside the framework of the life-cycle model) that

[2] This also applies in the case where individuals affected by the change in pension entitlements perceive it to be financed in part by a change in the amount of taxes they paid.

dedicated pension accounts from which withdrawal is more cumbersome and carries a penalty increase private savings because these resources are locked away, and therefore induce self-control in individual saving behaviour (Thaler, 1994).[3]

As indicated above, both strands of literature reach mixed conclusions on the effect on private savings. Feldstein (1974) found that an additional dollar of social security would offset 30-50 cents of private savings; roughly the same range as estimates reported by Hurd, Michaud & Rohwedder (2012). Gale (1998) found offset effects upwards of 80 cents per dollar. Attanasio & Rohwedder (2003) report offset effects roughly in the middle of those from Feldstein and Gale. Chetty et al. (2012) study the effect of mandatory pension contributions on total savings and total pension savings and report that roughly about 15 percent of individuals react to changes in the contribution rates. Turning to estimates of the offset effect on other private savings from IRAs and 401(k)s, they range from little or no offset (Poterba, Venti & Wise, 1995, 1996) to close to full offset (Engen, Gale & Scholz, 1996; Attanasio & DeLeire, 2002) with findings in between (Hubbard & Skinner, 1996; Benjamin, 2003).

While our analysis is closely related to the literature on the effect of IRAs and 401(k)s on other private savings there are two distinct differences. Since, as noted above, the mandatory pension contributions do not introduce any new incentives to save, because any mandatory pension contribution plan can be mimicked voluntarily, our findings will have to be attributed to liquidity constraints or precautionary saving motives if we stay within the confinements of the life-cycle framework.

The paper therefore adds to the literature in three ways. First, it provides estimates of the offsetting effect of mandatory pension contributions on private savings for Denmark. The only other study of the offsetting effect of mandatory pension contributions at the individual level that we are aware of is Chetty et al. 2012. They study the administrative

[3] See also recent contributions from Thaler and Benartzi (2004), Benartzi and Thaler (2007), Card and Ransom (2011) and Madrian (2012) on behavioural biases related to (pension) savings decisions.

records from Denmark but use a very different empirical setup to ours. They also find little evidence of crowding out which is consistent with our results. Thus, the two studies complement each other.[4] Second, it relates to the literature on the effect of savings incentives for pension saving by providing an estimate for how much pension saving accounts affect other private savings even without additional saving incentives. Third, by allowing the estimates of the offsetting effect of mandatory pension savings to vary between the different age groups we account for the issue of the older age groups having a shorter time span to adjust to changes in the mandatory contribution rates.

We find little evidence of substitutability between current contractual mandatory labour market pension savings and private savings. Each euro paid into mandatory labour market pension accounts results in a reduction in private savings of approximately 0-30 cents depending on the age group in question. The low crowding-out effect of mandatory pension contributions on private savings is only, to a limited extent, explained by the presence of liquidity constraints. We find evidence that crowding-out is increasing as individuals approach retirement age. For the youngest cohort there is no evidence of any crowding-out, whereas the oldest group (50 to 54 year olds) dissaves around 30 cents of voluntary savings for each euro of mandatory pension contributions.

The paper is organised in the following way. The next section gives an account of the Danish labour market pension system. Section three describes the data sources available and the limitations they imply. Section four is devoted to specifics on econometrics. Finally, sections five and six provide results and a discussion.

[4] The empirical approach in Chetty et al. (2012) is different from our setup on at least 3 accounts: 1) We utilize changes in the pension policies over time (changes in the coverage of the labour market pension schemes and in the pension contribution rates). Chetty et al. utilizes the variation that comes from individuals changing jobs. Because pension contributions vary across firms, job changes often lead to changes in the pension contribution rates. 2) We study the substitution between mandatory pension savings and voluntary savings, whereas Chetty et al. analyze the share of individuals who react to changes in the contribution rates. 3) Our focus is on individuals who rent their homes, whereas Chetty et al. include real estate owners in their sample but restrict the analyses to individuals who change jobs. Our concern is that levels and changes in real estate values are not well reflected in the Danish administrative records. The measure of total savings includes fluctuations in real estate values, because it is derived as the change in net wealth – including real estate wealth. During the data period there have been large changes in real estate values. The value of real estate comes from the tax authorities and is measured with substantial uncertainty (see the Data chapter).

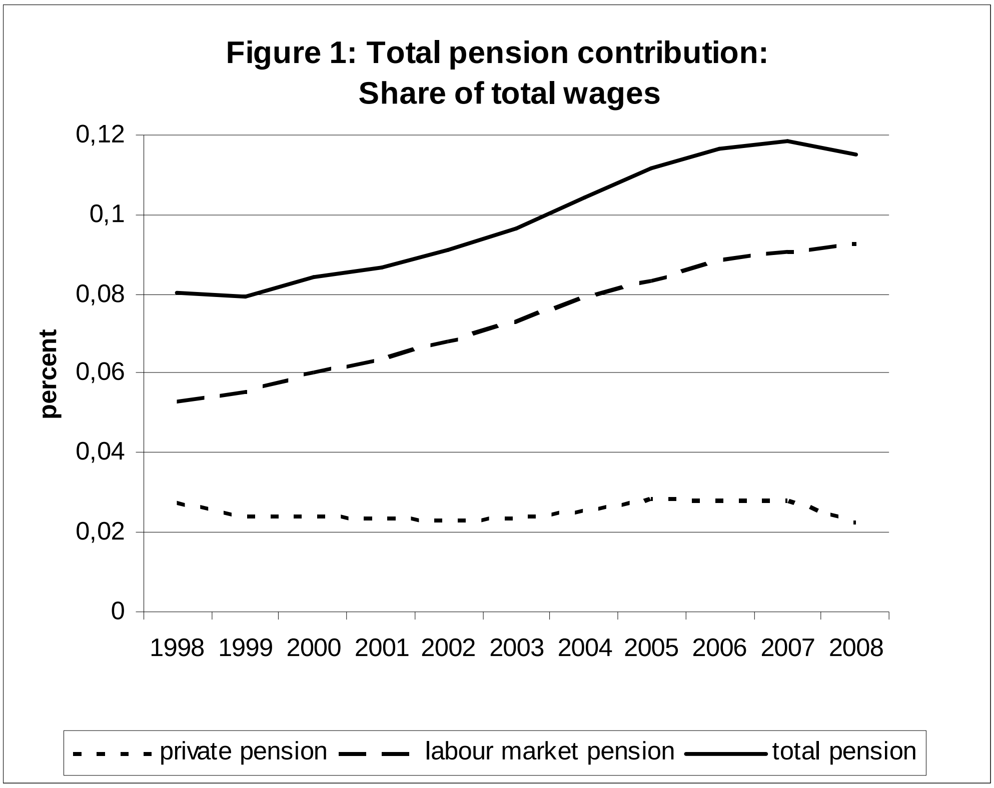
2. The Danish labour market pension schemes

During the 1990s the Danish labour market pension system was expanded to include the private sector, and, as a consequence, today the majority of employed people save for retirement. Labour market pension contributions are mandatory for workers employed in a firm for which a collective pension scheme has been negotiated. A collective pension scheme is either agreed upon as part of collective agreements between unions and employer associations or as an agreement for employees within an individual firm.[5] If a worker is employed in a firm for which a collective pension scheme has been agreed, the employer deducts a fixed percentage – corresponding to the agreed contribution rate – of the monthly wage and places the contribution in an individual pension savings account. Today, mandatory pension contribution rates typically range between 11 and 18 percent of the monthly wage, but it is possible individually to increase the pension savings rate above the mandatory contribution rate.

The development of the labour market pension system has resulted in an increase in total labour market pension contributions as shown in figure 1. Figure 1 shows total pension contributions divided by total wage income for all workers in Denmark. The increase in the total labour market pension contributions corresponds to increases in the total pension contributions. Even though mandatory pension contributions have increased markedly, the share of total employee remuneration that is paid into private contractual pension schemes is almost constant during the period considered. Several explanations are consistent with these aggregate trends. Demography plays a role. The Danish population has been getting older in the time span considered. Nearing retirement probably induces awareness of the need to save for retirement. It might also be that the increase in mandatory pension contributions has generated a general increase in the willingness to save for retirement – an

[5] The labour market pension contributions are mandatory for employees within a given collective agreement area, even for workers who have chosen not to join the union that has the right to negotiate. The implication is that the only way to avoid saving in a labour market pension scheme is to be employed in a private firm that is not covered by a collective labour market pension agreement.

effect operating at the macro level. The explanation we pursue in this paper is that the developments shown in figure 1 come about because substantial increases in mandatory contribution rates have only lead to limited crowding out of savings in private pension schemes and in non-contractual savings.



Source: Statistics from SKAT and Statistics Denmark (Statistikbanken)

Even though labour market pensions have become more widespread, there are some groups who are not covered by labour market pension savings schemes (mainly non-organised low paid unskilled workers and high paid white collar workers in small firms in the private sector, who are not covered by any collective agreement). In addition, the self-employed and those who are temporarily or permanently out of the labour force are not covered by a labour market pension scheme.

Table 1 shows the share of people in the workforce aged 30 to 55 years old who contribute to a pension scheme. The development of the mandatory labour market pension schemes has almost doubled the share of people who are covered by a labour market pension scheme. Thus, in 1988 only 37 percent of individuals between 30 and 55 years old contributed to a labour market pension scheme. In 2005, the share was 69 percent. The share of individuals contributing to a private pension scheme has remained at almost the same level during the observed period.

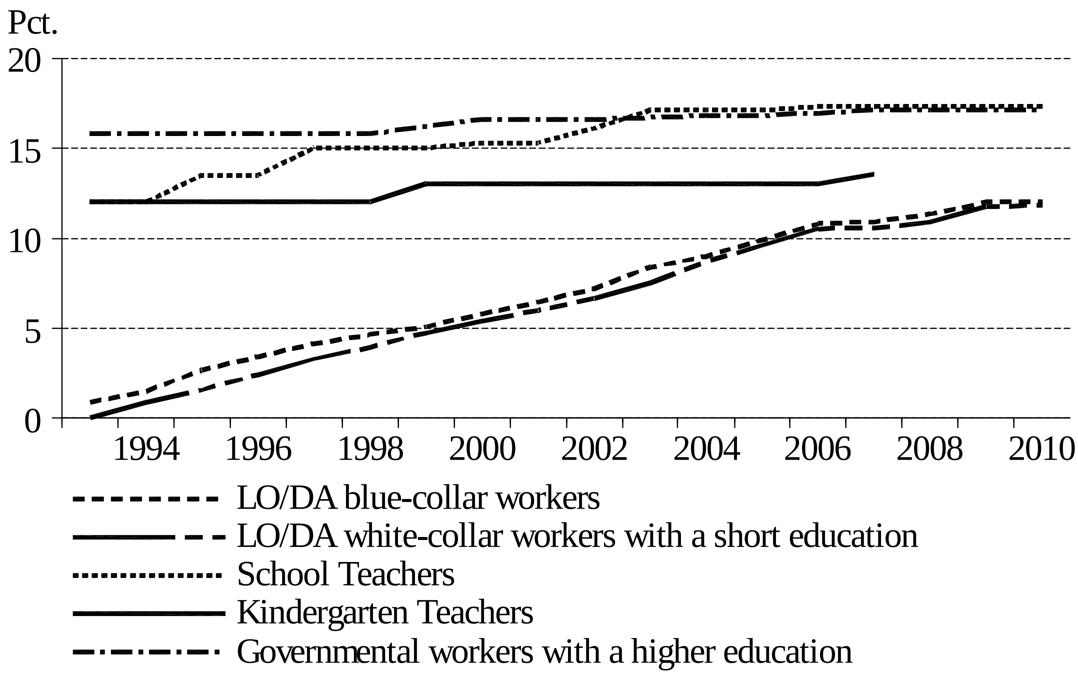
Table 1: Share of people between 30 and 55 years who contributes to a pension scheme

	1988	1995	2005
Labour market pension scheme	37	56	69
Private pension scheme	31	36	32
A pension scheme	56	71	77

Note. Civil servants are not included.
Source: Calculations based on register data from Statistics Denmark

Before 1990 labour market pension schemes were mainly reserved for workers in the public sector, but collective agreements between the Confederation of Danish Employers (DA) and the Danish Confederation of Trade Unions (LO) in 1991 resulted in a further approximately 520,000 blue and white collar workers with some post-secondary education or training being covered by a labour market pension scheme during the 1990s. This corresponded to about one sixth of the Danish labour force. Figure 2 shows the pension contribution rates in the collective agreements for selected labour unions. Most notable is the development of the labour market pension system for members of the Danish Confederation of Trade Unions. When it was first agreed to develop labour market pensions for that specific agreement area, the agreed contribution rate was about 0.9 percent of the monthly wage, cf. figure 2. During the following two decades the contribution rate increased to about 12 percent. The lines representing the other union areas in figure 2 all concern workers with bachelor degree level education mainly employed in the public sector, where the labour market pension system was developed before 1993.

Figure 2: Contribution Rates for Danish Mandatory Labour Market Pensions



Notes: The contribution rates are agreed rates in the collective agreements. LO are the initials (in Danish) for the Danish Confederation of Trade Unions. DA are the initials (in Danish) for the Confederation of Danish Employers

Source: Information from the Confederation of Danish Employers (DA), the Danish Confederation of Trade Unions (LO), Confederation of Professionals in Denmark (FTF) and the Danish Association of Lawyers and Economists (DJOF)

For employees covered by a collective labour market pension scheme, changes in the contribution rates are agreed upon as part of the collective agreements at the national level. Thus, the changes in contribution rates are exogenously given for the individual worker. The parts of the salary that are liable to pension contributions vary. The basic salary and increments that are fixed are always liable to pension contributions. Whether one-off bonus payments etc. are liable varies with the workplace. The default in the private sector is that bonuses are liable for pension contributions. In the public sector it is more mixed. This is agreed upon between the workers' representative and the management of the workplace. Whether or not bonuses are liable for pension contributions, the prevailing practice is rarely changed. Thus, unless the workplace is very small, whether bonus payments are liable to pension contributions or not is exogenous to the individual worker.

For workers covered by mandatory labour market pension schemes that have been facilitated at the firm level, the default is that all the salary is liable for pension contributions.[6]

The extent to which changes in contribution rates are anticipated or not is also an issue. We have observations for the period 1997-2006. Before that period collective agreements were agreed in 1995. In the public sector this was a two year agreement (1995-1997) and for large parts of the private sector it was a three year agreement (1995-1998). The next collective agreements were 1997-1999, 1999-2002, 2002-2005 and 2005-2008 for the public sector and for large parts of the private sector: 1998-2000, 2000-2004 and 2004-2007 (Statistics Denmark 2002, 2008). After a collective agreement is finalized information about changes in the contribution rates during the agreement period is available. Thus, depending on the length of the agreement period, exact information about future changes in the contribution rates is publicized between zero and three years in advance.

In addition to the collectively agreed pension schemes, workers make mandatory pension savings through the labour market additional pension scheme (known as "ATP") and – for the years 1998 to 2003 – the special pension scheme ("SP"). Both are mandatory for employed and unemployed workers. However, the contribution rates are relatively small compared to the rates in the collective labour market pension schemes. Pension savings in the ATP-pension scheme are a fixed amount of between 150 and 450 euros a year. The SP-pension scheme was introduced in 1998 as part of a counter cyclical fiscal package and suspended from 2004. The contribution rate was 1 percent of wages for all workers during the whole period.

[6] There are no official records on this. However, the union secretariats of LO, HK and DJØF have the impression (telephone communication) that the most common is that the whole salary is liable to pension contributions in private firms that have a labour market pension scheme for their workers.

Mandatory labour market pension schemes are either pension by instalments or annuity pension schemes. In rare cases it is also possible to choose a capital pension (lump sum) scheme. However, in most cases, the mandatory payment schemes only offer one the payment options. Voluntary private pension schemes, which are offered by banks and insurance companies, are also available. The voluntary private pension schemes offer all three options, that is, pension by instalments, annuity pension and capital pension. Thus, it is always possible to mimic mandatory labour market pensions with voluntary private pensions (Danish Economic Councils, 2008).[7]

Pension saving schemes are taxed favourably in Denmark. In general, income is liable to income tax. However, income that is paid into a pension savings account is not liable to income tax. Instead pension income is taxed. Interests and profits from funds locked up in a pension account are taxed at 15 percent compared to a 40-60 percent for profits from funds in non-pension accounts. The tax rules do not distinguish between private and mandatory pension saving schemes. Thus, they are taxed exactly the same.

Besides the payments from the labour market pension schemes, a retired person is entitled to old age retirement pension payments which amount to between 10,000 and 20,000 euros per year (gross of income tax) depending on the retired person's other income and marital status. In the time period considered here there has been no major change to the old age retirement pension system.

3. Econometric specification

In this section we start with a reduced form model, which can be thought of as being derived from a simple life cycle model, (Alessie et al. 1997), though we do not emphasize this. The value of the life cycle model in terms of understanding central features of the

[7] When the beneficiary dies, the spouse (if alive) and then their children become the beneficiaries of the pension by instalments and capital pension schemes. However, if the pension scheme includes an insurance element, the spouse usually only inherits a share of the payments rights. The children do not inherit the pension scheme when both spouses die. This applies to annuity pensions.

decision to save for retirement is increasingly disputed (Thaler, 1994; Benartzi & Thaler, 2007). Our estimating equation simulates an experiment where voluntary savings are compared for individuals who are identical with respect to other explanatory variables, but who differ in the share of their monthly wages that are mandated to contributions to their labour market pension account.

Consider an individual worker i at time t with mandatory labour market pension savings, s_{it}^{MP}. His additional voluntary savings consist of private savings locked-up for retirement, s_{it}^{PP}, and savings in free assets, s_{it}^{F} (e.g. bank accounts and financial assets). These three types of savings add up to total individual private savings. Voluntary savings, s_{it}^{V}, is defined as the sum of private pension savings and free savings:

$$s_{it}^{V} \equiv s_{it}^{PP} + s_{it}^{F} \tag{1}$$

Voluntary savings in period t for individual i are assumed to be a function of age (age_{it}), earnings (y_{it}) in the current period, total wealth (a_{it-1}), the present value of future expected earnings ($npvy_{it}$) and mandatory pension savings (s_{it}^{MP}):

$$s_{it}^{V} \equiv s_{it}^{V}\left(age_{it}, y_{it}, a_{it-1}, npvy_{it}, s_{it}^{MP}\right) \tag{2}$$

The arguments in the savings function would capture the features of a simple life cycle model. Individual voluntary savings are dependent on position in the life cycle (age), earnings, wealth, the expected value of future earnings, and mandatory savings. Our main interest lies in the effect of s_{it}^{MP} on s_{it}^{V}.

In order to arrive at an estimating equation we consider a linear version of equation (2) and eliminate the effect of age by estimating the equation for different age groups. This serves two purposes; it greatly reduces the number of potential parameters to be estimated since, in effect, parameters on earnings and wealth are potentially age dependant. In addition it will serve as a robustness check on the coefficient of the effect of s_{it}^{MP} on s_{it}^{V} across age groups. Thus,

$$s_{it}^{V} = \alpha + \beta_1 y_{it} + \beta_2 a_{it-1} + \beta_3 npvy_{it} + \gamma s_{it}^{MP} + \varepsilon_{it} \tag{3}$$

Identification and estimation

The administrative records (more on these below) contain information about annual savings in private voluntary pension schemes as well as annual mandatory pension savings. However, savings in other assets are not observed directly. Instead we use information about total wealth (excluding pension wealth) in period *t* and *t*-1 to derive annual savings in other assets. The change in total non-pension wealth can be written as:

$$a_{it}^{F} - a_{it-1}^{F} = s_{it}^{F} + r_{it}\, a_{it-1}^{F} \tag{4}$$

where a_{it}^{F} is individual *i*'s total non-pension wealth – also denoted as free assets - at ultimo time *t*, s_{it}^{F} is savings in free assets in period *t* as defined above, and r_{it} is the individual rate of return on the portfolio of total assets in period *t*. The return depends on the portfolio composition and can be written as a deviation from an average interest rate, *r*:

$$r_{it} a_{it-1}^{F} = \left(r + \bar{r}_{it}\right) a_{it-1}^{F} \tag{5}$$

We add equation (5) to equation (3) and thus redefine voluntary savings as contributions to private pension schemes and free savings plus the return from free savings. This yield

$$s_{it}^{V*} = s_{it}^{V} + r_{it} a_{it-1}^{F} = \alpha + \beta_1 y_{it} + \beta_2 a_{it-1} + \beta_3 npvy_{it} + \gamma s_{it}^{MP} + r a_{it-1}^{F} + \bar{r}_{it} a_{it-1}^{F} + \varepsilon_{it} \tag{6}$$

We assume the $\bar{r}_{it}$'s are identical and independently distributed across *i* and *t* with a symmetric distribution with zero mean. This reflects that the total value of an individual's assets can be diversified in a many ways, and that the expected excess return to any particular diversification is zero. The assumption rules out the possibility that individuals are able to consistently construct portfolios with higher returns than offered by the market rate, *r*.

Unfortunately, information about accumulated pension wealth is not available. This implies that our most parsimonious specification can be written as:

$$s_{it}^{V*} = \alpha + \beta_1 y_{it} + \delta a_{it-1}^{F} + \beta_3 npvy_{it} + \gamma s_{it}^{MP} + \bar{\varepsilon}_{it} \tag{7}$$

where $\delta = (\beta_2 + r)$ and $\bar{\varepsilon}_{it} = \beta_2 (a_{it-1}^{MP} + a_{it-1}^{PP}) + \bar{r}_{it} a_{it-1}^{F} + \varepsilon_{it}$. a_{it-1}^{MP} and a_{it-1}^{PP} are accumulated mandatory and private pension wealth, respectively, ultimo period *t*-1. The present value of future expected earnings, $npvy_{it}$, is approximated by dummy variables for education, industry of occupation and the interaction terms between the two.[8] The modified error term will be heteroscedastic due to the presence of $\bar{r}a_{it-1}^{F}$. Also, a_{it-1}^{F} may be endogenous because of the presence of private pension wealth, a_{it-1}^{PP}, and mandatory pension wealth, a_{it-1}^{MP}, in the modified error term.

In addition, even with changes in the levels of mandatory pension contributions being exogenous at the individual level as argued in section 2, we still suspect the level of mandatory pension contributions to be endogenous in equation (7). Individuals with a greater taste for saving for retirement are probably more likely to choose occupations – or jobs – where the mandatory pension contribution is higher relative to individuals with a lower taste for retirement saving. This would tend to bias γ upwards, when estimating equation (7) with OLS. That is, show too little offset from mandatory pension

[8] Note that, because all estimations are done on several different age groups, there is no need to include an age variable as a proxy for the present value of future earnings.

contributions. As a remedy to these complications we include an individual fixed effect in our preferred specification and additional control variables, X_{it}, including time dummy variables. This leads to

$$s_{it}^{V*} = \alpha + \beta_1 y_{it} + \delta a_{it-1}^F + \gamma s_{it}^{MP} + \lambda X_{it} + \eta_i + \bar{\varepsilon}_{it} \qquad (8)$$

Identification of the parameter of interest, γ, comes from differences in the level of mandatory pension contributions across individuals and time. The identifying assumption is that conditional on the fixed effect and other explanatory variables, the mandatory labour market pension contribution is exogenous. Thus, we assume that individual tastes for pension savings are constant over time and may, therefore, be approximated by a fixed effect. For a given age group the fixed effect causes the proxy for the present value of future expected earnings to be redundant in the estimation procedure (the transformations to eliminate the fixed effect cause the proxies to cancel out).

Estimation of (8) is complicated by the fact that a_{it-1}^F is present on the LHS as well as on the RHS, cf. equation 4 above, because lagged non-pension wealth is used to define non-pension savings in the current period. This gives equation (8) a partly dynamic panel structure. Simple within transformation or first-differencing to get rid of the fixed effect therefore leads to biased estimates without further measures.

We approach the estimation of (8) in two ways. First, we employ standard dynamic panel data methods using internal instruments in the form of further lags of a_{it-1}^F and transformations hereof (Arellano & Bond 1991; Blundel & Bond, 1998 and Roodman, 2009). However, because the tests of instrument validity (overidentification tests) are very rarely satisfied in our specifications, we emphasise another option which – given an assumption of strictly exogenous covariates – establishes bounds on the parameter of interest without recourse to instrumental variables methods. To appreciate this, note that we can get an upper bound, denoted δ^U, and a lower bound, denoted δ^L, on the parameter estimate of the coefficient on lagged non-pension wealth, δ, by estimating (8) by OLS, respectively, a within fixed effect estimator. Now consider the following modified version of (8):

$$s_{it}^{MOD} = s_{it}^{V*} - \delta^m a_{it-1}^F = \alpha + \beta_1 y_{it} + \gamma s_{it}^{MP} + \lambda X_{it} + \eta_i + \bar{\varepsilon}_{it},\ m \in \{U, L\}. \tag{9}$$

If δ^m is a consistent estimate of δ, equation (9) can be consistently estimated by a within fixed effect estimator (or any standard method to eliminate the fixed effect, such as first-differencing). Let $\gamma(\delta^m)$ be the resulting estimate of the crowding-out effect from equation (9) given the value δ^m. Because $\gamma(\delta^m)$ is a monotone function of δ^m, effective bounds on $\gamma(\delta^{consistent})$ can be obtained by first estimating (9) with the within fixed effect estimator using δ^U to get $\gamma(\delta^U)$, and then repeating the process using δ^L to get $\gamma(\delta^L)$. Whether $\gamma(\delta^U)$ will be the upper or the lower bound on $\gamma(\delta^{consistent})$ depends on the correlations in the data, but is not important for our purpose. In our application this method generates very tight bounds on the estimated crowding-out effect.

In section 2 we noted that information about future changes in contribution rates may be published 0-3 years in advance in the beginning of a collective agreement period. Even though these changes are exogenous to the individual it allows for the individual worker to change occupation if he dislikes the upcoming changes in contribution rates during the agreement period. This raises the concern that the estimates may be biased if the selection is not taken care of. However, we argue that this possibility is remote for two reasons. First, the costs of changing occupation are high if gained qualifications are not utilized in the new occupation or new qualifications would have to be obtained. For instance, during the agreement period 2002 to 2005 the contribution rates for school teachers were raised from 15.3 to 16.1 percent in 2002 and further to 17.1 percent in 2003. In the same period the contribution rates for kindergarten teachers were unchanged at 13 percent. School teachers who disliked the increases in contributions rates may have considered becoming kindergarten teachers instead. However, this would imply lower wages, because kindergarten teachers are paid less than school teachers. It would also imply not exploiting the gained qualifications as a school teacher (which is a 3½ year education in Denmark). Further, it would require gaining qualifications as a kindergarten teacher (which is a 2½ year education in Denmark). Thus, the costs of changing occupations are high.

Second, there is evidence that workers' knowledge about their pension affairs is incomplete even though this information is public. A Danish survey by Amilon (2008) presents evidence that Danish workers are unable to predict their future pension income. The study applies data about individual wealth, income and pension savings to estimate individual income when retired. These estimates are compared with survey data where the respondent answers questions about his expected income when retired. The results indicate substantial deviations between the respondent's expectations and the estimated pension income. However, respondents on the brink of retirement have smaller expectation errors than younger people. These results are supported by studies from other countries (Botazzi et al., 2006; Gustman & Steinmeier, 2001 and Dominitz et al., 2002).

4. Data

Our data is obtained from Danish administrative individual records covering the full population aged 18 and above over the period 1997 to 2005. It contains information on the demographic variables; age, number of children in different age intervals (0-2 years, 3-6, 7-9, 10-14 and 15-17 years), family status (single, married, co-habiting), detailed information on education, type and amount of employment throughout each year, and place of residence. Information on wealth and income covers gross income for each year and financial wealth at the end of each year, including the official assessment of the value of private dwellings. These official assessments of the value of private properties are conducted every two years in a more or less mechanical way, which leaves the official assessment trailing actual buying and selling prices by approximately two years. Due to the strong rise in property prices towards the end of the data period, this poses a real problem because home owners may perceive their home to be worth more than the value reflected in the data available. We therefore focus exclusively on renters, defined as individuals who do not own real estate and are not living together with other individuals who own real estate. This definition excludes individuals living in families where the one partner is named as the sole owner of the dwelling. This is done because married or co-habiting individuals whose partner figures as the owner of the dwelling might have a very different notion of their wealth than is reflected in the administrative records. The drawback is that persons renting a room in a private house where the owners themselves reside are also excluded. We perceive this to be a minor issue.

On the issue of pension savings (voluntary and mandatory), we have information on the total amount paid into mandatory labour market pension schemes, and the amount paid into voluntary pension accounts for each individual each year. In addition we have contributions to the special pension scheme (SP), which was in effect in the years 1998 to 2003. The contributions to the labour market additional pension scheme (ATP) are not in our data. This is unfortunate; however, as explained above, the contributions to ATP are small in comparison to the agreed contributions in most labour market pension schemes.

All amounts paid into pension schemes are gross amounts, that is, they are taxable upon being paid out at the time of retirement. This is an issue which is common in the literature since non-pension financial wealth is net of taxes (Hubbard and Skinner, 1996). However, unless your contractual pension wealth at retirement is very large, you are liable to pay only the lowest income tax rate on pension payouts. Since the mandatory labour market pension system was only established recently for most (private sectors) groups, it is not likely that many individuals will have large contractual pension wealth upon retirement – particularly not the older cohorts. Therefore, in order to compare (non-contractual) financial wealth with contractual pension wealth, an amount equal to 40 percent (approximately corresponding to the lowest effective personal income tax rate) of gross pension contributions is deducted to reach the net amount of pension savings. It is important to note that this particular issue does not affect our estimates of the effect of mandatory pension contributions on voluntary pension contributions since both are gross contributions and liable to the same tax rate when paid out after retirement. A related issue is how to treat means-tested pension benefits. Because retirement benefits are, to some extent, means-tested, some individuals are likely to face a higher effective tax rate on their pension contribution than the marginal tax rate, since on top of taxes paid on their private pension payouts they will face a reduction in publicly provided retirement benefits. We consider this to be a minor problem, particularly for younger cohorts. To affect our estimates it would require (young) individuals to: a) have a detailed knowledge of regulations related to retirement benefits; b) believe these rules will stay in place until they retire; and c) have an ability to correctly estimate their pension wealth at retirement. In addition, it is emphasized that this will not affect our estimates of the effect of mandatory pension contributions on voluntary pension contributions.

Apart for confining the study to renters in the current year the sample is limited in other aspects as well. In particular, to get a reliable measure of the level of savings during each year, we exclude renters who owned property in the preceding year, due to the divergence between the market value and the value recorded in the administrative records described above.

Further, only individuals between 30 and 55 years of age, who are not registered as unemployed in the course of the year are included. These steps are likely to ensure that our results are not distorted by the presence of full or part time students, individuals living off their wealth or on an early disabled pension scheme. In addition, apart from a few individuals, retirement is still some years off for people aged 55, so that the results will have little contamination from early retirement decisions.

Finally, we leave out individuals with a defined benefit pension plan. The plan used to be widely offered to state employees in traditional state run companies (i.e. the postal service, the former national telecommunications company, the national railway company) and persons in vital positions (i.e. employees within the police force). The defined benefit pension scheme is now only available to a few occupational groups. If a person was in a defined benefit pension scheme in any year of the estimation period, they are not included in the sample. With these restrictions on the estimation sample, we have an effective estimation period from 1998 to 2005 with a total of around 1.5 million observations.

Table 2 shows summary statistics for the estimation sample. Voluntary savings include voluntary pension savings, free savings and the return from free savings. The average voluntary savings rate varies across time with small and positive savings rates in 2000 and small and negative savings rates in 1998 and 2005. This variation may come from fluctuations in stock and bond values. The mandatory pension savings rates increase across time as a result of the expansion of the labour marked pension schemes. The increments in the saving rates are smaller than indicated in figure 1. This is partly explained by differences in the definition of the savings rates between figure 1 and table 2. The macro savings rates in figure 1 include income tax, whereas the pension contributions in table 2 are net of income tax (40%). However, the increments in the average savings rate may also be smaller in our estimation sample of renters than for the whole labour force (as depicted in figure 1). Despite the increase in mandatory pension savings the average voluntary pension saving rates are almost constant across time which may indicate limited crowding out. However, there is a decline in the share of workers that participate in a voluntary pension saving programme. The average non-pension wealth is small and negative reflecting that many people have cash credits, car loans, other consumption loans etc. For the average renter the sum of these loans exceeds the sum of their free assets. In comparison the average non-pension wealth (including real estate wealth) is positive in a sample including both home owners and renters implying that the individuals in the estimation sample have smaller wealth. Table 2 show statistics for a constructed measure for liquidity constraints. About 65 percent of the individuals in the sample are liquidity constrained according to our definition (liquid assets less than 25,000 Danish kroner).

Table 2: Summary Statistics (Average,standard deviation in parenthesis)

Variables (selected years)	Age groups				
Voluntary savings (share of wage income)	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	-0.012	-0.007	-0.009	-0.006	0.004
	(0.397)	(0.312)	(0.283)	(0.267)	(0.284)
2000	0.000	0.007	0.007	0.008	0.015
	(0.338)	(0.327)	(0.290)	(0.287)	(0.285)
2002	-0.009	-0.002	-0.003	0.002	0.006
	(0.333)	(0.279)	(0.283)	(0.267)	(0.292)
2005	-0.029	-0.017	-0.013	-0.004	0.000
	(0.415)	(0.336)	(0.328)	(0.296)	(0.320)
Mandatory pension contribution (share of wage income)[a)]	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	0.036	0.038	0.040	0.039	0.040
	(0.024)	(0.024)	(0.024)	(0.024)	(0.025)
2000	0.040	0.041	0.042	0.043	0.043
	(0.025)	(0.024)	(0.024)	(0.023)	(0.025)
2002	0.043	0.044	0.045	0.046	0.046
	(0.025)	(0.024)	(0.025)	(0.024)	(0.024)
2005	0.044	0.045	0.046	0.046	0.047
	(0.025)	(0.024)	(0.023)	(0.022)	(0.023)
Voluntary pension contri-bution (share of wage income) [a)]	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	0.005	0.005	0.006	0.007	0.014
	(0.018)	(0.019)	(0.02)	(0.034)	(0.049)
2000	0.004	0.005	0.005	0.006	0.011
	(0.017)	(0.018)	(0.03)	(0.029)	(0.042)
2002	0.004	0.004	0.005	0.005	0.010
	(0.014)	(0.015)	(0.02)	(0.024)	(0.048)
2005	0.004	0.005	0.005	0.006	0.009
	(0.017)	(0.02)	(0.021)	(0.027)	(0.053)
Non-pension wealth (thousand Danish kroner)[b)]	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	-39	-37	-36	-30	-11
	(123)	(130)	(127)	(129)	(135)
2000	-43	-42	-40	-34	-15
	(128)	(136)	(135)	(134)	(143)
2002	-44	-42	-38	-32	-16
	(131)	(137)	(137)	(140)	(146)
2005	-55	-48	-43	-33	-21
	(140)	(147)	(147)	(151)	(159)

Wage (before tax, in thousand Danish kroner) [a]**:**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	289	292	290	284	275
	(104)	(103)	(98)	(96)	(94)
2000	293	295	292	289	276
	(108)	(105)	(100)	(97)	(96)
2002	294	300	297	296	283
	(110)	(104)	(99)	(97)	(94)
2005	290	304	306	305	296
	(110)	(105)	(101)	(98)	(95)
Share participating in voluntary pension program (1998-2005 average) [c]	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	0.28	0.28	0.28	0.32	0.40
2000	0.26	0.27	0.27	0.28	0.36
2002	0.23	0.25	0.26	0.27	0.33
2005	0.22	0.27	0.27	0.28	0.33
Share liquidity constrained (1998-2005 average) [c]	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
	64.73	66.96	68.30	67.51	61.34
Share women (1998-2005 average)	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
	0.48	0.51	0.55	0.57	0.65
Number of children in age intervals (1998-2005 average)	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
0-2	0.23	0.15	0.05	0.01	0.00
3-6	0.22	0.26	0.14	0.04	0.01
7-9	0.11	0.22	0.17	0.06	0.01
10-14	0.07	0.28	0.37	0.21	0.06
15-17	0.01	0.08	0.20	0.18	0.07
Number of observations	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**
1998	60,872	37,145	27,569	25,848	28,745
2000	60,921	43,260	29,935	27,070	30,632
2002	60,059	47,659	32,908	28,201	31,834
2005	56,878	43,028	37,640	29,365	30,487

[a] Pension contributions are net of income tax (40%) while income tax have not been deducted from the reported wages

[b] The net wealth does include all wealth except pension wealth, cash, durables (cars, boats etc.), as well as stocks, loans etc. that are not registered in financial institutions

[c] A person with less than 25.000 kr. in liquid assets is defined as liquidity constrained. Liquid assets include bank deposits and free assets (stocks, bonds etc)

Source: Calculations based on register data from Statistics Denmark

5. Results

Before we turn to the impact of mandatory pension savings on total savings, we first present results for the impact on voluntary pension saving. Since voluntary pension saving is non-negative in nature we employ a censored regression approach. Specifically, we estimate a censored version of equation (8) with only voluntary pension contributions as the dependent variable. Individual level fixed effects are accommodated by utilising the estimator proposed by Honore (1992). This is done separately for each of the five age groups in order to accommodate varying coefficients among age groups. The reasoning behind this exercise is that the size of the crowding out effect of mandatory pension savings on voluntary private pension savings gives an indication of the likely effect on total pension savings. As discussed in section 2, voluntary pension saving contributions are nearly perfect substitutes for mandatory labour market pension contributions. Therefore, we expect that individuals are more likely, as a first step, to reduce voluntary pension saving in response to increases in mandatory pension contributions. Thus, if the effect on voluntary pension savings is small, we would expect the overall effect on private savings to be small.

Table 3. The effect of mandatory pension savings on voluntary pension savings.

Coefficient estimates	Age groups				
Variables:	Age 30-34	Age 35-39	Age 40-44	Age 44-49	Age 50-54
Mandatory pension savings	-.195*** (.01)	-.177*** (.01)	-.155*** (.01)	-.154*** (.02)	-.148*** (.02)
Other controls included	Yes	Yes	Yes	Yes	Yes
Observations[1)]	476,664	348,100	257,638	220,591	244,808
Proportion non-censored	.24	.26	.26	.28	.35
Average marginal effect[2)]: Mandatory pension savings	-.05	-.05	-.04	-.04	-.05

Note: The estimation method is censored regression with individual fixed effects (Honore, 1992). Other controls are time dummy variables, wealth primo each period interacted with time dummies, variables controlling for number of children and wage variables. All are defined as detailed in the data section. Standard errors are reported in parentheses. *** denotes significance at the 1 percent level.

1) The number of observations differs from the number in the full sample since individuals without payments into voluntary private pension accounts in any year and individuals with payments in all years are excluded from the estimation procedure.

2) The average marginal effects are calculated following Honore, 2008. Specifically, the average marginal effect equals the coefficient estimate multiplied by the proportion of observations that are not censored.

Table 3 presents the results from the censored regressions with individual fixed effects. The coefficient on mandatory pension contributions is rather similar across age groups and fairly precisely estimated. The coefficient on mandatory pension contributions should be interpreted as the average reduction in voluntary pension savings stemming from a 1 euro increase in mandatory pension contributions for an individual already making voluntary pension contributions. Thus, for individuals in all age groups who make voluntary pension contributions, a one euro mandatory pension payment crowds out less than 20 cents of voluntary pension contributions. The estimated coefficients on mandatory pensions are relatively low compared with a situation entailing full crowding out equivalent to coefficients close to minus one. The average marginal effect of mandatory pension contributions on voluntary pension contributions is markedly lower than the coefficient estimate and around 0.05 cent per euro for each age group. This is due to the relatively low share of uncensored observations.[9]

The level of faith one is inclined to attach to these results clearly depends on how much emphasis one puts on the bias caused by pension wealth being omitted in the estimation. Deriving – if possible – the exact conditions necessary to sign and further guess the magnitude of the bias is not a straightforward task in a semi-parametric non-linear framework. In order to argue that the bias is likely to be small or in line with the conclusion that the crowding out effect is small, two arguments are offered. First, we reiterate the point of view that only a rather small minority of individuals pay close attention to their yearly pension statement.[10] The omitted variable bias is, therefore, likely to be small. Second, one can make the case that individuals – in particular young individuals – should only adjust their voluntary pension contributions very little in response to changes in pension wealth. Changes in pension wealth over and above the pension contributions are entirely related to the overall performance of the portfolio of assets that constitute the pension wealth. Granting some sophistication to pension saving individuals, one could argue that individuals – in particular young ones – choose their asset allocation according to some expected very long term return.[11] How ones portfolio is expected to perform in the long run should only change marginally when considering the most recent return. We are more inclined to trust the first argument, but in any case believe that the crowding out estimates presented here are not qualitatively affected by the lack of data on pension wealth.

The results and discussions above suggest that the crowding out effect of mandatory pension contributions on total savings is somewhat small and relatively far from generating full crowding out.

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[9] We also estimated the model with a fixed effect (within estimator). The results were qualitatively similar and are available upon request.
[10] There is evidence from the US that people spend very little time on their financial decisions related to retirement benefits (Bernartzi & Thaler, 1999).
[11] In many mandatory labour market contribution schemes it is not possible for the individual to chose an individual portfolio. How you expect the portfolio, which is chosen for you, to perform in the very long run should only marginally depend on the most recent return.

We now turn to the estimation of the full effect of mandatory pension contributions on total private savings. We first present estimates for both equation (8) (fixed effect, within transformation) and equation (9) (first differences) together with OLS estimates of the level equation (equation 8). As argued earlier, this last set of estimates is likely to show a substantial downward bias in the absolute size of the crowding-out effect, because the fixed effect can reasonably be expected to be correlated with mandatory pension contributions. Both the sets of within group fixed effect and first differences estimates are biased due to the dynamic panel structure. Our main interest is not in the coefficient on the potential dynamic variable, lagged non-pension wealth, but rather in the coefficient on mandatory pension contributions. The bias on this coefficient is of second order importance and we expect it to be small in absolute size as is often found in Monte Carlo simulations (Arellano & Bond, 1991; Kiviet, 1995). Lastly, in order to corroborate this expectation we present estimated bounds on the crowding-out effect following the method outlined in section 4.

Table 4 summarises the main results for each of the five age groups for different estimators. For brevity only the coefficients of the crowding out effect are presented.[12]

Table 4. Estimated crowding-out effect for different age groups.

Age group	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54
	Coefficient estimates of the crowing out effect				
- OLS	.01 (.02)	.02 (.02)	-.00 (.02)	.00 (.02)	-.06 (.02)
- Fixed effect (within)	-.00 (.03)	-.09 (.04)	-.14 (.04)	-.29 (.05)	-.25 (.05)
- First differences (OLS)	-.01 (.02)	-.07 (.03)	-.16 (.03)	-.18 (.04)	-.23 (.04)
- First differences (GMM-IV)	-.03 .02	-.10 .03	-.18 .03	-.22 .04	-.27 .04
- Bounds on estimate	-.11 – -.01 (.03) – (.03)	-.16 – -.09 (.04) – (.04)	-.14 – -.13 (.04) – (.04)	-.29 – -.28 (.05) – (.05)	-.26 – -.25 (.05) – (.05)
- 95 pct. ci on bounds	-.17 – .05	-.24 – 0	-.22 – -.05	-.39 - -.18	-.37 – -.15

Note: Estimation of equations (8) and (9). See main text.

[12]A full set of all estimation results are available from the authors upon request.

Estimation of equation (8) by OLS leads to a parameter estimate that is virtually zero for all age groups. An exception is the oldest age group of 50 to 54 year olds where the crowding out effect is 6 cent per euro and significant. Within group fixed effects estimates yield more plausible results. The crowding-out effect rises with age from zero for the younger group (aged 30 to 34 years) to around 30 percent (or 30 cents per euro) for the 45 to 49 year olds. For the oldest age group the estimate is 25 percent offset. All parameter estimates are fairly precisely estimated with a standard error of around 5 cents or less.

Estimation of (8) in first differences delivers results of a similar pattern but generally with slightly lower crowding-out effects. Standard errors are small at around 4 cents or less. Our attempts to instrument the difference in lagged non-pension wealth in the first difference version of (8) lead to results for the crowding-out effect similar to those for the simple first difference model and the within group fixed effects estimators. But, as mentioned earlier, we were unsuccessful in getting the dynamic estimator to perform well in terms of accepting the overidentification tests.

We therefore turn to the results from the method outlined to establish credible bounds on our parameter of interest. As can be seen from table 4 these bounds are very tight – particularly for the oldest age groups which exhibit the larger (in absolute values) crowding-out effects. For the youngest age group – those aged 30 to 34 – the central estimate lies between -.01 and -.11. This might be fairly wide, but it nevertheless shows that the crowding-out effect for this age group is rather low. For the 35 to 39 year olds the bounds on the parameter are -.16 and -.09, respectively.

For the three oldest age groups the bounds on the crowding-out effect are so narrow that we virtually get a point estimate, with only one percentage point between the upper and the lower bounds. For the 40 to 44 year olds the upper absolute value of the bound is -.29 and the corresponding number is -.29 and -.26, respectively, for the 45-49 year olds and the 50-54 year olds.

The central message we derive from the results presented in table 4 is that the estimated crowding-out effects of mandatory pension contributions on total voluntary savings are fairly modest and compatible with the results obtained from looking at the effect on voluntary pension contributions only. Furthermore, the crowding-out effect is rising with age. Results are also consistent with those obtained in recent studies (Chetty et al., 2012, and Hurd, Michaud & Rohwedder, 2012),

Both the low crowding-out effects and the tendency of the effect to rise with age might be attributable to the presence of liquidity constraints if older cohorts are less liquidity constrained than younger cohorts. Before reporting a range of robustness checks of the results we therefore first look at the effect of allowing for different estimates of the crowding-out effect depending on whether an individual is considered liquidity constrained or not.

To assess the potential impact of credit constraints on the estimated coefficients, equation (8) is augmented with a dummy variable measuring whether the individual is considered liquidity constrained in a given year interacted with the mandatory pension contribution in that year. This setup provides a separate estimate for the crowding-out effect for liquidity constrained and unconstrained individuals. Table 5 presents the coefficient estimates for the 5 age groups when not being liquidity constrained is defined as having cash, stocks and bonds with a value in excess of 25,000 DKK at the beginning of the year.[13]

[13] Changing the definition of being liquidity constrained does not alter the reported results qualitatively. Specifically, we looked at cut-off values of 0; 10,000; 50,000; 75,000 and 2 months gross wages.

Table 5. Estimated crowding-out effects for different age groups allowing for liquidity constraints.

Age group	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54
	Coefficient estimates of the crowing out effect				
Liquidity constrained	.04 (.04)	-.03 (.04)	-.10 (.05)	-.21 (.06)	-.15 (.06)
Not liquidity constrained	-.02 (.09)	-.20 (.07)	-.32 (.09)	-.43 (.10)	-.44 (.11)

Note: The augmented version of equation (8) (see main text) is estimated with fixed effect (within). Being liquidity constrained is defined as having less than 25,000 DKK in cash, stocks and bonds at the beginning of the year. The coefficient on the liquidity non-constrained is the sum of the coefficients on the main variable, mandatory pension contributions, and the dummy interaction terms as described in the main text. Standard errors clustered on individuals are in parenthesis.

Around a third of the individuals in the sample are liquidity constrained following the definition adopted here. This share is relatively stable across age groups with the 50 to 54 years old having a slightly larger share of non-constrained individuals (39 percent). Table 5 reveals that the low crowding-out effect is not an artefact of credit constraints, although non-constrained individuals do have a somewhat higher crowding-out in voluntary savings from mandatory pension contributions than liquidity constrained individuals. Table 5 also confirms the structure of rising crowding-out with age.

In all specifications the crowding out effect rises with age - including the specification which takes account of liquidity constraints. We have no clear explanation for this. However, one could speculate that individuals in their thirties and early forties may have higher incentives to save up to buy cars, furniture and other durables that are convenient when establishing a home and/or family (the down payment motive). This motive may be smaller once these goods have been acquired. Furthermore, recent empirical evidence suggests that older people have more accurate knowledge of their future pension entitlements than younger people and are thus better equipped to make crowding out decisions (Amilon, 2008).

We conclude this section with a number of robustness tests. First, to check whether our findings are robust over time, the sample is divided into two, covering the periods 1998 to 2001 and 2002 to 2005. For each period a fixed-effect within estimation is compared with the results from table 4 above (row 2). Apart from revealing whether the results are period specific (and therefore less general), it also relaxes the strain on the assumption that the fixed effect is time-invariant for a relatively long period.

A second concern is the treatment of individual returns to assets/investments (the $\bar{r}_{it}$'s in equation 6 above). Since an individual's deviation from the market return is tucked away in the error term of the estimating equation, the estimated crowding-out effect might be biased if there is a correlation between mandatory pension contributions and the excess return on investments. If more risk-averse individuals are simultaneously more likely to choose an occupation with large mandatory pension contributions and invest in low-risk assets with a corresponding lower average return, there will be a negative correlation between the error term and mandatory pension contributions if returns are primarily positive. Since individual asset levels are time-variant, this will only, to a minor extent, be captured by the individual fixed effect. In order to limit this concern assets are divided into three groups (the most detailed level possible in the data); bank deposits, stocks and bonds and other assets. A regression is then run controlling for the three groups of assets separately, such that the assumption regarding returns is that the ability to earn results above the market result within each asset class is uncorrelated with other explanatory variables. In addition, different returns/interest rates are allowed for positive and negative bank deposits, and other assets.

Table 6 shows the results of the robustness tests. The two sets of estimates from the periods 1998 to 2001and 2002-2005, are very similar and also close to the coefficients obtained from the full sample. Likewise, when we control for individual asset composition, the estimates are in line with those obtained in table 4. Again, the crowding-out effect is qualitatively unchanged.

These results lend credibility to our main result emphasizing that the crowding-out is low and rising with age.

Table 6. Robustness test: estimated crowding-out effects for different specifications.

Age group	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54
	Coefficient estimates of the crowing out effect				
Split sample (1998-2001)	-.08 (.04)	-.08 (.05)	-.17 (.07)	-.25 (.07)	-.29 (.08)
Split sample (2002-2005)	-.06 (.05)	-.12 (.06)	-.17 (.06)	-.31 (.07)	-.31 (.08)
Controls for different asset types	-.01 (.03)	-.09 (.03)	-.13 (.04)	-.29 (.05)	-.26 (.05)

Note: All regressions are estimated with fixed effect (within). Standard errors clustered on individuals are in parenthesis.

6. Conclusion

The present paper presents results from analysing the extent to which mandatory pension contributions are offset in other private savings. It is of interest because mandatory pension contributions have previously been used as an instrument for business cycle stabilisation and its effectiveness, as such, depends crucially on the offset effect. Further, the results may have wider implications for the effect on national private savings in countries changing from a pay-as-you-go unfunded pension system to a funded defined contribution pension system similar to the existing Danish system.

In a large sample of renters with data based on administrative tax records, we utilise the Danish mandatory labour market pension system to estimate the crowding out effect of mandatory pension contributions on private savings. Econometric identification comes from the fact that the mandatory contributions are negotiated centrally and that different occupational groups have implemented the labour market pension system at different times and with differing speeds. Our findings suggest that mandatory pension contributions have an offset effect substantially smaller than full offset indicating that mandatory pensions add substantially to national private savings. For the 5 five-year age groups considered, the central estimate of the crowding-out effect of mandatory pension contributions on private savings is always less than 30 percent, that is, a one euro mandatory pension contribution offsets 30 cents in other forms of private saving. For the younger age groups the crowding out effect is substantially smaller at around 0-15 cents per euro. These results are corroborated by estimations showing that the crowding-out effect is very small for voluntary private pension savings – the form of saving that is the nearest substitute for mandatory pension contributions.

References

Alessie, R., Kapteyn, A. & Klijn, F. 1997: Mandatory pensions and personal savings in the Netherlands. *De Economist* 145(3), pp. 291-324.

Amilon, A. (2008): Danskernes forventninger til pension (in Danish). SFI-report. Copenhagen.

Arellano, M. & Bond, S. 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies* 58, pp. 277 – 297.

Attanasio, O.P. & Brugiavini, A. 2003. Social security and households' saving. *Quarterly Journal of Economics*. 118 (3), pp. 1075-1119.

Attanasio, O.P. & DeLeire, T. 2002. The effect of individual retirement accounts on household consumption and national saving. *Economic Journal* 112, pp. 504-538.

Attanasio, O.P. & Rohwedder, S. 2003. Pension wealth and household saving: Evidence from pension reforms in the United Kingdom. *American Economic Review* 93 (5), pp. 1499-1521.

Benartzi, S. & Thaler, R.H. 1999. "Risk Aversion or Myopia? Choices in Repeated Gambles and Retirement Investments," *Management Science* 45.3, pp. 364-381.

Benartzi, S. & Thaler, R.H. 2007. Heuristics and biases in retirement savings behavior. *Journal of Economic Perspectives* 21(3), pp. 81-104.

Benjamin, D.J. 2003. Does 401(k) eligibility increase saving? Evidence from propensity score subclassification. *Journal of Public Economics* 87, pp. 1259-1290.

Bottazzi, R., Jappelli, T. & Padula, M. 2006. Retirement expectations, pension reforms, and their impact on private wealth accumulation. *Journal of Public Economics* 90, pp. 2187-2212.

Card, D. & Ransom, M. 2011. Pension Plan Characteristics and Framing Effects in Employee Savings Behavior." The Review of Economics and Statistics 93(1), pp. 228-243.

Chetty, R, Friedman, J. N., Leth-Petersen, S, Nielsen, T. H. & Olsen, T. 2012. Active vs. Passive Decisions and Crowd-Out in Retirement Savings Accounts: Evidence from Denmark. NBER Working Paper

Danish Economic Councils (2008): Danish Economy Spring 2008 (in Danish with English summary). Copenhagen.

Dominitz, J.; Manski, C. & Heinz, J. (2002): Social Security Expectations and Retirement Savings Decisions. NBER Working paper no. 8718.

Engen, E.M., Gale, W.G. & Scholtz, J.K. 1996. The illusory effects of saving incentives on saving. *Journal of Economic Perspectives* 10(4), pp. 113-138.

Euwals, R. 2000. Do mandatory pensions decrease household savings? Evidence for the Netherlands. *De Economist* 148(5), pp. 643-670.

Feldstein, M. 1974. Social security, induced retirement, and aggregate capital accumulation. *Journal of Political Economy* 82(5), pp. 905-926.

Feldstein, M. 1982. Social security and private saving: reply. *Journal of Political Economy* 90(3), pp. 630-642.

Gale, W. 1998. The effects of pensions on household wealth: a reevaluation of theory and evidence. *Journal of Political Economy* 106(4), pp. 706-723.

Gelber, A.M. 2011. How Do 401(k)s Affect Saving? Evidence from Changes in 401(k) Eligibility. *American Economic Journal: Economic Policy*, 3(4), pp. 103-22.

Gustman, A.L. & Steinmeier, T.L. 1999. Effects of pensions on savings: Analysis with data from the health and retirement study. Carnegie-Rochester Conference Series on Public Policy, Vol. 50, Pp. 271-325, June 1999.

Gustman, A.L. & Steinmeier, T.L. 2001. Imperfect knowledge, Retirement and Saving. NBER Working paper No. 8406.

Honoré, Bo E. 1992. Trimmed Lad and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects. *Econometrica* 60(3), pp. 533-565.

Honore, Bo E. 2008. On Marginal Effects in Semiparametric Censored Regression Models. Working Paper. Available at SSRN: http://ssrn.com/abstract=1394384

Hubbard, R.G. & Skinner, J.S. 1996. Assessing the effectiveness of saving incentives. *Journal of Economic Perspectives* 10(4), pp. 73-90.

Hurd, M., Michaud, P-C and Rohwedder, S. 2012. The Displacement Effect of Public Pensions on the Accumulation of Financial Assets. *Fiscal Studies* 33(1), pp. 107-128.

Japelli, T. 1995. Does social security reduce the accumulation of private wealth? Evidence from Italian survey data. *Ricerche Economiche* 49, pp. 1-31.

Kim, S. & Klump, R. 2008. The effects of public pensions on private wealth: evidence on the German savings puzzle. *Applied Economics*, pp. 1-10, June 2008.

Kiviet, J.F. 1995. On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. *Journal of Econometrics* 68, pp. 53-78.

Madrian, B.C. 2012. Matching Contributions and Savings Outcomes: A Behavioral Economics Perspective. NBER Working Paper 18220.

Pence, K.M. 2001. 401(k0s and household saving: New evidence from the survey of consumer finances. Federal Reserve Working Paper No. 2002-06.

Poterba, J.M., Venti, S.F. & Wise, D.A. 1995. Do 401(k) contributions crowd out other personal saving? *Journal of Public Economics* 58, pp. 1-32.

Poterba, J.M., Venti, S.F. & Wise, D.A. 1996. How retirement saving programs increase saving. *Journal of Economic Perspectives* 10(4), pp. 91-112.

Roodman, D. 2009. How to do xtabond2: A introduction to “difference” and “system” GMM in Stata. *Stata Journal* 9(1), pp. 86-136.

Statistics Denmark 2002. Ten-year Review. Statistics Denmark, Copenhagen

Statistics Denmark 2008. Ten-year Review. Statistics Denmark, Copenhagen

Thaler, R.H. 1994. Psychology and savings policies. *American Economic Review* 84(2), pp. 186-192.

Thaler, R.H., & Benartzi, S. 2004. Save More Tomorrow (TM): Using Behavioural Economics to Increase Employee Saving. *Journal of Political Economy* 112(S1), pp. S164-S187.

Welfare Commission. 2004. *Befolkningsudvikling, velstandsdilemma og makroøkonomiske strategier*. (In Danish).