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No. 5/11

BATH ECONOMICS RESEARCH PAPERS

Department of Economics

Work Now, Pay Later? An Empirical Analysis of the Pension-Pay Trade Off[1]

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Abstract: We investigate the potential compensating differential between wages and pensions on a sample of British workers. Random effects panel regressions are run applying the Schiller and Weiss (1980) methodology to test whether a pension-wage compensating differential exists. Using data from British Household Panel Survey (BHPS) and derived prospective pension variables, calculated by the Institute for Fiscal Studies (IFS), the regression results do not support evidence for a trade off. Further analysis finds no significant differences in results between public and private sector workers, even after controlling for sample selection bias wage.

Key Words: Monitoring; tenure; efficiency wages.
JEL Classification: J33, J41, J54.
Acknowledgements: The normal disclaimer applies.

August 2011

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1. Introduction

According to the theory of compensating wage differentials, competition between firms equalises the overall value of employment packages for a particular type of occupation [Rosen (1986)]. Thus, one would expect jobs that offered minimal fringe benefits to offer high wages, and vice versa.

The theory of compensating wage differentials has been tested, with mixed results, on a variety of such benefits: health insurance [Olson (2002), Currie and Madrian (1999)]; maternity benefits [Gruber (1994)]; work-related injury and sickness insurance [Gruber and Krueger (1991)]; paid vacation leave [Altonji and Usui (2007)]. In contrast, relatively little empirical work has been undertaken on the compensating differential between wages and pensions, particularly on UK data. The empirical evidence that does exist is somewhat mixed - see Table 1 (Appendix). For North America, compelling evidence of a trade-off is found by Smith (1981), Clark and McDermed (1986), Moore (1987), Montgomery, Shaw and Benedict (1990), Gunderson *et al*. (1992). Less compelling are the findings of Ehrenberg (1980), Schiller and Weiss (1980) and Bulow and Landsman (1985). No evidence of a trade-off is found by Smith and Ehrenberg (1983) or Mitchell and Pozzebon (1986) whilst significant positive relationships are found by Gustman and Steinmeier (1987), Dorsey (1989) and Even and Macpherson (1990).

In terms of the UK, Inkmann (2006) finds evidence of a perfectly compensating wage differential using data from the English Longitudinal Study of Ageing (ELSA). Andrietti and Patacchini (2004) find evidence to support the implicit contract argument that male occupational pension participants employed in the private sector earn a positive wage premium only at the beginning of their career. However, once they account for the endogenous sorting of individuals into occupational pension schemes, the magnitude decreases sharply.[2]

In this paper we investigate the relationship between wage and pension benefits using data from the British Household Panel Survey (BHPS) and derived prospective pension rights variables as calculated by the Institute of Fiscal Studies (IFS). We find no evidence of a trade-off, even after accounting for possible sample selection bias.

This paper is set out as follows: Section 2 sets out the legislative background to pension schemes in the UK whilst Section 3 discusses the theory of compensating differentials, examining in particular the remuneration trade-off in between current pay and future promised pension benefits. Section 4 outlines our data and empirical methodology. Our results are set out in Section 5 and final comments are collected in Section 6.

2. Background

2.1 Occupational Pension Schemes in the UK[3]

All UK Employees who earn more than the 'Lower Earnings Limit' (LEL – currently £5304 per year) are automatically enrolled in the 'State Second Pension' (S2P), the earnings-related tier of the UK public pension system. Employees may choose to join an employer provided occupational pension scheme, either in conjunction with or instead of the S2P. The latter option is termed 'Contracting-Out' and reduces the employee's National Insurance (NI) contributions to the S2P. Employers are not obliged to offer an occupational pension scheme, and employees are

[2] Studies that analyse the trade-off tend to adopt either a 'spot' or 'life-cycle' approach. The former approach focuses on pension benefits that have been accrued up to a particular point in time, looking at the value of pension benefits that a particular employee is enjoying in a particular year. The latter approach utilises assumptions regarding salary growth to calculate prospective benefits that may accrue over an individual's life-cycle. Whilst Inkmann (2006) and Andrietti and Patacchini (2004) find trade-offs using life-cycle approaches, it has been uncommon to find such a trade-off from a spot approach.

[3] For more detailed descriptions of the UK Pension environment, see Blake (2003), Cocco and Lopes (2004), and Banks *et al* (2005). The following section draws heavily from Inkmann (2006).

not required to join such a scheme if it is offered. If they do so join, then employees are able to claim income tax relief on their total contributions (up to a limit of 15 per cent of gross earnings) to any occupational pension scheme that is deemed ‘exempt approved’. Higher employee contributions are explicitly prohibited in exempt approved schemes but corporation tax relief is given on employer contributions without an upper bound. Also a tax-free lump sum payment may be received at retirement age from an exempt approved scheme.

Employers are required to contribute a minimum of 10 per cent of the sum of employee and employer contributions to exempt approved schemes. Although employee contributions are not compulsory for exempt approved schemes, most employers set mandatory contributions as a precondition for scheme membership.

There are two main types of exempt approved schemes, ‘Defined Benefit’ (DB) and ‘Defined Contribution’ (DC). The former defines a pension related to the members’ salary (or some other value) preset in advance, whereas the latter is a pension based on the contributions made and the investment return that they have produced. Employees may augment mandatory scheme contributions by Additional Voluntary (AV) and / or Free-Standing (FS) contributions. AV contributions may be used to purchase additional years of service for DB schemes or may be paid into a DC scheme offered by the employer. FS contributions are paid into an externally provided DC scheme.

2.2 Calculating Pension Benefits

Because individuals place a higher value on income received sooner than later, the value of a pension is usually defined as the discounted present value of the stream of pension income received from the date of retirement to death [see, for example, Disney *et al*. (2007a, 2007b 2009)]. What this implies for DB and DC pensions is examined below.

The Value of a Defined Benefit (DB) Pension

The annual income received from a final salary DB pension will depend on a measure of 'final' salary, an accrual fraction and the length membership in the scheme *vis*:

$$p_t = \alpha n_t y_t \qquad (1)$$

p_t denotes annual pension income from normal pensionable age (NPA), α denotes the fraction of accrual, n_t denotes years of membership up to year *t* and y_t denotes the member's 'final' salary.[4] Gross pension wealth at time *t*, w_t, is defined as the present discounted value of the lump sum plus this stream of pension income:

$$w_t = \delta^r \alpha n_t y_t + \sum_{s=r}^{T} \delta^s \alpha n_t y_t + \sum_{q=T+1}^{T_P} \delta^q \alpha n_t y_t \qquad (2)$$

where δ denotes the real intertemporal discount factor, *r* the number of years to retirement, *T* the year of member's death and T_p the year of partner's death (if this is later than T_p). Expression (2) assumes an exponential discount function and, for simplicity, we follow Disney *et al*. (2007) in assuming a constant discount rate of 2% such that $\delta = (1+0.2)^{-1} = 0.83$¢.

The marginal benefit of remaining in the scheme for an extra year will be greater the longer the member expects to receive the pension income for (i.e. the longer is the period from retirement, *r*, to death of the member, *T*, or partner, T_p). This accrual is shown in expression (3):

$$\Delta w \equiv w_{t+1} - w_t = \delta^r \alpha \left(n\Delta y + y_{t+1} \right) + \sum_{s=r}^{T} \delta^s \alpha \left(n\Delta y + y_{t+1} \right) + \sum_{q=T+1}^{T_P} \delta^q \alpha \left(n\Delta y + y_{t+1} \right) - \delta c y_{t+1} \qquad (3)$$

[4] Most DB schemes also provide lump sum payments upon reaching NPA in addition to a stream of pension income until death. Where scheme rules apply, a proportion of the pension income will continue to be paid to the partner of the member, as survivor's benefits. If an employee leaves the scheme early and defers taking a pension until NPA, then the annual pension income that they will receive from NPA will depend on the salary they received when they left up-rated by the Retail Price Index (RPI). Beyond NPA, the pension received is also increased in line with inflation each year.

where c denotes the employee contribution rate and $\Delta y \equiv y_{t+1} - y_t$ The marginal value of remaining in a final salary pension comes both from the extra year of accrued service and the higher final salary used to calculate the pension for all previous service. The marginal value therefore depends fundamentally on the number of years of service, n.

The Value of a Defined Contribution (DC) Pension to Members

In a DC pension plan, contributions, c, from the employee and employer are placed each year into a fund. This fund will then grow over time as a result of additional contributions and investment returns, x, until the date of annuitisation when the employee chooses to withdraw the pension, at which time an annuity is purchased (at rate ρ) that provides an annual income until death (at time T) – see Disney *et al* (2009). The value of a DC pension is thus the discounted present value of the stream of pension income that will be received from the date of annuitisation until death. In return for this extra stream of pension income, the employee gives up some proportion, c, of his current salary. The value of an additional year's pension accrual is therefore:

$$\Delta w = \sum_{s=r}^{T} \delta^{s} \Delta b_{t+1} - \partial c y_{t+1} \tag{4}$$

where $\Delta b_{t+1} \equiv b_{t+1} - b_t = \bar{c}\,\rho\, y_{t+1}(1+x)^{r-1}$, ρ denotes the indexed annuity rate, δ the real intertemporal discount factor, x the real investment return, c the employee contribution rate and $\bar{c}$ the combined employer and employee contribution rate.

The discounted present value of the wealth therefore depends on the annuity rates available when the individual purchases the annuity, and on the prior level of contributions invested and investment returns.[5] The utility derived from contributing to a DC pension scheme is more complicated, because it depends on factors such as the annuity rate and the member's age at birth, but in general the greater the investment return, *x*, the more beneficial is the DC scheme.[6]

Risk Allocation versus Monetary Reward

The benefits of an occupational pension can be split into two categories: First, insurance, especially against outliving savings; and second, the tangible monetary value of the pension provided. By changing the scheme rules and/ or structure of the pension scheme, it is possible to change the risk allocation, thereby increasing the level of insurance offered to the employee. For example, by offering an indexed pension, the employer is providing additional risk allocation against inflation.

Additionally, schemes may alter their rules to encourage or discourage the retention of employees. This may be done by changing accrual rates, early retirement rules or maximum service requirements to name a few examples. It is possible to change the structure of the pension scheme (i.e. whether it is DB or DC) so as to re-allocate the risk between the employer and employee. The extremes of this spectrum are a final salary DB scheme, where the majority of risks are borne by the employer, and a money purchase DC scheme, where the employee bears most of the risk. There is substantial body of research into how the structure of occupational pension schemes influences the recruitment and retention of employees [see, for example, Andrietti and Patacchini (2004), Disney and Whitehouse (1996), Gustman and Steinmeier,

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[5] This dissertation follows Disney's *et al* (2007b) assumption that the annuity rates that will be available when the individual annuitises will be the second-best currently available age and sex-specific individual life annuity rates. As quoted by the Financial Services Authority (FSA) on 13 March 2007 on the basis of a £100,000 fund, www.fsa.gov.uk/tables. The assumption used of investment return that individuals receive on their pension funds is real 2 ½ per cent a per year.

[6] There is an important interaction between the investment return, *x*, and the discount factor, $d(r)$. If $d(r)(1+x)r > 1$ then the scheme member would gain utility by investing a sum from now until time *r*.

(1993), Akerlof and Katz (1989)]. It has been found that final salary defined benefit pensions are better at retaining employees than DC schemes. This is because employees who leave a final salary pension scheme will be disproportionately disadvantaged by a significant financial penalisation simply due to the structure of the scheme. As a result, the provision of final salary schemes often encourages retention in these organisations.

3. Theoretical Underpinning

The theory of compensating differentials implies that employees will self-select into occupations that offer the combination of wage and non-wage benefits that most closely match their preferences. Holiday entitlement, pension and other fringe benefits will therefore act as substitutes for direct cash wage payments in the overall remuneration package.

Holding non-pecuniary benefits aside and focussing on the relationship between wages and occupational pension benefits, one would expect employees who prefer higher pension benefits to be paid lower wages than otherwise identical employees, and vice versa. For example, older workers and workers with relatively high (low) marginal tax brackets (rates of time preference) are likely to prefer to receive a higher portion of their remuneration as pension. It would also follow that a pension-wage trade off will exist between the yearly increase in promised pension benefits, discounted at the individual's rate of time preference, and the direct current wage payment each employee receives. Figure 1 illustrates this trade-off for two individuals with differing marginal rates of substitution between wage and pension benefits but facing competitive employment packages as implied by the single isocost line. Individual 1 (resp. 2) has a relatively higher (resp. lower) preference for pension benefits implying an optimal pension-wage allocation of (P_B, W_B) [resp. (P_B, W_B)].

Profit maximising firms will endeavour to recruit labour up to the point at which the marginal cost of employment equals the marginal revenue from employment. Under competition and assuming no differential effects on productivity, firms will be indifferent between wage and pension benefits *ceteris paribus* such that that the isocost line illustrated in Figure 1 would have a slope of -1 [see Smith (1981) and Montgomery *et al* (1992)]. The equilibrium market locus is then the function tracing out the tangencies between the individuals' indifference curves and the firms' isocost curves. Alternatively, a nonlinear market equilibrium locus may result. Nonlinear isocost curves might arise if there were economies of scale in the provision of pension benefits because of fixed costs of setting up plans. Similarly, if the pension effect on worker productivity was an increasing function of the level of benefits, then the isocost curves would become flatter as pension benefits increase In this case the slope of the equilibrium locus may lay between 0 and -1, or may even be positive, if a pension premium exists.

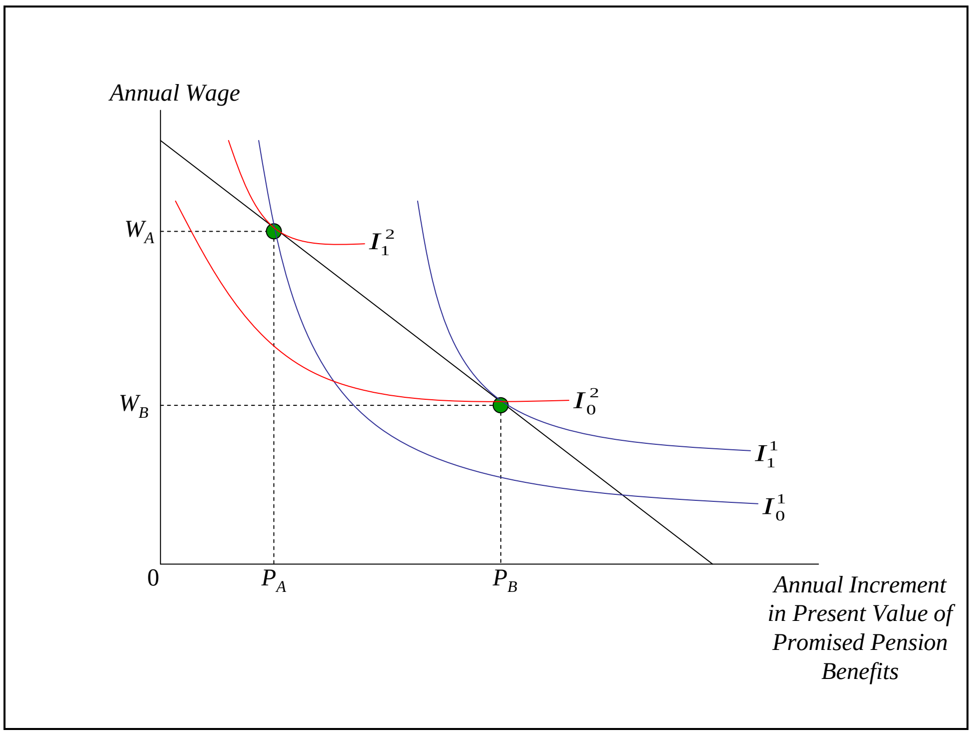

Figure 1: The Pension-Wage Trade Off

The implication of all this is that the sign of a non-wage benefit variable in a correctly specified wage regression, after controlling for qualification and other characteristics that affect wages, should turn be negative. The magnitude of the estimated coefficient should be unity in absolute terms unless fringe benefits increase the productivity of employees, in which case the coefficient should be less than unity in absolute terms.

Reasons why such a premium may exist could be either theoretical or the result of data misspecification. Theoretically, the existence of a pension wage premium in a static context may be a sign that occupational pensions are being used as a form of payment for more productive, higher paid employees. If pensions act as an efficiency wage and increase the productivity of workers, then the straightforward trade-off would not hold and premium would exist. Additionally, implicit contract theory also predicts higher wages in firms offering pensions of the DB type because firms must pay a compensating wage premium to workers who accept deferred wage contracts [Ippolito (1994)].[7] A premium could also be the result of data mis-specification. Ippolito (1997) suggests that any compensation schemes that emphasize occupational pensions, can select in high quality workers via a sorting effect. If this were the case, then it would not be the efficiency wages pushing the premium, but the unobservable individual heterogeneity earnings capacity characteristics, (i.e. superior job performance) of occupational pension participants.

[7] The premium is required because workers in long-term contracts forgo some opportunities for higher paying jobs in their career. This specifically applies to final salary DB occupational pension provision where the ‘pension loss’ on quitting is potentially much higher.

4. Data and Methodology

Data

Analysis on pensions is hindered by a lack of individual level data containing information on accumulated pension entitlements attached to other covariates of interest. Two exceptions for UK data are the British Retirement Survey (BRS) and the English Longitudinal Study of Ageing (ELSA). Both of these are, however, only representative of older individuals (55 to 69 years in the BRS and 50 years and over in the ELSA) and are therefore not informative of the behaviours of the majority of working age individuals.

Our data are derived from waves 2 to 11 of the British Household Panel Study (BHPS) covering the period 1991-2001. The BHPS allows for the analysis of both a larger and cross sector sample of working individuals than is possible from either the ELSA. We restrict our sample to employed individuals below the age of 68 years, excluding those who report usual yearly gross earnings below £4000 or above £200000 in order to avoid outliers. Based on these criteria, an unbalanced panel is created with a total of 50771 observations. Summary statistics of all the variables used are set out in Table 3 (Appendix).

Methodology

Our empirical methodology is based on the estimating framework proposed by Schiller and Weiss (1980) to test for a compensating wage differential. Consider a standard Mincer-Becker type wage regression of the form:

$$\ln W = b_0 + b_1 S + b_2 E + b_3 E^2 + e \qquad (5)$$

where *W* is gross labour income, the error term ε, *S* denotes the individual's years of schooling and *E* denotes experience. Schiller and Weiss (1980) add employer provided fringe benefits, *F*, to the left hand side of the regression, arguing that it is the total benefit package that should matter to compensate the employee's productivity potential - the theory of compensating differentials suggests that, given productivity, any granted fringe benefits will be compensated by a corresponding wage differential. With $f = F/W$, the regression equation (5) may be transformed:

$$\begin{aligned} &\ln\left[W(1+f)\right] = \beta_0 + \beta_1 S + \beta_2 E + \beta_3 E^2 + \varepsilon \\ &\Rightarrow \\ &\ln W = \beta_0 + \beta_1 S + \beta_2 E + \beta_3 E^2 - \ln(1+f) + \varepsilon \\ &\Rightarrow \\ &\ln W = \beta_0 + \beta_1 S + \beta_2 E + \beta_3 E^2 + \gamma f + \varepsilon \end{aligned} \tag{6}$$

Since $\ln(1+f) \approx f$ for small *f*, it is possible to test the theory of compensating differential between wages, *W*, and fringe benefits, *F*, with the hypothesis that:

$$H_0: \qquad \gamma = -1 \tag{7}$$

In this analysis, the fringe benefit that needs to be measured is the benefit of remaining in the pension scheme for an additional year, vis. the yearly increment in pension benefit. Inkmann (2006) initially used employer contribution rates as an estimation of this value. This is arguably a superior measure of pension benefits than the binary nature of a simple pension coverage variable as used, for example, by Andrietti and Patacchini (2004) because it incorporates depth of the pension provision into the analysis. The drawback of using the employer contribution rate as a proxy for pension benefits is that in DB schemes the rate is based on both the current benefits for an individual employer and the paying out of current payments to pensioners. A projective pension variable is generally considered to be preferable. Inkmann (2006), for example, uses such projected calculations in his preferred regression results where a trade-off is found.[8] In what follows, we use the calculated projected rights as computed by Disney *et al* (2007) - see Table 1 following:[9]

- *2% discount rate*
- *Age-earnings profiles computed from each education/age group using Family expenditure survey*
- *All DC schemes- employer contribution 4.6% + match employee + fund growth 2.5%*
- *Private sector DB schemes – 1/60th accrual rate with a NPA of 65*
- *Public sector DB scheme – 1/80 accrual rate plus 3/80 lump sum with a NPA of 60*
- *All individuals are assumed to live until their age and sex specific life expectancy*

Table 1: Assumptions used in Disney et al (2007) to compute private pension wealth variable

Our pension variables are calculated using the actual projected method of valuing pensions, encapsulating what has already been accrued in the current year and, as such, more likely to determine recruitment and retention, rather than looking at the whole life-cycle possibilities of the employee.

5. Results

All Workers

Preliminary investigation of our data revealed that most of the variables exhibited *between effects* that were larger than those of *within effects*. This would suggest that there is more variation across individuals than there is within individuals. We therefore estimated our panel regression through a random effects random model, the results of which are set out in Table 3 (Appendix).

[8] Contributions are often set by actuaries to meet certain funding requirements that the scheme has to meet. Changes in the funding ratios will affect contributions but will have no effect on the individuals pension benefit. By calculating prospective variables this problem is avoided.

[9] These derived BHPS variables are publicly available through the Economic and Social Research Council (ESRC) data archive.

The results from the standard Mincer-Becker type regression equation (5) are set out in column (1) of Table 3 and appear to accord with *a priori* expectations: higher qualification levels are associated with higher gross pay and experience increases pay at a decreasing rate. All variables are statistically significant at the one per cent interval.

The annual accrued pension variable, *f*, is included in our second regression, set out in column (2), which also controls for ethnicity, union membership and gender. The estimate of g, the coefficient of the ratio of annual accrued present value pension rights to the gross wage, is 0.04, which would appear to reject the theory of compensating differentials. The finding of a premium between pension benefits and pay does not, however, entirely negate hypothesis (7). The theory is traditionally applied for a given level of productivity, but it is possible that fringe benefits may distort behaviour. For example, workers receiving fringe benefits may work more productively and thus earn higher wages than other workers *ceteris paribus*.[10] There may also be econometric reasons why the trade-off does not hold. Altonji and Usui (2005) recount the 'sorry story' for compensating differential studies. More often than not, findings contradicting the theoretical expectations are explained by an omitted variable bias triggered by insufficient observable information on ability. Currie and Madrian (1999) provide further discussion on this.

In our specification, the education, qualification and experience variables are all imperfect measures of general and firm specific capital. If the associated measurement error is positively correlated with the fringe benefit variable, then an OLS estimator of the fringe benefits' variable's coefficient, γ, will be biased upwards and may eventually switch sign from negative to positive. Inkmann (2006) is aware that when testing for the occupational pension

[10] Askildsen and Ireland (2003) review possible sources of productivity gains: pension benefits may be used to protect investments in firm specific human capital [see Johnson (1996)], to reduce shirking through the deferred wage characteristic for pension benefits [see Akerlof and Katz (1989), Curme and Kahn (1990)], and to attract the desired type of employee by offering the particular wage and fringe benefit compensation package this type of employee is likely to expect.

compensating wage differential, there is an opportunity to test this measurement error. If the gross pension accrual variable is broken down into the component from the employer and the employee, then it may be possible to identify such an error.

We follow Inkmann's (2006) approach by creating a measure of employee contributions, C, from a question in wave 11 of the BHPS that asked respondents *what percentage of their salary they contribute into their employer's pension scheme*. Given the obstinacy of most pension arrangements, we assume that this percentage is the same across the other waves. We then restructured our original wage equation, calculating gross salary, net of these employee contributions ($Y = W - C$).

$$\begin{aligned} &\ln\left(Y + C\right) = \beta_0 + \beta_1 S + \beta_2 E + \beta_3 E^2 + \gamma f + \varepsilon \\ &\Rightarrow \\ &\ln\left[Y\left(1 + c\right)\right] = \beta_0 + \beta_1 S + \beta_2 E + \beta_3 E^2 + \gamma f + \varepsilon \\ &\Rightarrow \\ &\ln Y = \beta_0 + \beta_1 S + \beta_2 E + \beta_3 E^2 + \gamma f + \varphi c + \varepsilon \end{aligned} \tag{7}$$

where $c = C/Y$ such that the (pure) theory of compensating differentials would imply $\gamma = \varphi = -1$. Column (3) in Table 3 sets out the results from this regression. The estimate of γ at 0.08 is still not negative but that of φ, with a value of –1.07, is much closer to –1 and more in line with the theoretical prediction.

If there were a measurement error in the education and qualification variables, then it would be difficult to argue that the error is correlated with employer provided benefits to the pension scheme but not correlated with the employee contributions [Inkmann (2006)]. From looking at these results, we gain some assurance in the methodological structure of the regressions used.

One would expect the relationship between wage and pension benefits to depend to some extent on the nature of the pension provision. DB pension schemes allocate more risk to the employer and the nature of their financing makes it harder to adjust the compensating wage differential for every given employee's productivity potential. In DC provision, where accrual is more transparent and where the employer does not need to worry about financing in the same way, adjusting the trade-off for each employee should be more possible. There should therefore be a greater trade-off under DB provision rather than DC provision because, *ceteris paribus*, DB provision provides more non-monetary risks.

Wave 11 of the BHPS provides information on the type of employer pension provision. If we assume that the type of employer pension remains stable across other waves, it is then possible to decompose *f* into $f = f^{DB} + f^{DC}$ such that:

$$\ln Y = b_0 + b_1 S + b_2 E + b_3 E^2 + g_1 f^{DB} + g_2 f^{Dc} + j\ c + e \qquad (8)$$

Results from this regression are set out in column (4) of Table 3 and continue to show a wage-pension premium for both DB and, although to a lesser extent, DC schemes.

Public Sector Workers

An interesting and hitherto unaddressed issue is the nature of the wage-pension relation amongst public sector workers. Public sector employment in the UK is generally more secure than private sector employment and one might anticipate that those individuals who select themselves into public sector employment are more risk averse than their private sector counterparts. How these factors impact on the trade-off is illustrated in columns (5)-(8) of Table 3 where we apply our regression analysis to a restricted sample of public sector employees. The results from our underlying Mincer regression are set out in column (5) and those from our basic wage-pension regression, which focuses only annual pension benefits, are set out in column (6). The latter suggests a larger premium at 0.06 than that found for the whole sample. Incorporating employee contributions into our analysis makes very little change to the coefficient on the pension benefit variable, but employee contributions do exhibit a much smaller trade-off than for the whole sample – see column (7). The results from decomposing the type of pension provision into DB and DC are set out in column (8) and reinforce our previous findings that DB provision is related to a slightly higher premium than DC provision.

Our results for public sector should be interpreted with caution since attitudes towards risk may affect both the preferred trade-off between pensions and wages and preferred employment. Individuals who are risk averse may prefer to maintain more money in the form of a pension in order to save for an uncertain future or they may prefer to increase their current holdings of cash. And the same type of individuals may also be attracted to the security of public sector employment, ceteris paribus. To account for potential sample selection bias, we adopt the Heckman (1976) two-step estimation procedure using the inverse Mills' ratio. We follow Hersch and Viscusi (1990), Hersch and Pickton (1995), Viscusi and Hersch (2001) and Brown *et al*. (2006) in proxying risk averseness by a variable detailing whether or not the respondent smoked. The underlying probit set out in Table 5 shows that public sector individuals are significantly less likely to smoke than other workers, ceteris paribus. The significant Mills ratio suggest that sample selection bias is an issue but the adjusted regression results, set out in Table 4, do not show significant change for the coefficients of interest from the previous analysis.

Given the failure of previous empirical work to find conclusive results of a relationship between pay and pensions, it is unsurprising that similar results are found in this case. It appears that rather than a small trade-off, there is in fact a very small premium effect. This means that for every unit increase in the pension: wage ratio there is a (small) increase in associated pay. The reverse is also true, if the pension: wage ratio is reduced it does not appear that this automatically leads to higher pay levels. There is a slightly higher premium, 0.06 in the public sector than the whole sample, 0.04. However once employee contributions are deducted the premium is smaller than for the whole sample.

6. Final Comments

In this paper we investigate the relationship between wages and pensions payments using data from the BHPS and derived prospective pension rights variables as calculated by the Institute of Fiscal Studies (IFS). We find no evidence of a trade-off in either the public sector or the complete workforce, even after accounting for possible sample selection bias. The coefficients for the pension: wage ratio variables are very small suggesting that the proportion of salary that is paid as pension benefits to employees has little effect on explaining their wage level. There appears to be only marginal differences between the public and private sector labour markets and DC provision is associated with slightly less of a pension premium than DB.

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Appendix

Table 1: Previous studies on the wage-pension benefit trade-off

Study	*Country of Study*	*Data*	*Pension Variables*	*Results*
Ehrenberg (1980)	US	Two data sets on municipal police, firefighters, and sanitation workers in the years 1973-75	Ratio of pension benefits to earnings at time of retirement; employee's contributions; measures of likely underfunding; other characteristics of pension plans	Some evidence that increased employee contributions and underfunding lead to higher wages; limited evidence of wage-pension benefit trade-off (police in one data set); mixed results for other characteristics
Schiller & Weiss (1980)	US	1969 pension file linked with Social Security earnings for men	Ratio of pension cost to wages; other pension plan characteristics	Trade-off for 3 of 5 age groups, but significant only for 45-54 age; mixed results for other characteristics
Smith (1981)	US	Government employees in 86 cities in Pennsylvania in 1976	Pension benefit accrual and measure of pension underfunding	Significant trade-offs for higher pension benefits, and compensating wage premiums for risk of underfunding
Smith & Ehrenburg (1983)	US	193 firms with wage and pension differences across jobs of different Hay point job evaluations	Differences in pension value across jobs of different Hay Scores	No significant trade-offs
Bulow & Landsman (1985)	US	1982 data on 993 faculty at Stanford	Probability of signing up for pension plan	Weak trade-off, usually insignificant
Clark & McDermed (1986)	US	1971/73/75 Retirement History Survey, men	Working past age of normal retirement and hence experiencing negative pension accruals	Trade-off in the sense that a significant compensating wage premium is associated with expected pension loss from delayed retirement
Mitchell & Pozzebon (1989)	US	1696 employees, 666 with pension plans, from 1983 Survey of Consumer Finance	Coverage by Pension plan; pension contributions; and other pension plan characteristics	No trade-off; more often a wrong-signed relationship
Gustman & Steinmeier (1987)	US	558 full-time private sector men from 1983 Survey of Consumer Finance	Coverage by Pension Plan	Significant positive relationship
Moore (1987)	US	4500 employees from 5 firms	Pension cost to employer	Significant negative trade-off under 2SLS to account for the fact that pensions are positive function of wages in earnings-based plans; significant positive relationship under OLS
Dorsey (1989)	US	1973 full time private sector employees from 1983 Survey of Consumer Finance	Coverage by pension plan. Simultaneously determined	Significant positive relationship in both OLS and 2SLS, the latter to account for the possibility that pension coverage is a function of wages

Table 1 (Continued): Previous studies on the wage-pension benefit trade-off

Study	*Country of Study*	*Data*	*Pension Variables*	*Results*
Even & Macpherson (1990)	US	6,317 employees with defined benefit plans, from 1983 Survey of Consumer Finance	Coverage by pension plan	Significant positive relationship
Montgomery *et al*. (1992)	US	529 employees with defined benefit pension plans, from 1983 Survey of Consumer Finance	Pension benefit accrual as % of wages	Significant trade-off, but it becomes insignificant when 2SLS is used to account for simultaneity
Gunderson *et al*. (1992)	Canada	98 matched pension plans and collective agreements, Ontario	Actuarial calculation of employer's expected pension cost, and pension plan characteristics affecting that cost	Significant trade-off, especially for flat benefit rate, but not for early and postponed retirement provisions; trade-off only when pension variable specified as replacement rates, not amounts
Andrietti & Patacchini (2004.	UK	BHPS, 1991-2001, restricted to white males 20-55, full-time in non-agricultural jobs	Pension Coverage	Find a premium for those in an occupational pension, but only early on in their career.
Inkmann (2006)	UK	First wave (2002/3 of English Longitudinal Study of Ageing	Pension plan tenure, employer contribution	In preferred specification find evidence of perfect trade-off for wages with both occupational defined contribution and defined benefit pension scheme benefits

Source: Updated from Gunderson et al (1992)

Table 2: Summary Statistics

	Sample			
	All Workers		*Public sector workers*	
Variable	*Mean*	*Std. Dev.*	*Mean*	*Std. Dev.*
Male	0.5291	0.4992	0.3591	0.4798
Age	38.76	11.49	41.15554	10.5054
Gross Yearly wage (W)	15941	10216	16544	9278
Yearly pension (F)	5468	10251	8232	13080
Employee contribution (C)	1125	1132	1235	986
Years since left education (E)	18.79	11.44	21.16	10.49
Years in scheme membership	3.1756	6.5016	6.6218	8.4838
Union member	0.2714	0.4447	0.5793	0.4937
Qualification Level 1 (S_1)	0.4352	0.4958	0.5978	0.4904
Qualification Level 2 (S_2)	0.3470	0.4760	0.2723	0.4451
Qualification Level 3 (S_4)	0.0804	0.2719	0.0899	0.2861
Public Sector job	0.2582	0.4376	-	-
Private Sector job	0.6838	0.4650	-	-
Ethnicity	0.1284	0.3455	0.1428	0.3579
DB	0.2303	0.4210	0.3994	0.4898
Number of Observations	50771		13109	

Table 3: Compensating Wage Differentials (Random Effects)

Dependent Variable: Ln Wage

				All Workers				*Public Sector Workers*	
Variable	*Symbol*	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Intercept		8.604 (0.01)	8.400 (0.02)	8.4467 (0.0386)	8.4126 (0.0363)	8.5938 (0.0281)	8.4393 (0.0400)	8.4822 (0.0620)	8.4901 (0.0601)
Yearly pension/Yearly wage	f	-	**0.039** (0.01)	**0.0766** (0.0068)			**0.0552** (0.0061)	**0.0550** (0.0078)	
	f^{DC}	-	-	-	**0.1017** (0.0158)	-			**0.0419** (0.0212)
	f^{DB}	-	-	-	**0.1204** (0.0068)	-			**0.1016** (0.0079)
Employee contribution/ Net year wage	C	-	-	**-1.0740** (0.2325)	**-1.1454** (0.2239)	-		**-0.4906** (0.3153)	**-0.5186** (0.3070)
Years since left education	E	0.056 (0.01)	0.056 (0.00)	0.0591 (0.0020)	0.0649 (0.0018)	0.0407 (0.0179)	0.3941 (0.0229)	0.3980 (0.0313)	0.3843 (0.0302)
Years since left education squared	E^2	-0.001 (0.00)	-0.001 (0.00)	-0.0006 (0.0000)	-0.0008 (0.0000)	-0.0005 (0.0000)	-0.0395 (0.0051)	-0.0169 (0.0071)	-0.0191 (0.0070)
Union		-	0.072 (0.01)	0.0459 (0.0072)	0.0446 (0.0068)	-	0.0929 (0.0072)	0.0591 (0.0096)	0.0677 (0.0095)
Ethnicity		-	-0.049 (0.01)	-0.0768 (0.0146)	-0.0910 (0.0132)	-	-0.0516 (0.0151)	-0.0602 (0.0213)	-0.0697 (0.0211)
Male		-	0.413 (0.01)	0.3868 (0.0224)	0.3876 (0.0217)	-	0.3319 (0.0236)	0.3132 (0.0346)	0.3059 (0.0335)
Qualification Level 1	S_1	0.424 (0.01)	0.357 (0.02)	0.2979 (0.0260)	0.2646 (0.0245)	0.5022 (0.0214)	0.4339 (0.0304)	0.3580 (0.0446)	0.3568 (0.0439)
Qualification Level 2	S_2	0.221 (0.01)	0.205 (0.02)	0.1328 (0.0270)	0.1019 (0.0257)	0.2651 (0.0226)	0.2371 (0.0315)	0.1719 (0.0460)	0.1715 (0.0456)
Qualification Level 3	S_4	-0.119 (0.015)	0.101 (0.02)	0.1256 (0.0380)	0.0840 (0.0367)	0.1897 (0.0350)	0.2837 (0.0478)	0.2454 (0.0651)	0.2253 (0.0649)
R-Squared		0.1354	0.1957	0.1612	0.1880	0.1081	0.1912	0.1415	0.1664

Notes: (i) Dependent variable is log yearly gross pay (W) for columns (2-3,6-7) but net of employee contributions ($Y = W - C$) in (4) and (8); (i) Education; Level 2: A Levels, O levels or equivalent; Level 3: Commercial, Apprenticeship, CSE Grade 2-5,; Level 4: others; (ii) Standard errors in parenthesis (iv) $c = C/Y = C / (W - C)$ and $f = F / W$, with yearly gross wage, W, yearly present discounted pension, F, and yearly employee contribution, C.

Table 4: Compensating Wage Differentials for Public Sector Workers Adjusting for Sample Selection Bias (Random Effects)

Dependent Variable: Ln Wage

Variable	*Symbol*	*(1)*	*(2)*	*(3)*	*(4)*
Intercept		8.5901 (0.2413)	8.4755 (0.3033)	8.9539 (0.4130)	8.7557 (0.4062)
Yearly pension/Year wage	f		**0.0554** (0.0061)	**0.0554** (.0078)	
	f^{DC}				**0.0417** (0.0212)
	f^{DB}				**0.1025** (0.0080)
Employee contribution/ Net year wage	C			**-0.5535** (0.3169)	-0.**5659** (0.3082)
Years since left education	E	0.0412 (0.0041)	0.0388 (0.0051)	0.0327 (0.0070)	0.0344 (0.0068)
Years since left education squared	E^2	-0.0005 (0.0000)	-0.0004 (0.0001)	-0.0001 (0.0001)	-0.0002 (0.0000)
Union			0.0932 (0.0072)	0.0592 (0.0097)	0.0677 (0.0095)
Ethnicity			-0.0546 (0.0157)	-0.0671 (0.0228)	-0.0779 (0.0225)
Male			0.3313 (0.0236)	0.3123 (0.0347)	0.3046 (0.0336)
Qualification Level 1	S_1	0.4999 (0 .0747)	0.4227 (0.0948)	0.2153 (0.1309)	0.2757 (0.1290)
Qualification Level 2	S_2	0.2599 (0.0391)	0.2312 (0.0506)	0.1085 (0.0711)	0.1346 (0.0705)
Qualification Level 3	S_4	0.1853 (0.0363)	0.2807 (0.0479)	0.2358 (0.0653)	0.2172 (0.0653)
Lambda			-0.0062 (0.0537)	-0.0830 (0.0727)	-0.0459 (0.0714)
R-Squared		0.1044	0.1921	0.1423	0.1663

Notes: (i) Dependent variable is log yearly gross pay (W) for columns (1) and (2) but net of employee contributions (Y=W-C) in (3) and (4); (ii) Standard errors in parenthesis; (iii) Qualification: Level 1: Higher education, Level 2: A Levels, O levels or equivalent, Level 3: Commercial, Apprenticeship, CSE Grade 2-5, Level 4: other.

Table 5: Underlying Probit Analysis for Heckman Sample Selection

Dependent Variable: Public Sector Employment

Variable	*Coefficient*	*T-Statistic*
Smoker	-0.2872	0.0529
lyrpay	-0.0010	0.0415
Years since left education	0.0903	0.0081
Years since left education squared	-0.0006	0.0002
Qualification Level 1	1.8110	0.0931
Qualification Level 2	0.7927	0.0936
Qualification Level 3	0.0394	0.1296
Intercept	-5.4059	0.3808
Log Likelihood	-14501.62	
Chi-Squared	1229.44	