The Impact of Pension Type on Retirement Income: Defined Benefit versus Defined Contribution

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Abstract

This study investigates the effect of pension type on retirement income, exploring the outcomes created by Defined Benefit (DB) and Defined Contribution (DC) pensions. Utilising the English Longitudinal Study of Ageing, and employing OLS and Logit regression techniques, this study found that DB pension holders experienced higher annual private pension incomes, and a greater probability of passing minimum retirement living standards, compared to DC pension holders. However, on average, individuals with DC pensions possessed higher net non-pension wealth, suggesting these assets could be used to mitigate the impact of lower private pension income. The analysis also observed consistently positive relationships between retirement income and variables such as retirement advice, homeownership, and education. This study has contributed to a limited body of research directly comparing DB and DC incomes, generating actionable insights with clear policy implications for pension and non-pension wealth.

AI Statement

I confirm that generative AI was not used during the research or drafting of this paper.

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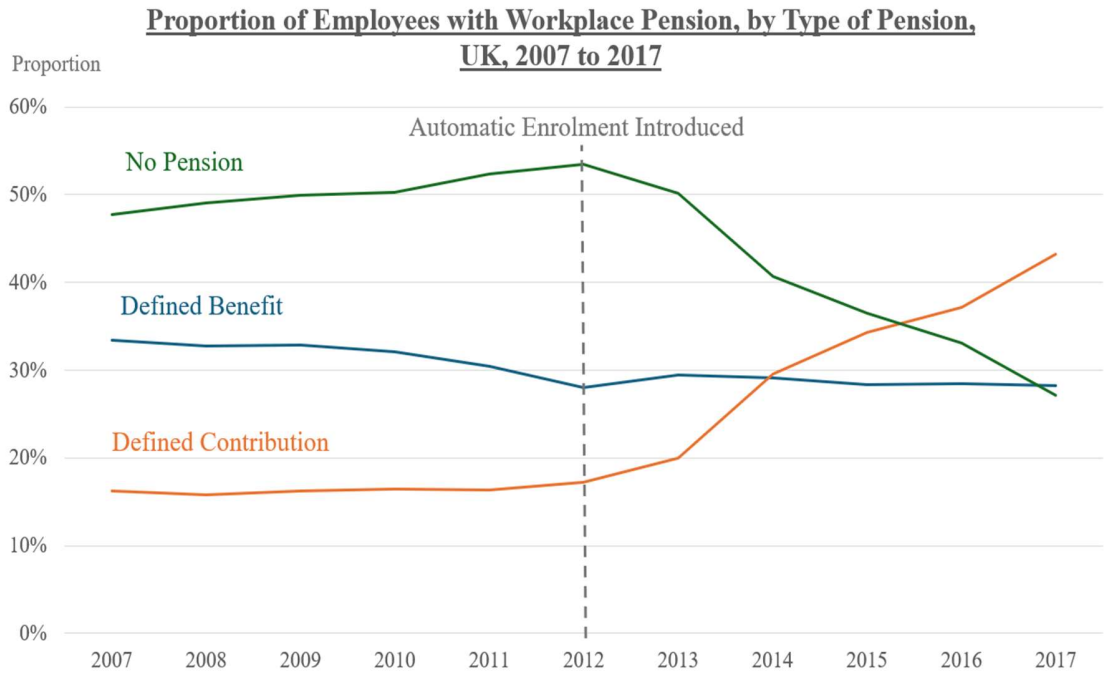
For Norman, Emma, Emily, and Bess, without whom this would not have been possible.

1 Introduction

Facing growing pension-related expenditure, countries across Europe are introducing pension reforms to reduce reliance on the State in retirement (Doctrinal 2024). The United Kingdom (UK) introduced Automatic Enrolment (AE) in 2012 to increase private pension participation, bringing with it a dramatic shift in the pensions landscape (Wood 2013). AE's introduction accelerated a long-term trend towards Defined Contribution (DC) pensions (The Pensions Regulator 2025), eclipsing the previously dominant Defined Benefit (DB) pensions within two years, as shown Figure 1 (Office for National Statistics 2018).

Figure 1: Proportion of Employees with Workforce Pension by Pension Type



The proportion of retirees holding DC pensions will grow in the coming decades, raising an important question; DB and DC pensions offer distinctly different approaches to retirement, but do they also offer different retirement incomes?

1.1 Objectives

This study will utilise Ordinary Least Squares (OLS) regressions to investigate whether DB and DC pensions yield different retirement incomes. To contextualise this effect, a Logit regression

will estimate the impact of pension type on the probability of passing minimum retirement living standards. An additional regression will explore the impact of pension type on net wealth, acknowledging that retirees may draw on non-pension funds to support their retirement.

1.2 Contribution to Research

Existing econometric research on retirement income largely investigates public and private pension ratios, or the effect of different asset allocations and contribution rates. This study will contribute to a small body of research specifically comparing DB and DC pensions, incorporating household and socio-economic control variables to test relationships observed in previous research.

1.3 Structure

- **Section Two:** Background to contextualise motivation of study objectives and defining key concepts.
- **Section Three:** Literature review on relevant economic theory and research to inform study design.
- **Section Four:** Research aims and hypotheses.
- **Section Five:** Methodology, including data, variable choice, descriptive statistics, and robustness checks.
- **Section Six:** Model specifications, results, and interpretation of regressions.
- **Section Seven:** Discussion of results with comparison to literature, limitations, future trends, and policy implications.
- **Section Eight:** Conclusion.

2 Background

A growing emphasis is being placed on private pension income in retirement, driven by rising pension-related expenditure and concerns for the long-term viability of State-funded schemes (Doctrinal 2024). The responsibility of achieving an ‘adequate’ retirement income is increasingly shifting from the State to individuals (Ebbinghaus and Gronwald 2011), with private pensions expected to constitute a growing share of overall retirement income.

AE reflects this increased privatisation. Designed to reverse declining private sector pension participation (Karjalainen 2022), employers are required to enrol eligible employees into a workplace pension scheme, leveraging the Status Quo Bias by requiring employees to actively ‘opt-out’ if they wish to avoid enrolment. Employers must contribute a minimum 3% of the

employee's income to a default fund, with employees contributing an additional 5%. Although employees can change their fund or contribution rate, data indicates most remain with default options (Office for National Statistics 2018).

2.1 Pension Types

For this study, the term 'Private Pension' encompasses all non-State pensions, including workplace and personal pensions. This definition aligns with terminology used in existing literature (Mackley *et al.* 2025).

2.1.1 Defined Contribution

Final pension value is determined by contributions, investment returns and withdrawal methods. Common decumulation options include:

- **Drawdown:** flexible withdrawals at individual's discretion whilst keeping remaining funds invested.
- **Annuity:** converts lump-sum payment into guaranteed income, offering similar decumulation method to DB pensions. May incorporate inflation protection or survivor benefits. Income based on size of lump-sum and annuity rates.

2.1.2 Defined Benefit

Value of pension dependent on years of service with sponsoring-employer, and career average or final salary. Provides guaranteed income for life, typically distributed as a monthly payment. May include inflation protection or survivor benefits.

3 Literature Review

3.1 Status Quo Bias (SQB)

A cognitive bias whereby individuals prefer the current situation or default option, resisting change even when this creates suboptimal outcomes (Godefroid, Plattfaut and Niehaves 2023).

Robertson-Rose (2019) suggests reliance on the SQB within AE may exacerbate factors associated with inadequate pension savings, such as low contribution rates and engagement.

Although the study is based on a small sample, its findings are supported by Bekir and Doss (2020), who find that individuals consistently underestimate the risk of maintaining the status quo, remaining in suboptimal retirement plans. The study has its own limitations, drawing participants from higher educational programmes to achieve a baseline level of financial comprehension; this may limit the applicability of their findings across more diverse educational backgrounds.

3.2 Consumption Smoothing

Consumption smoothing, as defined by Modigliani's Life-Cycle hypothesis (Deaton 2005), involves balancing present and future consumption to optimize living standards over a life-cycle. Literature on consumption smoothing in retirement primarily examines the decumulation methods of DC pensions, as this mechanism is automated under DB pensions.

Studies highlight limitations to Modigliani's rational consumption model, with evidence suggesting a bias towards overconsumption when presented with large sums of money (Hankins, Hoekstra and Skiba 2011). Research from Keohane, Richards and Evans (2015) employs a dynamic micro-simulation model to address this inconsistency, finding that decumulation methods significantly impact DC pension outcomes, with annuities yielding better results than drawdown methods.

Banks and Crawford (2022) synthesize research on individuals' ability to manage their own retirement wealth and observe mixed results. However, they highlight a substantial body of empirical evidence pointing to low financial literacy, imperfect information, behavioural biases, and irrational decision-making. They also note the increasing complexity of decumulation choices for DC pension holders, and the increasing age at which these decisions are made, raising concerns around cognitive decline and the effect this will have on pensioners ability to manage longevity risks and smooth consumption.

3.3 Shift from DB to DC Pensions

The shift from DB to DC pensions began in the early 2000's, and is not isolated to the UK. Cocco and Lopes (2011) attribute this transition to demographic changes; extended longevity and falling birth rates increase DB pension liabilities and reduce future contributions as working age populations decline. Employing a utility-based financial model, their analysis supports literature

suggesting that AE isn't the primary driver behind the shift towards DC in the UK, although data from other sources suggests it has accelerated this trend (The Pensions Regulator 2025).

Aaronson and Coronado (2005) use difference-in-difference estimation to analyse United States (US) pensions data, identifying the cost pressures of high DB pension liabilities as a key factor driving firms toward DC pensions, aligning with observations from UK research (Sweeting 2016).

Josiah *et al.* (2014) identify similar employer-driven motivations in their UK-based qualitative analysis, analysing the effect of accounting implications like the taxation of pension surpluses. Taking a critical view, they find that although the shift has been framed as empowering employees in their retirement planning, it primarily serves to reduce employer costs and liabilities, transferring the obligation of achieving an 'adequate' private pension onto workers.

Beyond costs, Hinrichs (2021) argues that increased labour market mobility and non-standard employment patterns have made DC pensions more attractive. Broadbent and Palumbo (2006) support this conclusion, noting that DC pensions mitigate the 'accrual risk' present in DB pensions; Aaronson and Coronado (2005) suggest this flexibility could be particularly appealing to couples and women with children.

Overall, the literature indicates that demographic shifts and cost concerns have driven the transition to DC pensions, rather than compelling evidence to suggest they create better retirement outcomes.

3.4 DB and DC Incomes

Since DB incomes are determined by individual contract agreements, existing literature on pension income variability primarily focusses on DC pensions.

Stocker (2023) finds that DC incomes can exceed inflation-protected DB pensions, but they must pursue high stock allocations, associated with greater volatility in returns, and contribution rates far exceeding current defaults. This suggests that for DC pensions to compete, they require higher member engagement (to alter default funds and contributions) and increased risk exposure.

Similar findings emerge in the US, where Poterba *et al.* (2007) observe that while DC pensions tend to yield higher average retirement wealth accumulation, they also carry a greater risk of generating very low retirement wealth outcomes. This volatility is driven by exposure to financial markets, investment decisions, and contribution levels.

Exposure to financial markets is a common theme across the literature. Omorodion (2014), applying Vector Autoregression analysis to Nigerian DC pensions, highlights the role of macroeconomic factors like inflation and stock performance as key determinants of outcomes. While DC pensions may benefit during economic growth, periods of low investment returns risk producing suboptimal outcomes. This effect is compounded when converting funds into annuities, which are heavily influenced by economic conditions; in 2020, a cut of 0.1% to the UK base rate reduced average annuity payouts by 4% (McDougall 2025).

Despite DC pensions appearing more vulnerable to market volatility, DB pensions are not without risk, as payments are reliant on the sponsoring employer continuing to meet their obligations. For example, the collapse of construction firm Carillion in 2018 threatened 27,000 DB members' pensions (Thurley *et al.* 2025), leaving an estimated funding deficit of £800-£900 million. Although protections are in place, namely the government-sponsored 'Pension Protection Fund', compensation may not match promised benefits.

3.5 Broader Pension Influences

Given the limited availability of literature directly comparing DB and DC incomes, research on factors affecting general pension income has been collated to inform variable selection.

Murari, Shukla and Adhikari (2021), using multiple linear regression on Indian data, find that key demographic variables like age, marital status and education levels significantly influence retirement preparedness. Park and Martin (2022) support these findings, utilising OLS regressions and US data to explore similar variables; they observe positive effects on retirement planning for financial literacy, income, and savings, and indicate a positive correlation between higher net wealth and retirement planning.

Parsey (2019) employs propensity score matching to link retirement advice and outcomes, showing a £31,000 increase in pension wealth for those seeking advice; interestingly, the type of advice sought had no significant effect.

Pension disparities are identified across sex and ethnicity, with research estimating women hold private pension incomes 34% below the population average (Adams and Wilkinson 2024), and non-white ethnicities at 24% below (Tapp 2020). Veira-Ramos and Schmelzer (2023) support findings on gender disparity, observing that highly qualified men accumulate greater retirement assets, but the benefit of tertiary education for women is more moderate.

Research from Sodini *et al.* (2023) finds that transitioning from renting to homeownership significantly improves net wealth, and moderately increases financial wealth. This is supported by MacLennan and Long (2023), who identify home ownership as a key driver of wealth accumulation.

Crawford and O'Dea (2020) identify failure to model the effect of couple status as a key limitation in their study, suggesting the variable is worth exploring. Research on the topic is mixed; some suggest couples produce higher pension income and wealth (Department for Work and Pensions 2025a), and that children can incentivise retirement planning and preparedness (Damman 2015). Others indicate women in couples are more likely to generate lower private pensions (Stanley 2023), though this is closely linked to the penalties of childrearing and associated career breaks, with Munnell, Hou and Sanzenbacher (2017) suggesting children can reduce household wealth and increase retirement inadequacy risk.

3.6 Summary and Limitations

The shift from DB to DC pensions has largely been driven by employer costs and demographic changes. While the portability of DC pensions may benefit a mobile labour market, research indicates they produce more volatile outcomes. Decumulation methods significantly impact results, with products mimicking the consumption smoothing mechanism of DB pensions yielding the best outcomes. Variables including retirement advice, tenure, and education show strong positive correlations with pension income, however, protected characteristics like 'Sex' can negatively impact results.

A key limitation to existing research is the scarcity of analysis directly comparing DB and DC incomes, and fewer still examining their implications on retirement living standards. The previous focus on financial variables creates limited quantitative studies on household and socio-economic characteristics. Finance-based models analyse variables typically beyond Government control, such as investment returns, limiting the policy application of findings; by examining household and socio-economic variables this study addresses evidence gaps and produces more actionable insights. The study will reduce evidence gaps by modelling the effect of couple status, correcting a limitation observed by Crawford and O'Dea (2020), and providing a clear overview of both pension and non-pension assets, contextualising findings against retirement living standards.

4 Research Aims and Hypotheses

This study aims to answer three key questions.

4.1 Does Pension Type Affect Private Pension Income?

Utilising OLS econometric techniques, this model will assess the impact of pension type on annual private pension income.

- $H_0 = Pension\ type\ has\ no\ impact$
- $H_1 = DB\ pensions\ produce\ higher\ private\ pension\ incomes$

4.2 Does Pension Type Affect the Probability of Passing Minimum Retirement Living Standards?

Employing Logit econometric techniques, this model will contextualise the relationship between pension type and retirement income, assessing the impact of pension type on the probability of passing minimum retirement living standards.

- $H_0 = Pension\ type\ has\ no\ impact$
- $H_1 = DB\ pension\ holders\ have\ a\ higher\ probability\ of\ passing$

$minimum\ standards$

4.3 Does Pension Type Affect Net Wealth?

Applying OLS econometric techniques, this model aims to provide a fair representation of the resources available to DB and DC pension holders. It will explore the relationship between pension type and net non-pension wealth, acknowledging that retirees may draw on non-pension assets to support retirement.

- $H_0 = Pension\ type\ has\ no\ impact$
- $H_1 = DC\ pension\ holders\ have\ higher\ net\ wealth$

5 Methodology

5.1 Data

This analysis utilises data from the English Longitudinal Study of Ageing (ELSA), which gathers information on health, social, wellbeing and economic issues for English respondents aged fifty and older (*About ELSA* n.d.). ELSA doesn't include technical financial variables like investment returns, and integrating external data is impractical given the complexity of individual decision making around finances. Given these challenges, analysis will focus on household and socio-economic characteristics.

Although ELSA provides a panel dataset from 2002 to 2023, this study employs a cross-section utilising Wave 10 of the survey, with respondents interviewed between 2021 and 2023. This approach is consistent with Crawford and O'Dea (2020). Pension type is assumed to remain stable across waves, reducing the analytical advantage of a panel or time-series approach; a comparison of Waves 9 and 10 supports this assumption, showing no changes in pension type after accounting for missing and 'Not Known' responses.

Analysis will be conducted in 'Gretl', using OLS and Logit regressions. The use of OLS is consistent with prior research (Murari, Shukla and Adhikari 2021; Park and Martin 2022), and offers a simple method of estimating variable effects for applied economic research. OLS is

unsuitable for modelling binary dependent variables, so a Logit regression is employed to assess the probability of passing retirement living standards.

5.2 PLSA Standard

The Pensions and Lifetime Savings Association (PLSA) produces 'Retirement Living Standards' outlining the expenditure required to achieve 'Minimum', 'Moderate', and 'Comfortable' consumption levels (PLSA - Retirement Living Standards n.d.). The PLSA standards have limitations, namely the exclusion of rent and mortgage costs, but are widely used across the pensions industry and serve as a suitable benchmark in this analysis. Regressions are compared against the 'Minimum' standard, which represents a threshold for pensioner poverty.

5.3 Sample

Analysis focusses on respondents aged sixty-six or older in receipt of both State and Private pension payments. To isolate the effect of pension type, the dataset has been filtered to only include individuals holding DB *or* DC pensions; the final sample comprised 1208 respondents after excluding those with a mixture of pension types, 'Not Known', and missing values. Those with international qualifications were also removed, as their achievements could not be quantified against UK standards.

The PLSA provides different thresholds by couple status; for Logit regressions analysing the probability of passing minimum PLSA standards, the sample was split into 'Singles', comprising 536 respondents, and 'Couples', comprising 538 respondents.

ELSA lacks data on partners' private pension income, necessitating assumptions to estimate total household pension earnings. Male respondents received, on average, 33% higher private pension income than females. Assuming heterosexual pairings within similar income brackets, partners' private pension income was estimated as a proportion of the respondents; for example, a male respondent reporting £6000 of private pension income was assumed to be partnered with a female receiving £4000. Respondents failing to report their partners' State pension income represented less than 1% of the sample and were excluded.

This analysis assumes respondents provide accurate financial data, but acknowledges literature indicating a tendency for under-reporting wealth in surveys (Burton *et al.* 2020).

5.4 Variables

Variable selection is informed by literature review and available data. Tables 1 and 3 display variable descriptions.

5.4.1 Dependent Variables

Table 1: Dependent Variable Descriptions

Notation	Description
AnnualPrivatePension	Total annual private pension income in GBP.
SinglePLSAWeighted	Sum of State and private pension income compared to weighted Single PLSA Standard. Passes minimum = 1 Doesn't pass = 0
CouplePLSAWeighted	Sum of household's State and private pension income compared to weighted Couple PLSA Standard. Passes minimum = 1 Doesn't pass = 0
NetNonPensionWealth	Household's net non-pension wealth in GBP.

PLSA standards provide different thresholds for London and non-London residents, requiring the use of population weighting to create a single standard. In the absence of geographic data, figures from the Office for National Statistics have been used to create a population weighted average, as shown Table 2 (Office for National Statistics 2023).

Table 2: Weighted PLSA Standard

Couple-Status	London	Non-London	Population Weighted
Single	£15,700	£14,400	£14,602
Couple	£24,500	£22,400	£22,726

5.4.2 Independent Variables

Expected effect of variables are informed by literature review.

Table 3: Independent Variable Description

Notation	Description	Expected Effect on Dependent Variables
PensionType	DB Pension/s = 1 DC Pension/s = 0	Mixed
RetireAdvice[1]	Sought any form of retirement advice = 1 Otherwise = 0	Positive
Sex	Female = 1 Male = 0	Negative
Tenure	Renting = 1 Own home with mortgage = 2 Own home outright = 3	Positive
CoupleStatus	Couple = 1 Single = 0	Mixed
Children	Has at least one child = 1 Otherwise = 0	Mixed
Education	No qualification = 1 NVQ 1 = 2 NVQ 2 = 3 NVQ 3 = 4 Higher education below degree = 5 NVQ 4= 6	Positive
Ethnicity	Non-white ethnicity = 1 White ethnicity = 0	Negative
Sex*Children	Woman with at least one child = 1 Otherwise = 0	Negative
Sex*Couple	Woman in a couple = 1 Otherwise = 0	Negative
Sex*Education	Woman's education level ≥ 1 Otherwise = 0	Negative

[1] Use of 'RetireAdvice' as binary variable in keeping with findings from Parsey (2019).

5.5 Descriptive Statistics

Tables 4 and 5 display descriptive statistics. The sample produces a good balance between DB and DC pension holders. While variables like 'RetireAdvice' and 'Tenure' are skewed towards certain values, sample sizes are large enough to provide meaningful regression results. The number of non-white respondents is very small and will be acknowledged as a limitation in any findings.

Table 4: Descriptive Statistics, Categorical Variables

Variable	Proportion of Sample in Category
PensionType	DB pension = 58% DC pension = 42%
RetireAdvice	Sought Advice = 27% No Advice = 73%
Sex	Female = 48% Male = 52%
Tenure	Own Outright = 87% Own with Mortgage = 4% Renting = 9%
CoupleStatus	Couple = 55% Single = 45%
Children	Has Children = 87% No Children = 13%
Education	No Qualification = 15% NVQ 1 = 4% NVQ 2 = 22% NVQ 3 = 12% Higher Education below Degree = 22% NVQ 4 = 26%
Ethnicity	Non-White = 2% White = 98%
SinglePLSAWeighted	Pass = 53% Fail = 47%
CouplePLSAWeighted	Pass = 73% Fail = 27%

Table 5: Descriptive Statistics, Non-Categorical Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
NetNonPensionWealth	£622,491	£740,757	-£11,190	£10,908,000
AnnualPrivatePension	£10,437	£12,519	£12	£151,062
PercentageFromState	0.633	0.224	0%	100%

This study recognises the large range between minimum and maximum financial variables, but has chosen not to exclude outliers, as these values represent the real-world variation present in a population.

5.5.1 Comparison with Population

Table 6 compares descriptive statistics with external figures to indicate how representative the sample is of the wider population. Representative samples enhance the validity of findings and indicate whether the relationships observed have broader policy applications.

While comparable data is not available for all variables, ‘RetireAdvice’, ‘Sex’ and ‘TotalPensionIncome’ show strong similarities with external sources. The balanced distribution of DB and DC pensions in ELSA helps minimise bias toward one pension type. ‘Tenure’ reveals higher home ownership rates in this cohort compared to population averages, supporting Hood and Joyce's (2013) findings on wealth accumulation among older generations. The elevated ‘Single’ response rate may reflect widowed individuals. Comparison confirms ELSA provides a small non-white sample. Overall, this sample appears relatively representative of the wider population.

Table 6: Comparing ELSA and External Data

Variable	ELSA	External	Source
PensionType	DB pension = 58% DC pension = 42%	DB = 34% DC = 66%	(*UK Pension Surveys - Office for National Statistics* 2020)
RetireAdvice	Sought Advice = 27% No Advice = 73%	Sought Advice = 28% No Advice = 72%	(Khan 2024)
Sex	Female = 48% Male = 52%	Female = 51% Male = 49%	(*Male and Female Populations* 2023)
Tenure	Own Outright or with Mortgage = 91% Renting = 9%	Own Outright or with Mortgage = 63% Renting = 37%	(*Housing, England and Wales - Office for National Statistics* 2023)
CoupleStatus	Couple = 55% Single = 45%	Living with Other/s = 70% Living Alone = 30%	(*Families and Households in the UK - Office for National Statistics* 2023)
Ethnicity	Non-White = 2% White = 98%	Non-White = 18% White = 82%	(Office for National Statistics 2023)
TotalPensionIncome	£23,909 per year	£20,437 per year	(Department for Work and Pensions 2025b)

5.6 Robustness Checks and Statistical Tests

5.6.1 R-Squared

The fit of regression models is measured by the extent to which independent variables explain variation in the dependent variable. OLS regressions will report Adjusted R-Squared values, which penalise overfitting to balance complexity and accuracy. Logit regressions use McFadden's R-Squared, which is more suitable for use with binary dependent variables representing probabilities, and compares the model's log-likelihood values to a null model.

Micro-level studies examining socio-economic variables often yield lower R-Squared values due to the complexity of human behaviour and decision making; Ozili (2023) proposes that an R-Squared value between 0.2 and 0.5 is acceptable, and this benchmark will be applied in the analysis.

5.6.2 Significance

General model significance indicates the explanatory variables have a meaningful impact on the dependent variable. The statistical significance of individual predictors indicates a meaningful relationship with the dependent variable, and will be the focus of this analysis.

Statistical significance will be tested at the 5% level using P-values, but weaker statistical significance at the 10% level will be acknowledged.

5.6.3 Heteroskedasticity

If present, this can cause biased standard errors, inefficient estimates, and invalidate hypothesis testing. Tested for using White's test.

- $H_0 = Error\ variance\ homoskedastic$
- $H_1 = Error\ variance\ heteroskedastic$

Heteroskedasticity-robust standard errors have been used throughout regressions.

5.6.4 Misspecification

If present, this can lead to biased, inconsistent, or inefficient estimates which undermine the reliability of results. Tested for using Ramsey's RESET test, checking for factors including omitted variable bias and incorrect functional forms.

- $H_0 = Model\ correctly\ specified$
- $H_1 = Model\ misspecified$

5.6.5 Multicollinearity

If present, signals a strong correlation between independent variables, potentially affecting coefficient interpretation and model reliability. Tested for using Variance Inflation Factor (VIF) test; while literature varies on the threshold, this analysis will adopt a conservative standard,

considering VIF values of 2.5 or higher as indicative of multicollinearity (Johnston, Jones and Manley 2018).

5.6.6 Akaike Criterion (AIC)

Used to compare Logit model selections, it balances fit and model complexity, with lower AIC values indicating a better-fitting model.

5.6.7 Likelihood Ratio (LR) Test

Determines whether additional variables significantly improve model fit, compared to a restricted specification.

- $H_0 = Restricted\ model's\ fit\ is\ equal\ or\ better\ than\ Unrestricted$
- $H_1 = Additional\ variables\ improve\ Unrestricted\ model's\ fit\ over\ Restricted$

6 Results

6.1 Does Pension Type Affect Private Pension Income?

The initial model specification, with 'AnnualPrivatePension' as dependent variable, exhibited heteroskedasticity during robustness checks. To address this, the dependent variable was log-transformed. Results displayed Table 7.

Model specification, OLS regression:

$$log\_AnnualPrivatePension = \alpha + \beta_1 PensionType_i + \beta_2 RetireAdvice_i + \beta_3 Sex_i + \beta_4 Tenure_i + \beta_5 CoupleStatus_i + \beta_6 NetNonPensionWealth_i + \beta_7 Children_i + \beta_8 Education_i + \beta_9 Ethnicity_i + \beta_{10}(Sex * Children)_i + \beta_{11}(Sex * Couple)_i + \beta_{12}(Sex * Education)_i + \epsilon_i$$

In a log-linear regression, coefficients are exponentiated to determine the percentage change in the dependent variable for a one-unit increase in an independent variable. To interpret 'Sex' interaction effects, 'Sex' coefficient is summed with the interaction coefficient and then exponentiated, isolating the impact of sex on the variable.

Table 7: Results, Model One

Model One: OLS Sample Size: 1208 Dependent Variable: log_AnnualPrivatePension Heteroskedasticity-robust Standard Errors				
Variable	**Coefficient**	**Standard Error**	**P-Value**	**Significance**
const	7.135	0.190	>0.000	***
PensionType	0.943	0.063	>0.000	***
RetireAdvice	0.236	0.062	0.000	***
Sex	0.077	0.204	0.707	
Tenure	0.124	0.054	0.023	**
CoupleStatus	0.110	0.080	0.168	
NetNonPension Wealth	>0.000	>0.000	>0.000	***
Children	0.032	0.100	0.749	
Education	0.167	0.024	>0.000	***
Ethnicity	0.165	0.205	0.422	
Sex*Children	-0.494	0.165	0.003	***
Sex*Couple	-0.495	0.127	>0.000	***
Sex*Education	-0.018	0.034	0.595	
Significance and Fit				
Adjusted R-Squared			0.350	
Overall Model P-Value			>0.000	

The main independent variable 'PensionType' is highly statistically significant, producing a positive coefficient of 0.943, indicating that holding a DB pension is associated with a 157% higher annual private pension income, on average, compared to DC pension holders.

Statistically significant positive effects are also observed in ‘RetireAdvice’ (27%), ‘Education’ (18%) and ‘Tenure’ (13%). While ‘NetNonPensionWealth’ is highly statistically significant, its coefficient is small, suggesting a positive but negligible effect.

The interaction variables ‘Sex*Children’ and ‘Sex*Couple’ show statistically significant and negative coefficients of a similar magnitude, reducing annual private pension income by 37% for women with children and 32% for women in couples. This supports research on the ‘Gender Pensions Gap’, which estimated a 34% reduction (Adams and Wilkinson 2024). The statistical insignificance of ‘Sex’, ‘CoupleStatus’ and ‘Children’ as individual variables suggests there is no meaningful impact on men’s private pension income within these categories.

The interaction variable ‘Sex*Education’ is statistically insignificant, and cannot contribute to findings from Veira-Ramos and Schmelzer (2023) on reduced education returns for women.

6.1.1 Robustness Checks

Table 8: Robustness Checks

Test	Result
White’s Test – Heteroskedasticity	P-Value: 0.195 Fail to reject null hypothesis, no strong evidence of heteroskedasticity.
Ramsey RESET Test - Misspecification	P-Value: 0.333 Fail to reject null hypothesis, no strong evidence of functional form misspecification.
VIF Test - Multicollinearity	Range: 1.009 to 1.152 VIF under 2.5, no strong evidence of multicollinearity.

After constructing a log-linear regression, this model passes all robustness checks, as shown Table 8. There’s no strong evidence of heteroskedasticity, misspecification, or multicollinearity.

An Adjusted R-Squared value of 0.35 indicates moderate explanatory power, falling within the benchmark range proposed by Ozili (2023). The general model shows high statistical significance.

Overall, this model supports the hypothesis that, on average, DB pension holders have higher annual private pension income than DC pension holders.

6.2 Does Pension Type Affect Probability of Passing Minimum Retirement Living Standards? 'Single' Sub-Sample

Interpretation of Logit regressions in sections **6.2** and **6.3** will focus on marginal effects, which measure how a one-unit change in an independent variable influences the probability of passing the minimum PLSA standard, holding all other factors constant. Results displayed Table 9.

Model Specification, Logit Regression:

$$SinglePLSAWeighted = \alpha + \beta_1 PensionType_i + \beta_2 RetireAdvice_i + \beta_3 Sex_i + \beta_4 Tenure_i + \beta_5 NetNonPensionWealth_i + \beta_6 Children_i + \beta_7 Education_i + \beta_8 Ethnicity_i + \beta_9 (Sex * Children)_i + \beta_{10} (Sex * Education)_i + \beta_{11} PercentageFromState_i + \epsilon_i$$

The main independent variable 'PensionType' is statistically insignificant, leaving this model unable to confirm its effect on passing the minimum standard within this 'Single' sub-sample.

'PercentageFromState' produces the largest effect of those regressed, creating a statistically significant and negative coefficient, indicating a 10% increase in reliance on the State pension reduces the probability of passing the minimum standard by 22%.

The 'Children' variable is statistically significant and positive, but results for the 'Sex*Children' interaction variable indicate differing effects by gender. Despite its weaker statistical significance, the interaction variable suggests men see a 22% increase in the probability of passing the minimum PLSA standard, and women an 8% decrease.

As in Model One, 'NetNonPensionWealth' is statistically significant and positive, but has a negligible effect on the probability of passing the minimum standard.

Table 9: Results, Model Two

Model Two: Logit Sample Size: 536 Dependent Variable: SinglePLSAWeighted Heteroskedasticity-robust Standard Errors					
Variable	**Coefficient**	**Standard Error**	**Slope**	**P-Value**	**Significance**
Const	3.306	1.048		0.002	***
PensionType	0.369	0.274	0.091	0.178	
RetireAdvice	0.049	0.287	0.012	0.863	
Sex	0.578	0.830	0.142	0.486	
Tenure	0.336	0.195	0.083	0.085	*
NetNonPensionWealth	>0.000	>0.000	>0.000	0.027	**
Children	0.881	0.423	0.217	0.037	**
Education	0.071	0.109	0.017	0.515	
Ethnicity	-0.970	1.069	-0.236	0.364	
Sex*Children	-1.227	0.643	-0.295	0.056	*
Sex*Education	-0.060	0.153	-0.015	0.693	
PercentageFromState	-8.951	1.000	-2.202	>0.000	***
Fit and Robustness					
McFadden R-Squared			0.417		
VIF Test - Multicollinearity			Range: 1.011 to 1.522 VIF under 2.5, no strong evidence of multicollinearity.		

6.2.1 Robustness Checks

The model's initial specification did not include 'PercentageFromState' and exhibited a relatively low McFadden R-Squared value. After the addition of this variable, the revised model was compared across three key metrics: McFadden R-Squared, Akaike Criterion, and Likelihood Ratio Test.

Table 10: Robustness Checks

Measure	Restricted	Unrestricted
McFadden R-Squared	0.181	0.417
Akaike Criterion	606.641	432.124
Log-Likelihood	-292.320	-204.062

The McFadden R-Squared value more than doubled, showing improved explanatory power and 'goodness-of-fit' in the new model, as shown Table 10. The Akaike Criterion decreased, and the LR statistic was highly significant at the 5% level, allowing rejection of the restricted model and indicating the additional variable significantly enhanced model fit.

While this model cannot confirm whether DB pension holders have a higher probability of passing the minimum PLSA standard, it does reinforce relationships identified between variables in Model One.

6.3 Does Pension Type Affect Probability of Passing Minimum Retirement Living Standards? 'Couple' Sub-Sample

This model replicates the specification selected for 'Single' sub-sample in section **6.2**. Results displayed Table 11.

Model Specification, Logit Regression:

$$CouplePLSAWeighted = \alpha + \beta_1 PensionType_i + \beta_2 RetireAdvice_i + \beta_3 Sex_i + \beta_4 Tenure_i + \beta_5 NetNonPensionWealth_i + \beta_6 Children_i + \beta_7 Education_i + \beta_8 Ethnicity_i + \beta_9 (Sex * Children)_i + \beta_{10} (Sex * Education)_i + \beta_{11} PercentageFromState_i + \epsilon_i$$

Unlike the 'Single' sub-sample, 'PensionType' is highly significant in this model, with DB pension holders observing a 10% increase in their probability of passing the minimum PLSA standard. 'RetireAdvice' also produces a positive effect, increasing the probability of passing by 6%.

'PercentageFromState' shows a strong negative effect, with a 10% increase in reliance on the State pension lowering the probability of passing minimum standards by 8%.

'Ethnicity' is statistically significant at the 10% level, with non-white pensioners observing an 8% higher probability of passing the minimum standard. This contradicts existing literature, which suggested non-white ethnicities would see a reduction in retirement income adequacy (Tapp 2020). However, this result may be influenced by the small non-white sample size (1.7%), requiring further analysis to assess the reliability of these findings.

Table 11: Results, Model Three

Model Three: Logit Sample Size: 538 Dependent Variable: CouplePLSAWeighted Heteroskedasticity-robust Standard Errors					
Variable	**Coefficient**	**Standard Error**	**Slope**	**P-Value**	**Significance**
Const	5.935	1.912		0.002	***
PensionType	0.985	0.305	0.101	0.001	***
RetireAdvice	0.692	0.342	0.057	0.043	**
Sex	1.182	1.255	0.106	0.367	
Tenure	-0.056	0.474	-0.005	0.907	
NetNonPensionWealth	>0.000	>0.000	>0.000	0.560	
Children	-0.922	0.931	-0.063	0.322	
Education	0.421	0.116	0.039	0.000	***
Ethnicity	1.523	0.813	0.081	0.061	*
Sex*Children	-0.002	1.121	-0.000	0.999	
Sex*Education	-0.439	0.171	-0.041	0.010	**
PercentageFromState	-9.031	0.960	-0.839	>0.000	***
Fit and Robustness					
McFadden R-Squared			0.450		
VIF Test - Multicollinearity			Range: 0.998 to 1.555 VIF under 2.5, no strong evidence of multicollinearity.		

As with the ‘Sex*Children’ variable in Model Two, the statistically significant coefficients of ‘Education’ and ‘Sex*Education’ suggest gender-based disparities. While men see a 4% increase in the probability of passing minimum standards per one-unit rise in qualifications, women observe a 0.2% reduction. Though this supports findings from Veira-Ramos and Schmelzer (2023), the effect is small, and further research is needed to separate the effects of child-rearing and associated career breaks on this variable.

6.3.1 Robustness Checks

Statistical testing aligns with Model Two, with the addition of ‘PercentageFromState’ improving model fit and explaining more of the variance in the dependent variable, as shown Table 12.

Table 12: Robustness Checks

Measure	Restricted	Unrestricted
McFadden R-Squared	0.226	0.450
Akaike Criterion	505.787	367.622
Log-Likelihood	-241.893	-171.811

The LR Statistic was highly significant at the 5% level, allowing rejection of the restricted model and indicating the additional variable significantly improved model fit.

Ultimately, the effect of pension type on the probability of passing minimum PLSA standards is inconclusive. While the ‘Single’ sub-sample could not confirm the effect of pension type, the ‘Couple’ sub-sample supports the hypothesis that DB pension holders have a higher probability on average of passing the minimum standard.

6.4 Does Pension Type Affect Net Non-Pension Wealth?

Selected specification replicates Model One, but uses ‘NetNonPensionWealth’ as dependent variable, and switches ‘AnnualPrivatePension’ to independent variable. Results displayed Table 13.

Model specification, OLS regression:

$$NetNonPensionWealth = \alpha + \beta_1 PensionType_i + \beta_2 RetireAdvice_i + \beta_3 Sex_i + \beta_4 Tenure_i + \beta_5 CoupleStatus_i + \beta_6 Children_i + \beta_7 Education_i + \beta_8 Ethnicity_i + \beta_9 (Sex * Children)_i + \beta_{10} (Sex * Couple)_i + \beta_{11} (Sex * Education)_i + \beta_{12} AnnualPrivatePension + \epsilon_i$$

Unlike previous models, 'PensionType' has a statistically significant negative coefficient, indicating DB pension holders have approximately £126,000 less net non-pension wealth, on average, to DC pension holders.

'RetireAdvice' produces the strongest effect, increasing net non-pension wealth by £305,000. 'Tenure' contributes £180,000 per one-unit increase, likely driven by property values, and 'Education' adds £82,000, likely reflecting its link to lifetime earnings or career progression.

The interaction variable 'Sex*Couple' suggests women in partnerships report higher net non-pension wealth, likely driven by the ability to pool resources and invest in assets, e.g. property. The insignificance of 'Couple' and 'Sex' as individual variables leaves the impact of partnerships on men's net non-pension wealth unclear.

Table 13: Results, Model Four

Model Four: OLS Sample Size: 1208 Dependent Variable: NetNonPensionWealth Heteroskedasticity-robust Standard Errors				
Variable	**Coefficient**	**Standard Error**	**P-Value**	**Significance**
const	-£342,798	86674.6	>0.000	***
PensionType	-£125,566	50039.4	0.012	**
RetireAdvice	£304,888	55221.3	>0.000	***
Sex	£35,827	103421	0.729	
Tenure	£179,591	23943.2	>0.000	***
CoupleStatus	£45,661	56798.4	0.422	
Children	-£5,246	58799.6	0.929	
Education	£82,015	12535.6	>0.000	***
Ethnicity	-£123,759	86270.2	0.152	
Sex*Children	£22,712	81136.3	0.780	
Sex*Couple	£171,387	79503.6	0.031	**
Sex*Education	-£29,140	20617.3	0.158	
AnnualPrivatePension	£9	3.350	0.010	***
Significance and Fit				
Adjusted R-Squared			0.153	
Overall Model P-Value			>0.000	

'AnnualPrivatePension' is highly statistically significant, with a £1 increase in private pension income correlated with a £9 increase in net non-pension wealth. This supports research highlighting the close link between income and retirement inequalities, with individual's holding high-value pensions more likely to hold high net non-pension wealth (Brain *et al.* 2024).

6.4.1 Robustness Checks

This model passes robustness checks, as shown Table 14, showing no strong evidence of heteroskedasticity, misspecification, or multicollinearity.

Table 14: Robustness Checks

Test	Result
White's Test – Heteroskedasticity	P-Value: 0.397 Fail to reject null hypothesis, no strong evidence of heteroskedasticity.
Ramsey RESET Test - Misspecification	P-Value: 0.883 Fail to reject null hypothesis, no strong evidence of functional form misspecification.
VIF Test - Multicollinearity	Range: 1.010 to 1.221 VIF under 2.5, no strong evidence of multicollinearity.

Adjusted R-Squared value of 0.153 falls outside of Ozili's (2023) proposed range, but the general model is highly statistically significant.

Overall, this model supports the hypothesis that DC pension holders, on average, have higher net non-pension wealth than DB pension holders.

7 Discussion

7.1 Discussion

Table 15 presents an overview of statistically significant variables and their effect on dependent variables across the four models.

Table 15: Statistical Significance across Models

Variable	Model One	Model Two	Model Three	Model Four
PensionType	Positive ***	-	Positive ***	Negative **
RetireAdvice	Positive ***	-	Positive **	Positive ***
Sex	-	-	-	-
Tenure	Positive **	Positive *	-	Positive ***
CoupleStatus	-	-	-	-
NetNonPensionWealth	Positive ***	Positive **	-	-
Children	-	Positive **	-	-
Education	Positive ***	-	Positive ***	Positive ***
Ethnicity	-	-	Positive *	-
Sex*Children	Negative ***	Negative *	-	-
Sex*Couple	Negative ***	-	-	Positive **
Sex*Education	-	-	Negative **	-
PercentageFromState	-	Negative ***	Negative ***	-
AnnualPrivatePension	-	-	-	Positive ***

Holding a DB pension is associated with a significantly higher private pension income, though its effect on the probability of passing the minimum PLSA standard is inconclusive. Results for 'PensionType' variable support findings from Stocker (2023), who suggested DC pensions would require increased contributions and higher risk investments to match DB income levels.

Model Four indicates DC pension holders possess higher net non-pension wealth than DB pension holders, suggesting they could draw on these assets to support retirement and compensate for shortcomings in private pension income. Further analysis is required to understand this effect, but it could link to research from Hinrichs (2021) and Broadbent and Palumbo (2006), who suggested the portability of DC pensions could benefit employees. If increased flexibility makes DC pension holders more willing to change employers in pursuit of career growth, this could create opportunities for higher earnings, and feed through into asset accumulation. Additional research on links between pension type and career earnings could provide valuable insights.

Findings on ‘RetireAdvice’ support research from Parsey (2019). The positive impact of this variable, across both pension and non-pension wealth, implies that individuals who seek retirement advice may possess higher levels of financial literacy, or exhibit greater engagement with their finances in general (Dick 2020).

‘Tenure’ also generates a consistently positive effect across three of the models, supporting findings from Sodini *et al.* (2023) and MacLennan and Long (2023) on the benefits of home ownership.

The positive coefficient of ‘Children’ in Model Two contrasts with findings from Munnell, Hou and Sanzenbacher (2017), who linked children to an increased risk of retirement inadequacy, but supports qualitative analysis from Damman (2015) on children incentivising retirement planning and preparedness. However, the statistically significant ‘Sex*Children’ interaction variable implies this benefit is male-specific, with women observing a weakly negative effect. This supports findings from Cribb, Karjalainen and O’Brien (2023), who observed lower pension participation and contribution rates for women with children.

Similarly, Model One’s statistically significant ‘Sex*Couple’ interaction variable shows lower private pension income among women in couples. Respondents in the analysed sample were born between 1922 and 1955, so this effect could reflect the socio-cultural norms prevalent during this cohorts working life; between the 1940s and 1960s it was common for women to reduce hours or stop working after marriage (Jenkins 2022), limiting their capacity to build pension assets.

These strong gender disparities are not evident in education, contrasting findings from Veira-Ramos and Schmelzer (2023). Models One and Four showed no meaningful difference in returns to education between gender, and Model Three produced a marginally negative effect of 0.2%.

Finally, ‘PercentageFromState’ proves a strong predictor on the probability of passing the minimum PLSA standard, supporting literature that the State pension alone is insufficient to provide an ‘adequate’ level of retirement income (Miller 2020).

7.2 Limitations

Each model passes robustness checks, confirming the reliability of their results, but there are limitations arising from model fit and variables.

The R-Squared values, ranging from 0.153 to 0.450, indicate a large degree of the variation in dependent variables is still unexplained.

Examples of uncaptured factors include:

- **DC Fund Use –** if annuitisation yields comparable outcomes to DB pensions, suboptimal results may stem from the drawdown method, rather than pension type itself.
- **Financial Variables** – including investment returns or interest rates during accumulation phase and at retirement.
- **Employment Variables** – profession, career earnings, and years with employer.

The absence of geographical data prevents testing for regional inequalities. Conclusions from 'Ethnicity' variable are limited, as non-white respondents comprised just 2% of the total sample.

Demographic shifts introduce further complexities, as trends in pensions data can lag behind real-world changes. Relationships observed in this cohort may not apply to future generations, necessitating caution when considering the policy implication of findings.

For example:

- Wealth accumulation among younger generations is declining (Hood and Joyce 2013), suggesting net non-pension wealth may shrink over time.
- Workforce participation among women has increased, with more women continuing or resuming employment after childbirth. Fewer children and later pregnancies may further reduce the negative 'Sex' interaction effects observed in this analysis (Roantree and Vira 2018).
- More retirees are expected to rent or hold mortgages (Barnard 2023), affecting retirement housing costs and the accumulation of net non-pension wealth.

7.3 Policy Implications

7.3.1 DB pension holders have higher private pension income, and a higher probability of passing minimum PLSA standards:

- Incentivising employers to select and maintain DB pensions, such as subsidising costs or offering protection against long-term liabilities, could improve retirement outcomes.
- As DB pension membership declines, policy changes may be required to improve DC pensions, e.g. through increased contribution rates, raising awareness on the effectiveness of different decumulation methods, or mandating annuitization.
- If higher DC pension membership creates higher rates of inadequate retirement incomes, adjustments to the State pension or pension-related benefits may be necessary; this would undermine the motivation behind AE's introduction, and could present a negative externality of the policy.
- Awareness campaigns should highlight that minimum contributions into DC pensions may be insufficient, encouraging higher contributions or supplementary savings.

7.3.2 DC pension holders have higher net non-pension wealth:

- Information campaigns on decumulation strategies for non-pension wealth, e.g. avoiding predatory equity release schemes (Pickford and Vincent 2020), could optimise asset use in retirement.
- A review of wealth taxation and inheritance laws could encourage individuals to build pension and non-pension assets for retirement.
- While non-pension wealth provides a theoretical source of support, assets may be illiquid or difficult to access, meaning policy makers cannot assume these assets are sufficient to offset low private pension income, and should continue monitoring DC pension outcomes.

7.3.3 Broader Policy Implications:

- Retirement advice increases both pension and non-pension wealth, indicating there is value in supporting policies promoting retirement guidance services, e.g. the Mid-Life MOT (Davies 2023).
- Policies supporting women's participation in the workforce, such as free childcare hours (Ross 2023), could reduce gender disparities and improve retirement outcomes.

7.4 Future Analysis

Future analysis should focus on how DC pensions are utilized in retirement, exploring how different decumulation methods compare to DB outcomes.

Models Two and Three utilised binary Logit models to assess respondents against the minimum PLSA standard; an ordered Logit regression could extend this research further by evaluating pension income against 'Minimum', 'Moderate' and 'Comfortable' thresholds. Similarly, despite a debate over their effectiveness (Chybalski and Marcinkiewicz 2016), replacement rates remain a standard measure of pension adequacy, and could provide further insight into the impact of pension type on retirement outcomes.

Analysis accounting for demographic shifts could improve policymakers' ability to predict the need for interventions, forecasting changes in the size and trend of variable effects. For example, the proportion of single and divorced households has increased (Office for National Statistics 2020), and research suggests this may affect asset accumulation and pensions (Buckley and Price 2021).

8 Conclusion

This study sought to explore the effect of pension type on annual private pension income, the probability of passing minimum retirement living standards, and net non-pension wealth. Though there are clear avenues for further research, this study has been successful in achieving its objectives.

Holding a DB pension is associated with an, on average, 157% higher annual private pension income compared to DC pension holders. This is consistent with existing literature, which suggested DC pensions were subject to greater variability (Poterba *et al.* 2007), requiring higher contribution rates and greater risk exposure to compete with DB incomes (Stocker 2023).

The effect of pension type on the probability of passing the minimum PLSA standard is less conclusive. While the variable lacked statistical significance in the 'Single' sub-sample, results from the 'Couple' sub-sample indicate holding a DB pension increases the probability of passing by 10%. Given these results, and findings on private pension income, holding a DB pension likely has a positive association with the probability of passing the minimum standard.

Furthermore, pension type is shown to have a statistically significant effect on non-pension wealth, with DB pension holders reporting, on average, £126,000 less net non-pension wealth than DC pension holders. This supports literature indicating people could benefit from the increased flexibility of DC pensions (Hinrichs 2021; Broadbent and Palumbo 2006), and supplement shortfalls in private pension income with non-pension wealth. This may ease concerns around pension inadequacy, but investigation is necessary to assess whether DC pensions are creating suboptimal outcomes.

The results of this study align with existing research, confirming positive effects from retirement advice (Parsey 2019), tenure (Sodini *et al.* 2023), and education (Veira-Ramos and Schmelzer 2023). Women in couples and with children face lower pension outcomes, reflecting established findings on the 'Gender Pensions Gap' (Adams and Wilkinson 2024), though the interaction between sex and education produced a weaker effect than observed by Veira-Ramos and Schmelzer (2023).

Beyond reinforcing established trends, this study expands the limited research directly comparing DB and DC incomes, contextualising these results against retirement living standards, and providing a clear overview of pension and non-pension wealth. Private pensions play an increasingly important role in retirement, making research into their effectiveness evermore vital; this study has produced quantitative analysis of household and socio-economic characteristics, generating actionable insights to inform the policies needed to meet future challenges.

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