

Pension Plans and Retirement Insecurity

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Ageing International

ISSN 0163-5158

Ageing Int

DOI 10.1007/s12126-018-9326-x



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Pension Plans and Retirement Insecurity

Wei-Ting Yen¹

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Abstract Why do we observe higher and higher retirement insecurity over the years? This paper argues that an individual's retirement insecurity hinges on the interplay between her registered pension scheme and the level of market volatility. A pension scheme reflects the extent to which pension investment risk is individualized, providing the seed for retirement insecurity. The fear for retirement was triggered as capital markets became more volatile over the past decade. Market volatility creates an immediate information shortcut for individuals when forming expectations about post-retirement income that will only be realized in the long run. Due to the “available information bias,” citizens have developed overall downward expectations of retirement income under growing market volatility, forming pessimistic perceptions about retirement. This pessimism is more striking among those with a Defined Contribution pension scheme than those with a Defined Benefit plan because of the risk individualization feature. The argument is tested with data from the British Household Panel Survey (BHPS). The findings suggest that individuals' perceptions of insecurity in post-working life are driven by the type of pension plan in which they are enrolled and the degree of market fluctuation facing them.

Keywords Old-age security · Market volatility · Welfare state · Public pension · United Kingdom · Economic insecurity · Retirement insecurity; BHPS

Introduction

The most transformative social policy reform in the twentieth century was the introduction of the Defined Contribution pension plan (DC), a retirement plan in which the contributed amount is fixed but the final benefit is not. Before 1980, most countries adopted the Defined Benefit scheme (DB) for their national pension systems. The DB plan features fixed retirement benefit, preventing individuals from carrying pension

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investment risks independently. Starting from Chile in 1980, more than 20 countries have transformed their pension schemes into DC plans. As of 2013, more than half of the OECD countries offered the DC pension plan (OECD 2013: 28). Many developing countries have chosen to privatize pension programs as well, with the goal of attracting and accumulating financial capital under globalization (Brooks 2009: 11).

What came along with the pension transformation was the fall of citizens' subjective wellbeing toward retirement. It is not surprising the DC scheme may increase some uncertainty for citizens as they now bear the investment risks of their pension funds; yet, what is striking is the fast-growing worries among DC pensioners over retirement worldwide in the last decade (ILO 2004: 39). In the United States where the 401(k) is the buttress of employment-based pensions, the percentage of adults fearing they will not have enough money to live "comfortably" in retirement grew from 32% in 2002 to 66% in 2011 (Morin and Fry 2012: 3–5). Worries jumped the most among middle-aged adults, those between 35 and 44. Moreover, DC pensioners (i.e., those relying on the 401(K)) have had higher risk than DB pensioners in maintaining old-age life (Munnell et al. 2006). Growing concerns about retirement are not unique to Americans. In a global attitude project toward retirement conducted by the Pew Center in 2013, many surveyed countries have more than 50% of their citizens not feeling confident they will be able to maintain an adequate living standard in old age (Pew Research Center 2014: 15).¹

Why do we observe higher and higher retirement insecurity over the years? The demographic transformation is the usual suspect, but it does not account for the pattern since older people, ironically, belong to the subgroup most confident about their retirement security (Morin and Fry 2012). It is also puzzling why DC pensioners bear more retirement insecurity. First, the average investment returns over time should be the same regardless of pension schemes (Samwick and Skinner 2003). Second, the DC pension program aligns with people's incentive structure better, which ought to make citizens more willing to contribute and feel more confident about old-age life (Feldstein 1998).

This paper proposes one possible explanation to the puzzle. I argue that an individual's retirement insecurity hinges on the interplay between her registered pension scheme and the level of market volatility. A pension scheme reflects the extent to which pension investment risk is individualized, providing the seed for retirement insecurity. The fear for retirement was triggered as capital markets became more and more volatile over the past decade. Market volatility creates an immediate information shortcut for individuals when forming expectations about post-retirement income that will only be realized in the long run. Due to the "available information bias," citizens have developed overall downward expectations of retirement income, forming pessimistic perceptions about retirement. This pessimism is more striking among those with a DC pension scheme than those with a DB plan because of the risk individualization feature.

I use the case of the United Kingdom to present evidence that is consistent with my explanation. In the United Kingdom, each citizen has been required to enroll in either a

¹ The surveyed countries include South Korea, Mexico, Spain, France, China, Brazil, Nigeria, South Africa, Kenya, Pakistan, the United States, Indonesia, Germany, the United Kingdom, Israel, Argentina, Egypt, Turkey, Japan, Italy, and Russia.

DB pension or a DC pension since the 1986 pension reform. Citizens may choose to switch back and forth each year. With fine-grained data from the British Household Panel Study, I find empirical evidence lending support to my argument: DC scheme enrollment alone does not lower an individual's expected post-retirement income. However, as the market has become more volatile over the last decade, citizens have been constantly primed for pessimism with reports of fluctuation in the financial market. Because DC pensioners' future is more linked to the financial market, they are victims of the volatility priming bias, feeling more insecure about their retirement.

The freedom to switch between a DB and a DC scheme in the UK allows for self-selection into types of pensions that are rarely found in the world. In most countries that have gone through pension privatization, people are usually mandated to enroll in DC schemes. The attribute of self-selection makes the UK a critical case. It also makes my empirical test a conservative one because the group of people who would rationally opt into the DC plan should also be the group least likely to feel retirement insecurity.² Therefore, if the UK case can support the hypotheses – that is, that people enrolled in the DC scheme feel more insecure about retirement in a more volatile market– we would expect even higher retirement insecurity associated with individuals who are tied to a DC scheme with no choice.

The paper is organized in the following way: Second section addresses why it is of importance to study retirement insecurity in its own right. Third section proceeds to provide an explanation to account for rising retirement insecurity. Forth to Sixth sections present the empirical strategy, data, and the findings. I conclude the paper with potential future research directions.

Retirement Insecurity: Concept and Measurement

Economic insecurity has been identified as one micro-level foundation of welfare state demand in recent scholarship (Baldwin 1990; Dryzek and Goodin 1986; Moene and Wallerstein 2001; Rehm 2009). The higher the risk of economic adversity (i.e., job loss, etc.), the more insecure people feel, and the greater the demand for social insurance. Economic insecurity is a multi-dimensional concept. In practice, researchers measure each dimension separately before aggregating them into one single index (Dominitz and Manski 1996; Hacker et al. 2011; Osberg and Sharpe 2009).³ The dimensions already identified include job insecurity, retirement insecurity, illness insecurity, and insecurity from widowhood (Hacker et al. 2010; Osberg and Sharpe 2009). Of them, job insecurity has

² For example, risk loving people might prefer a DC scheme due to the potential high yield; High income earners might be more open to a DC scheme because only a smaller portion of their asset would be invested; People identified with the Conservative Party might be more supportive of a DC scheme because such reform was passed under Margaret Thatcher.

³ It is not entirely clear what it means to be “economically insecure” if the question asked is “how economically insecure do you feel.” Insecurity can come from the risk of job loss, from sudden declines of wealth, or from the financial burdens of insufficient health insurance, to name just a few. When the question is loosely defined, responses are likely to conflate the different dimensions of insecurity (Dominitz and Manski 1996). Moreover, the dimensions of risk confronting an individual might be different depending on which stage an individual is at in her life cycle (Whelan and Maître 2008b).

garnered the most attention and is often the proxy for economic insecurity in empirical analyses.⁴

As an aging population becomes more prevalent in many societies, retirement risk has gained importance over the years (Bender and Jivan 2005; Elder and Rudolph 1999). Retirement insecurity demands separate attention mainly because, compared to other types of social risks, it has the attribute of long-term realization (Jacobs 2011). Even though the concept of economic insecurity is about future economic misfortune, existing researchers tend to overlook how far away “the future” is. Would people employ the same information to evaluate economic outcomes three years down the line as they would for 30 years? While people may form accurate guesses about the unemployment rate next year, it remains puzzling, theoretically and empirically, whether people can foresee their retirement insecurity accurately.

Wisdom drawn from behavioral economics/cognitive psychology literature would suggest that people rely on all sorts of heuristics when forming inter-temporal choices. When making inter-temporal decisions, human rationality is bounded due to long-term uncertainty and time-discounting effects. The literature argues that instead of calculating the expected utility of different options and choosing the one that brings the highest utility, people make decisions based on the value of potential gains and losses and they rely on certain heuristics to make decisions. Because the future is far away with great uncertainty, individuals tend to rely on immediate information heuristics to make long-term judgments (Kahneman and Tversky 1979, 1982; Jones 1999; Berns et al. 2007; Jacobs and Matthews 2012). In other words, inter-temporality is the unique feature associated with retirement insecurity. If we know that what factors into perceptions toward the “far future” is different from that of the “near future,” then retirement insecurity begs separate investigation from other dimensions of economic insecurity.

At the conceptual level, retirement insecurity is the inadequacy of maintaining one's pre-retirement living standard during old-age. This concept contains both subjective and objective dimensions. On the subjective dimension, retirement insecurity can be measured by citizens' worry about retirement income sufficiency; on the objective dimension, it can be measured by the gap between one's retirement income and the targeted level of adequate retirement income.

The most common way to operationalize retirement insecurity is to use income replacement rate, which calculates retirement income as a share of pre-retirement income. The literature has suggested that 70% of one's pre-retirement earning is the ideal retirement income level, below which the retiree is at risk of inadequate income at old-age.⁵ Academics, financial planners, and policy makers have promoted this benchmark rate to the public as the retirement target. According to the Center for Retirement Research at Boston College, as of 2006, 43% of the working population is at risk of

⁴ In many widely used cross-national public opinion surveys, such as International Social Survey Programme (ISSP) or European Values Study (EVS), job insecurity questions are included regularly in the questionnaires. Existing research tends to agree that job insecurity is associated with stronger support for the welfare state, especially support for unemployment insurance. Studies agree that labor market conditions are what account for the level of job insecurity, though arguments differ as to what the changing conditions are.

⁵ Of note, the ideal replacement rate is the average income replacement rate suggested for the society. Depending on one's economic circumstance, one may need higher/lower income replacement rate. One is at the lower/upper end of the income spectrum. In other words, if we were to plot the ideal income replacement rate for everyone in the society, it would be a distribution centering around the 70% replacement rate.

inadequate retirement income in the United States if using this 70% target replacement rate. Moreover, DC pensioners systematically experience higher risk than DB pensioners (Munnell et al. 2006).

The objective measure is by no means perfect, and the problems are twofold. First, the projected income replacement rate is calculated based on several hypothetical parameters. As argued above, old age insecurity is a risk that can only be realized in the long-run, so the projected replacement rate might vary significantly from the real replacement rate 30 years from now, and it might still not be enough for maintaining a decent old-age life. Studies have continued to argue over what parameters to use and what would be the optimal target replacement rate (e.g., Vanderhei 2006; Scholz and Seshadri 2009; Macdonald et al. 2016). Second, and more importantly, even if the actual risk environment remains constant across time, individuals may still experience and interpret the investment risks differently. Their perception of investment risk depends on where they are in the life cycle (Whelan and Maître 2008a, b), how far they are from having old age, and the information they are processing at a given time (Jacobs and Matthews 2012). The subjective feeling is the motivation for most political actions. It is possible that a person's subjective perception of retirement insecurity is entirely biased, but it is still their "true" feeling about retirement, and it is the feeling, instead of the fact, that drives political behavior. In other words, it is of equivalent importance to study subjective retirement insecurity.

That said, the subjective dimension of retirement insecurity has gained much less attention than the objective dimension. What's more, the inter-temporal feature of retirement insecurity would have more impacts on individual perceptions—the subjective dimension—than on real replacement rate—the objective dimension. As a result, this article focuses on the subjective dimension of retirement insecurity and investigate what drives the subjective interpretation of future retirement well-being.

Roots of Retirement Insecurity

What determines an individual's subjective retirement insecurity? This paper argues that the interaction between risk individualization and greater market volatility account for the rising retirement insecurity observed worldwide.

Pension Reform and Risk Individualization

There are two main pension programs around the world, which differ principally according to how the investment risk is distributed: The Defined Benefit (DB) plan and the Defined Contribution (DC) plan. A DB plan is a scheme under which the ultimate pension benefit is set ex-ante (OECD 2008). The risk of inadequate investment return is carried by the state or the employer, whichever serves as the pension sponsor. On the contrary, under a DC scheme, it is the pension contribution rate that is defined ex-ante, and an employee typically pays a fixed contribution. Under a DC scheme, employees bear the financial risks associated with invested funds. The ultimate benefit an employee will receive is contingent upon

how well the pension fund is managed in the financial market.⁶ In other words, under a DC plan, the investment risk is individualized and is shouldered by the individual worker. The buffer between each individual and the market performance is attenuated. DC schemes emerged in the 1980s as the product of pension privatization led by Ronald Reagan and Margaret Thatcher.

Mandatory risk redistribution is at the heart of this transformation. Unlike the DB system, in which the uncertainty over retirement revenue is pooled within and across generations, the DC system individualizes the risk, forcing individuals to bear the uncertainty of future retirement income on their own (Brooks 2009). Moreover, such transformation is a structural change at what is called the “second tier” of a pension system, which is typically an earnings-related benefit that constitutes the primary source of a person’s post-retirement income.⁷ In most countries, the second layer protection is mandatory, which means that a structural transformation at this layer would subject all eligible citizens to a sudden risk increase. People are forced to carry risk individually that had previously been pooled.

However, it was not anticipated that pensioners would carry higher risk in the long run when DC schemes were introduced. For one thing, pension economists claim that individuals would allocate their assets efficiently according to their life cycle stage; in the long run, the risk level would be the same as those people in a DB plan. Governments also promote this point of view.⁸ For another, there is an implicit belief, especially when the pro-market doctrine was popular, that if pensions are privatized and operated under the market logic, the market will automatically optimize individuals’ pension investment choices. Under this ideology, pension privatization should not increase investment risk at all (Rudolph et al. 2010: 4). Even if investment risk increases *objectively* in the short run, people should not perceive this risk *subjectively*.

Contrary to economists’ ideal scenario, considerable evidence already suggests that the complexity of pension investment and the lack of full information easily lead to inertia and bad choices (Rudolph et al. 2010: 5). Moreover, even if investment risk for a DB and a DC plan were the same in the long run, it by no means suggests that people would feel that risk in the same way. On the contrary, it is likely that people feel the rising risk in the short term, which serves as a cue to shape an individual’s perception toward future retirement insecurity. Third, and more importantly, the nature of the financial market has transformed since the 1980s, particularly in terms of volatility. This factor, together with the pension scheme transformation, has altered retirement insecurity at the micro level. In other words, higher market volatility, which topic we now turn to, is another necessary condition for retirement insecurity.

⁶ While the benefit is highly dependent on the fund management, the extra fees associated with the investment (such as the management fee) matter too. All the extra fees would also eat up the benefit under the DC plan.

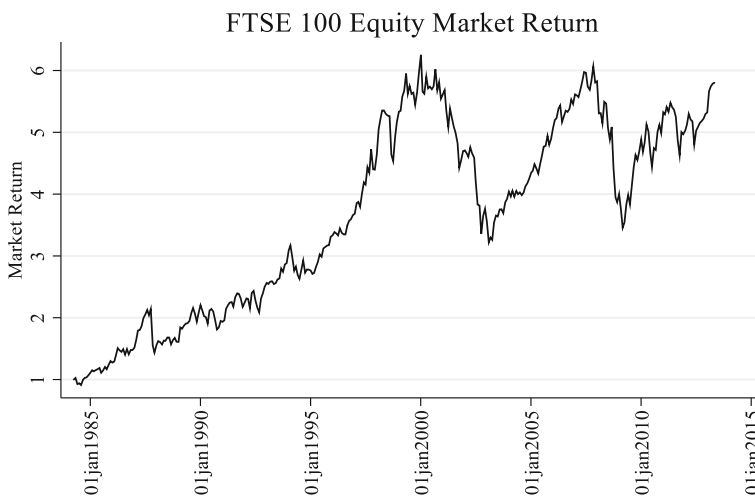
⁷ Briefly speaking, a pension system is typically composed of three layers. The first is a state provided (flat rate or subsistent) pension. The second layer is an earnings-related pension. Unlike the first layer, the pension benefit received in an employment-related pension is linked, to some extent, to the previous earning. The third layer is an individual’s voluntary private pension insurance. This layer provides extra protection for those who want a more guaranteed postretirement living standard. States usually play incentive creating roles at this layer, encouraging people to add extra protection through providing tax exempt for private contribution.

⁸ For example, in the United Kingdom, which underwent pension privatization in 1986, the government highlights this sentence on their pension investment website: “in the long run, pension should grow more than saving accounts (<https://www.gov.uk/workplace-pensions/types-of-workplace-pensions>)”.

Growing Market Volatility Since the 1990s

A deeper source of retirement insecurity is the upward return volatility in the financial market. Imagine a scenario in which investment return is stable or, if it fluctuates, remains within a very limited range. Under this scenario, given the same investment level, even if an individual in a DC scheme has to take the investment risk, the market return would probably be very similar to what she would get if she were under a DB plan. In other words, if the market is stable, regardless of the pension scheme, people should not feel insecure about investment risk. The problem is that the financial market has become more volatile in the last two decades. Against this backdrop, when a person is linked to investment risk under a DC plan, she is also related directly to higher market fluctuation.

Figure 1 shows the FTSE 100 market return from 1980 until 2015. We can see that the financial market was not as volatile in the 1980s as today when pension privatization swept across the world. Before 2000, the series presents a steady and upward trend; however, after 2000, the variability of market returns became apparent (it is shaped like a W), and there are more spikes in the month-to-month return. The market trend in the London stock market is similar to the trends in other financial hubs as well. Bewley et al. (2007) use time series analysis to detect a structural break in long run volatility in both the S&P 500 Index and the Morgan Stanley Capital International Index from 1990 to 2002. They find that both series present higher volatility after 1997, coinciding with the end of the Asian Financial Crisis; moreover, structural breaks in the volatility level are detected in both series, meaning that there is indeed a permanent transformation in volatility. Their finding confirms the qualitative change in the financial market, refuting the argument that the equity market only experiences temporary higher volatility during shocks and returns to equilibrium in normal periods.



Source: Yahoo Finance

Note: market return is presented in ratio, with 1988 July 1st price as the baseline.

Fig. 1 FTSE 100 market trend. source: yahoo finance. note: market return is presented in ratio, with 1988 July 1st price as the baseline

Increased market volatility is partially a result of greater capital mobility, and one primary source of moving capital is the pension fund industry.⁹ In the OECD private pension markets, which include occupational and personal arrangements, DC pension funds have continued to grow faster than the DB funds. From 2001 to 2011, the DC pension fund assets increased from 30 to 35% of total pension assets (OECD 2012: 7).¹⁰ Pension funds usually direct most of their investments in equity and bond markets, accounting for more than 75% of pension fund portfolios in 2015 (OECD 2016: 18). In particular, most pension funds under a DC scheme are heavily invested in equity markets; this leads not only to strong returns in most years, but also considerable volatility (Ashcroft 2009). As the financial market becomes more volatile in essence, pension fund performance is inevitably affected by market fluctuation and become more volatile as they have grown (ILO 2004: 38).

Embedded in an environment in which the financial market (and the associated pension investment risks) fluctuates rapidly, people are constantly primed with scary market information. Behavioral economists have argued that investors tend to form their subjective risk levels based on “availability heuristics” (Kahneman and Tversky 1982; Shiller 1999). That is, instead of paying equal attention to all investment-related information, individuals are drawn particularly to extreme events, such as economic shocks, and estimate their investment risks accordingly. Therefore, constant and frequent exposure to market fluctuation skews decision makers’ judgments when evaluating the probability of investment risks. Even when real risk level decreases, people may still overestimate market return losses from the last shock occurrence and shape their behaviors on this selective, distorted perception (Weyland 2007: 48). Such information availability bias would result in individuals expecting lower income after retirement, even when market return is rising at that moment. In sum, overall market volatility directly affects pension market performance, which in turn is at the root of individual retirement insecurity. Apart from the fact that people might lose more under a high-risk or poorly-managed investment portfolio, in a DC plan there is always a degree of uncertainty regarding the return to invested funds. For DB pensioners, the government and employers function as the first line buffer absorbing the uncertainty.

The argument can be summarized as below: Risk individualization, inherent in a DC plan, creates an institutional factor for micro-level retirement insecurity; however, the adverse effect of risk individualization is only apparent when the financial market has becoming more volatile. If my argument is correct, hypothesis that could be tested is listed as follows:

Hypothesis: Being in a DC plan, under rising market volatility, increases retirement insecurity.

⁹ Relative to the size of the economy as measured by GDP, on average, pension funds have increased from 67.3% of GDP in 2001 to 77.0% in 2012 in OECD countries (OECD 2012, p. 2, 2013, p. 10).

¹⁰ In particular, in countries where the DC scheme is the only available plan that every eligible citizen is mandated to join, DC pension assets constitute 100% of the total pension assets. As of 2013, there are eight countries that only have a DC scheme as a mandatory plan: Chile, the Czech Republic, Estonia, France, Greece, Hungary, Poland and the Slovak Republic (OECD 2013, p. 28).

Empirical Strategy: Leveraging the British Case

My empirical strategy is to find a case that allows me to control for many important variables while capturing variation in pension schemes as well as levels of market volatility. The United Kingdom stands out as a good case for these criteria for several reasons. First, in the UK system, working individuals are required to enroll either in a DB system or a DC system after the 1986 pension reform. This distinguishes the United Kingdom from other countries that have also undergone pension reforms but have made the DC scheme mandatory for all eligible citizens.

Second, focusing only on the United Kingdom enables me to control as many unobservable factors as possible, avoiding the effect of confounding variables. One strong advantage of using a single country design is to exclude the effects of a welfare system on the baseline retirement insecurity level. Since there are many different welfare systems around the world (Esping-Anderson 1990), the baseline insecurity level might also vary with the design and generosity of various welfare systems. A cross-country analysis cannot tease out the real effect of a pension scheme and is vulnerable to selection bias. For example, if a DC plan is more likely to be adopted under a particular type of welfare state, which might also affect the baseline insecurity level, there is a possibility for endogenous selection on the observables if we conduct a cross-national analysis. In this sense, a single country study is preferable to a cross-national analysis.

Third, regarding data availability, the British Household Panel Study (BHPS), an ongoing longitudinal study from 1991, provides a high-quality dataset to test my hypotheses. For one thing, it traces individuals over years, offering comprehensive and representative information on the British people.¹¹ For another, the survey asks respondents to subjectively estimate their income levels after retirement, which is rarely asked in most public opinion data. Subjective income replacement rate can be a direct proxy tapping into subjective retirement insecurity.

The UK Pension System

The pension system in the United Kingdom can be disaggregated into three layers: the Basic State Pension (BSP), the State Earnings Related Pension Scheme (SERPS)/State Second Pension (S2P),¹² and the voluntary personal pension. As the first layer, BSP is a flat rate pension program providing a modest level of

¹¹ With respect to how the survey is sampled, BHPS selects a nationally representative sample of more than 5000 households, making a total of approximately 10,000 individual interviews. In the selected family, every individual older than 16 years old is interviewed. Once interviewed, the same individuals would be re-interviewed in successive waves until they split from the original family. To fully capture an individual's life trajectory, for those who split from the original family and form a new family, all adult members in the new family would be interviewed.

¹² SERPS was first introduced in 1978, and it was replaced by S2P in 2002/3 with a goal to expand social protection coverage to more economically disadvantaged people and people who cannot work due to disability or caring responsibility. In essence, S2P is the same as SERPS, providing pension related to earnings in working life as the second layer protection.

security. As of 2010, the maximum weekly pension BSP pays out is £97.65 (ISSA 2010), which is equivalent to 17% of the average wage. On top of BSP is the earning-related pension, SERPS/S2P. The second layer protection is also mandatory, which means that employed citizens should enroll in SERPS/S2P. SERPS/S2P is run by the state and is a DB arrangement in which the UK government guarantees the final pension. The personal pension, as the third layer protection, is voluntary and was introduced in 1988. Stakeholder pension is a subtype of personal pension with different terms that was introduced after 2001.

What distinguishes the UK pension system is the “contract out” option of SERPS/S2P for individuals. If an individual finds some other pension programs more attractive or that might have a higher yield, either through her employer program or through a personal pension, she can contract out of the state-sponsored SERPS/S2P. Table 1 groups the pension programs by how their final pension is calculated. The underlying idea of “contract out” is to encourage people to invest more in private pensions, (both the occupational pension and personal pension are private), and rely less on state-provided pensions. The “contract out” reform was a privatization reform, along with other privatization processes introduced by the Prime Minister Margaret Thatcher in 1986.

At the individual level, since it is mandatory to have an earnings-related pension, the pension decision facing each individual is the choice among a state-offered plan, an employer’s occupational plan or a personal pension plan. With respect to how the final pension benefit is arranged, the SERPS/S2P (state provided plan) follows the defined benefit arrangement while the individual personal pension follows the defined contribution arrangement. As for the occupational pension plan, both the defined benefit and the defined contribution arrangement are possible, depending on what scheme the employer chooses.¹³ The DC arrangement bears higher investment risk, but at the same time, it has the potential for higher investment yield. Therefore, what confronts an individual is not merely a choice of which pension plan to enroll in, but also a decision between the defined benefit arrangement and the defined contribution arrangement and the ensuing investment risk built in each pension arrangement type.

Data Description

In the BHPS questionnaire, only respondents who are at least 40 years old are eligible to answer the retirement insecurity question.¹⁴ As my theoretical interest is to test how different types of employment-related pension schemes affect a person’s retirement insecurity level, I only focus on respondents who are still in the workforce; that is, those who are tied to an employment-related pension scheme.

¹³ In reality, the provided scheme can be more complicated than merely a choice between the DB and the DC. In some scenarios, employers may provide a scheme that combines the features of both DB and DC plans.

¹⁴ 40 years old seems to be agreed as roughly a cut point beyond which people start to worry about future retirement insecurity.

Table 1 pension program by how the final benefit is arranged

Pension arrangement	Pension program
Defined Benefit (DB)	1. SERPS 2. DB Occupational scheme
Defined Contribution (DC)	1. DC Occupational scheme 2. Personal pension 3. Stakeholder pension

Measuring Retirement Insecurity

One central task of this paper is to measure subjective retirement insecurity. I operationalize retirement insecurity in two ways. The first proxy uses “subjective income replacement rate,” which builds upon the longstanding literature on adequate retirement planning. For decades, academics, financial planners, and policy makers have advocated the projected retirement income as a percentage of pre-retirement income. The higher the replacement rate, the more financially adequate one’s retirement life should be. Because retirees are expected to pay fewer taxes, mortgages, etc., they do not need as much money to get by financially after retirement. The scholarship regarding income replacement has suggested that 70% should be an ideal replacement rate for retirement.

Despite the fact that the replacement rate is based on actuarial tools to be as accurate as possible, individuals might not perceive their future income replacement in the same way. It is one thing to say that the objective replacement rate is 70% projected by actuarial tools; it is another for the retiree-to-be to perceive the future replacement rate to be 70%. As argued above, behavioral tendencies (e.g. information bias, the certainty effect, etc.) might distort how citizens perceive the reality, which in turn factors into how they project retirement and the future income replacement rate.

The subjective income replacement rate becomes a good proxy tapping into the perceived financial security by citizens. In the BHPS, I utilize two survey items to construct the subjective replacement rate. The exact wording of the items goes as follows:

“Do you expect your income in the year after you retire to be more than your preretirement income, less than your preretirement income, or about the same?”

For those who answer “less than” are followed up by another question:

“Can you tell me from this card what you expect your income to be compared with your preretirement income? Less than a quarter, about a quarter, about a third, about a half, about two-thirds, about three-quarters? (Answers are shown on the card)”

The two items together enable me to identify a range of perceived post-retirement income replacement rates, from less than 25% of pre-retirement income to more than 100%. Following the 70% ideal replacement rate suggested by the literature, I divide the respondents into the secure/insecure groups. Because the survey item does not

allow me to identify the exact 70% and because the scholarship has started to question the adequacy of the 70% replacement rate (e.g., Macdonald et al. 2016), I picked 75%, a more conservative replacement rate, as the cutoff point. Individuals whose perceived replacement rate is above 75% are the secure group; those who perceived replacement rate below 75% are considered as the insecure group. Within the working population who are at least 40, about 30% of the respondents feel secure about their retirement.

I also use another proxy to tap into subjective retirement insecurity. The second proxy relies on the survey item that directly asks respondents about their expectation of future retirement income to be “less than sufficient,” “just about sufficient,” or “more than sufficient.” I create a measure that treats those who anticipate more than sufficient retirement income as secure individuals and the rest as insecure individuals. This proxy approaches the subjective retirement insecurity purely from a feeling-based perspective. The benefit of having this second measure is that it is a more direct proxy of subjective retirement insecurity as it elicits information on the perceived financial sufficiency during retirement life. The two proxies complement each other in capturing individual retirement insecurity. It is possible that an individual expects their income replacement rate to be above 75% but still feels as though they do not have sufficient income replacement for retirement. Table 2 shows the tabulation between the two measures; the correlation between the two measures is only 0.1. While a large portion of respondents think the 75% (or more) replacement rate is still not enough, there is also 27% of them agree that a replacement rate below 75% would be sufficient. The weak correlation suggests that people have different ideal replacement rates in their minds, which might partially be the result of one’s economic circumstance. The subjective retirement insecurity measure would help account for the variation of individual expectations.

Pension Programs and Other Control Variables

The first independent variable of interest is the pension scheme, which is a proxy for investment risk individualization. I construct a dummy variable (*Defined Contribution*) in which people are coded 1 if they are enrolled in either a defined contribution occupational pension program or in a private pension program (stakeholder pension programs included). People are coded 0 either when they stay in SERPS/S2P or when they contract out to a defined benefit occupational pension scheme. For those over 40 years old and working, around 24% of the people choose a defined contribution arrangement plan in which the final pension depends solely on investment return.

Of note, I only code those individuals according to their mandatory scheme. That is, it is the second layer protection scheme that defines an individual to be coded 1 or 0 in

Table 2 Tabulation between subjective replacement rate and income sufficiency

	Replacement rate below 75%	Replacement rate above 75%	Subtotal
Insufficient Income	2520	310	2830
Sufficient income	939	223	1162
Subtotal	3459	533	3992

Defined contribution. In reality, it is possible to have more than one arrangement scheme. For example, an individual can both belong to an employer's pension scheme and add another personal or stakeholder pension plan on top of the employer's scheme. While getting an extra level of insurance is beneficial, it is an entirely voluntary decision to add to the earnings-related mandatory pension schemes. For the purpose of this paper, I do not focus on voluntary pension contributions. Moreover, the possibility of making voluntary personal pension contributions makes the test of my hypothesis particularly conservative; people in a DB plan in the mandatory tier may still add a DC pension plan in their voluntary tier, which may dilute the effect of DB vs. DC in the mandatory tier on retirement insecurity.

Information on pension schemes was collected in 2001 and 2006. My argument would predict that increasing market volatility has transformed how people perceive and respond to the financial market. Against the backdrop of constant fluctuation, even when the current return is good and the short-term market is stable, the experiences of economic downturns a few years ago would still have lingering and psychological effects. As such, I expect that people would get more and more insecure over time after the financial market began to experience rising market volatility beginning in 1997 (Bewley et al. 2007). Therefore, I rely on a wave dummy variable (*Wave*) to capture the growing effect of market volatility.¹⁵ *Wave* takes the value 0 if the survey was conducted in 2001 and one if in 2006. It is assumed that the wave dummy would subsume the impact of increasing market fluctuation, even though it is still far from perfect. Following my argument, the interaction between *Defined Contribution*Wave* should be have negative effect on retirement security.

With respect to control variables, I employ a standard set of variables that may also affect the level of retirement insecurity. *Income*, measured in thousands of UK pounds, stands for annual individual income. I also include a measure of wealth, proxied by *Home Ownership*. *Male* is a dummy variable with one as male. I expect *Age* to have a negative impact on the income expectation after retirement since the closer people are to retirement, they should feel more worry about postretirement life, which implies lower expected income. *Education* adopts the CASMIN system; a higher value means more educational training. *Employed full-time* estimates whether a person is employed full-time or not. Recent literature has suggested that those who are employed part-time, an emerging phenomenon in labor markets around the world, have less stable income, hence higher insecurity levels (Marx 2014). Because the household composition also has influences on one's retirement planning, I include the *Married/Partnered* to control the effects of spouses. Last, individual characteristic such as risk preference factors in how much one cares about the future and future risks; risk takers worry less and have higher tolerance toward uncertainty in the future. I include *Risk Acceptance*, which is a ten-point scale measure, to control for this individual attribute. See Table 3 for descriptive statistics of the variables.

¹⁵ Besides 2001 and 2006, pension enrollment information was also collected on 2010 and 2012. However, data on 2010 and 2012 were damaged due to technical issues arising during the merging process, in which process BHPS was incorporated into a larger longitudinal study called Understanding Society (I confirmed the technical errors through email correspondence with data managers of the Understanding Society project, which BHPS was merged into. Those emails are available upon request.). The administrative error results in a mismatched sampling universe after the 2010 wave. Because of this error, we are left with only two waves of data (2001 and 2006) for our empirical analysis.

Table 3 Descriptive statistics of all variables

	Obs	Mean	Std. Dev.	Min	Max
(a): Subjective income replacement rate as DV					
Full sample					
Subjective income replacement rate	2911	0.28	0.45	0	1
Defined contribution	2911	0.28	0.45	0	1
Wave dummy	2911	0.65	0.48	0	1
Income*	2911	4.23	13.01	-18.58	41.10
Education	2911	5.79	2.81	1	9
Male	2911	0.56	0.50	0	1
Age	2911	49.40	6.33	40	64
Employed full time	2911	0.82	0.38	0	1
Risk Acceptance	2911	5.46	1.96	1	10
Married/Partnered	2911	0.73	0.44	0	1
Home Ownership	2911	0.89	0.31	0	1
Year2001					
Subjective income replacement rate	1007	0.31	0.46	0	1
Defined contribution	1007	0.27	0.44	0	1
Income*	1007	2.32	12.30	-17.82	41.10
Education	1007	5.81	2.80	1	9
Male	1007	0.58	0.49	0	1
Age	1007	49.09	6.22	40	64
Employed full time	1007	0.82	0.38	0	1
Risk Acceptance	1007	5.39	1.98	1	10
Married/Partnered	1007	0.73	0.44	0	1
Home Ownership	1007	0.88	0.33	0	1
Year 2006					
Subjective Income Replacement Rate	1904	0.27	0.44	0	1
Defined contribution	1904	0.29	0.45	0	1
Income*	1904	5.25	13.01	-18.58	41.10
Education	1904	5.79	2.83	1	9
Male	1904	0.55	0.50	0	1
Age	1904	49.56	6.39	40	64
Employed full time	1904	0.82	0.39	0	1
Risk Acceptance	1904	5.50	1.94	1	10
Married/Partnered	1904	0.73	0.44	0	1
Home Ownership	1904	0.90	0.30	0	1
(b): Feeling of income sufficiency as DV					
Full Sample					
Feeling of income adequacy	3883	0.12	0.33	0	1
Defined contribution	3883	0.26	0.44	0	1
Wave Dummy	3883	0.65	0.48	0	1
Income*	3883	2.47	12.75	-18.58	41.10
Education	3883	5.55	2.85	1	9

Table 3 (continued)

	Obs	Mean	Std. Dev.	Min	Max
Male	3883	0.50	0.50	0	1
Age	3883	50.26	7.29	40	82
Employed full time	3883	0.76	0.43	0	1
Risk Acceptance	3883	5.39	1.96	1	10
Married/Partnered	3883	0.73	0.45	0	1
Home Ownership	3883	0.89	0.32	0	1
Year 2001					
Feeling of income adequacy	1354	0.14	0.35	0	1
Defined contribution	1354	0.26	0.44	0	1
Income*	1354	0.58	12.04	-18.58	41.10
Education	1354	5.53	2.86	1	9
Male	1354	0.52	0.50	0	1
Age	1354	49.72	6.92	40	77
Employed full time	1354	0.76	0.42	0	1
Risk Acceptance	1354	5.30	1.97	1	10
Married/Partnered	1354	0.73	0.44	0	1
Home Ownership	1354	0.87	0.33	0	1
Year 2006					
Feeling of income adequacy	2529	0.11	0.32	0	1
Defined contribution	2529	0.27	0.44	0	1
Income*	2529	4.38	13.01	-18.58	41.10
Education	2529	5.56	2.85	1	9
Male	2529	0.49	0.50	0	1
Age	2529	50.54	7.47	40	82
Employed full time	2529	0.75	0.43	0	1
Risk Acceptance	2529	5.43	1.97	1	10
Married/Partnered	2529	0.72	0.45	0	1
Home Ownership	2529	0.89	0.31	0	1

*Income measure is mean-centered

Econometric Models

Because the dependent variables of interest are both on a binary scale, I employ a logistic model in the following analysis. The formalized form of the model is as follows:

$$\begin{aligned}
 & \text{Ln} \frac{\text{Prob(Insecurity}_i)}{1-\text{Prob(Insecurity}_i)} \\
 & = \beta_0 + (\text{Defined Contribution}_i)\beta_1 + (\text{Wave}_i)\beta_2 \\
 & + (\text{Defined Contribution}_i * \text{Wave}_i)\beta_3 + \mathbf{Z}_\kappa \beta_\kappa + \varepsilon_i
 \end{aligned}$$

$i = 1$ to N ; $\kappa = 4$ to K .

$\beta_{1\sim K}$ denote the estimated coefficients of all covariates. I expect to see β_3 to be negative.

Empirical Findings

The UK has moved toward greater market volatility over the past decades, and market volatility has become more acute as in other financial hubs in the world. With two waves of data, the UK citizens' perceptions move along with the market fluctuation trend; increasing market fluctuation made them feel more insecure about retirement. On the subjective income replacement rate, about 33% of UK citizens felt their post-retirement income would be more than 75% of their pre-retirement income, but only 27% of UK citizens held the same thought 5 years later. The difference was wide enough to be statistically significant (with a two-tailed t-test). On the feeling of post-retirement income sufficiency, even though the trend is the same, the difference is less obvious to be statistically significant. Around 13% of UK citizens thought they would have more than sufficient income when they retired in 2001; that number decreased to 11% in 2006. There is a considerable portion of citizens who think their income replacement rate will be above 75% but still perceive not having enough money during retirement. This contradicting picture echoes some skeptics who argue that 70% is not an adequate replacement rate for retirement (e.g., Vanderhei 2006; Scholz and Seshadri 2009; Macdonald et al. 2016). In sum, even though it is far from perfect to claim rising retirement insecurity with only two waves of data, the trend goes upward from the available evidence.

To investigate the linkage between pension schemes, market volatility, and retirement insecurity, Table 4 reports the main estimation result. The parentheses in all models provide *p*-value information instead of the standard errors. Model 1 and Model 2 show the estimation results of predicting subjective income replacement rate higher than 75% and perceiving sufficient retirement income respectively. In both models, *Defined Contribution* has a positive coefficient, though insignificant, which implies that being in the DC plan is associated with higher, if not the same, expected income replacement rate in 2001. In other words, pension reform alone does not necessarily lead to higher retirement insecurity. It is not surprising as UK citizens can self-select into a DC scheme. The coefficient of *Wave* has a negative sign. It suggests that the UK citizens on average perceived higher retirement insecurity in 2006 when the financial market was demonstrating higher market volatility. However, we cannot exclude the possibility that the negative sign is driven by other unobserved wave-specific factors.

The interaction term between *Defined Contribution*Wave* gives us some confidence that the increase in retirement insecurity can be partially accounted for by DC pensioners experiencing higher fluctuation in the financial market. The negative sign of the interaction terms in both models indicates that it is the DC pensioners, compared to DB pensioners, who are affected more by the fluctuating financial market. Because it is harder to understand the substantive effect of an interaction term in the logistic model, Figs. 2 and 3 present the predicted probability of *Defined Contribution*Wave* with 95% confidence intervals on subjective

Table 4 Estimation result

DV: Subjective income expectation	(1) DV: Subjective replacement rate	(2) DV: Income sufficiency	(3) DV: subjective replacement rate (treatment effect model)	(4) DV: Income sufficiency (treatment effect model)
Defined contribution	0.25 (0.113)	0.02 (0.927)	0.94 (0.244)	-0.01 (0.972)
Wave dummy	-0.06 (0.556)	-0.27* (0.026)	-0.01 (0.621)	-0.03* (0.015)
DC*wave	-0.37* (0.066)	-0.43* (0.073)	-0.07* (0.033)	-0.04* (0.073)
Income	-0.01*** (0.000)	0.04*** (0.000)	-0.01* (0.014)	0.01*** (0.005)
Education	-0.08*** (0.000)	0.05* (0.01)	-0.02*** (0.000)	0.00 (0.71)
Male	0.32** (0.002)	0.33** (0.005)	0.06*** (0.003)	0.03* (0.012)
Age	-0.39*** (0.000)	-0.10 (0.213)	-0.07*** (0.000)	-0.01 (0.311)
Age2	0.00*** (0.000)	0.00 (0.251)	0.00*** (0.000)	0.00 (0.358)
Employed full time	-0.53*** (0.000)	-0.49*** (0.001)	-0.11*** (0.000)	-0.06*** (0.000)
Risk acceptance	0.06* (0.013)	0.03 (0.227)	0.01 (0.375)	0.003 (0.229)
Married/partnered	-0.17* (0.072)	0.16 (0.175)	-0.03* (0.069)	0.017 (0.150)

Table 4 (continued)

DV: Subjective income expectation		(1)	(2)	(3)	(4)
		DV: Subjective replacement rate	DV: Income sufficiency	DV: subjective replacement rate (treatment effect model)	DV: Income sufficiency (treatment effect model)
Home ownership		-0.30* (0.025)	0.54* (0.01)	-0.07* (0.013)	0.04* (0.028)
Constant		9.59*** (0.000)	-0.11 (0.959)	2.14*** (0.000)	0.32 (0.182)
Treatment:					
Defined contribution (DC)					
Conservative				0.06 (0.354)	0.05 (0.347)
Income				0.01*** (0.000)	0.01* (0.000)
Risk Acceptance				0.02 (0.233)	0.00 (0.664)
Constant				-0.73*** (0.000)	-0.71*** (0.000)
Observations		2911	3883	2911	3883

p-values in parentheses

+ *p* < 0.1, * *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001

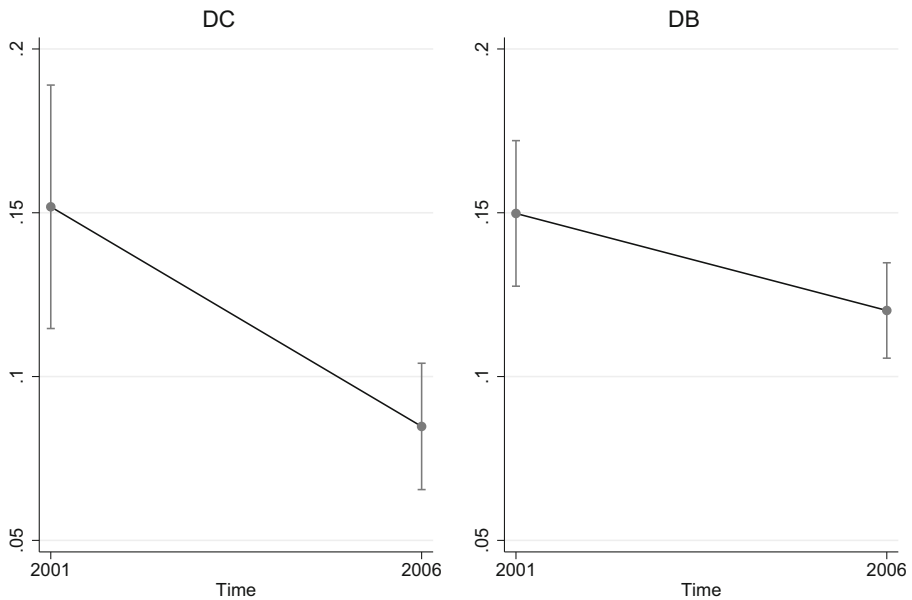


Fig. 2 Predicted probability on replacement rate more than 75 percent

income replacement and the feeling of income sufficiency, respectively. In both figures, we see that DC pensioners start to feel more insecure about retirement when the financial environment surrounding them became more volatile. On average, the predicted probability of feeling secure about future retirement (whether to be proxied by the subjective income replacement rate or the subjective

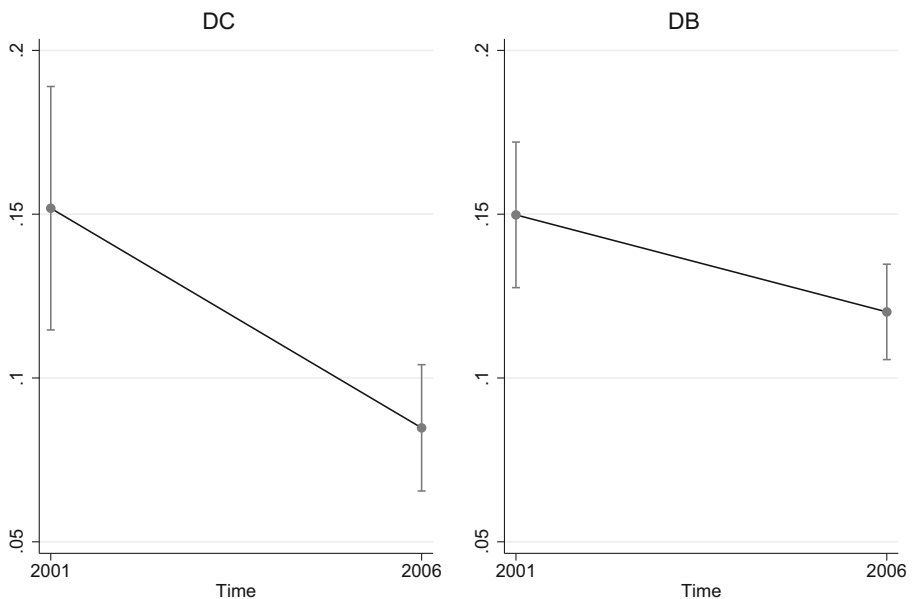


Fig. 3 Predicted probability on feeling income sufficiency in retirement

feeling of income sufficiency) dropped 8 percentage points for DC pensioners between 2001 and 2006; during the same period, DB pensioners only experienced a 1 to 2 percentage point drop. One interesting finding is that, for DB pensioners, while their predicted income replacement rate remained steady, more and more people feared that they might not have sufficient income for future retirement as well. A possible reason for this gap is the spillover effect of retirement insecurity from DC pensioners to DB pensioners. Even though the retirement income of DB pensioners is not affected by financial market, they are surrounded by DC pensioners who have had growing concerns toward their retirement.

Of note, because individuals can self-select into the DC scheme, the estimated effect of *Defined Contribution*Wave* on insecurity in the UK is a conservative test of my hypothesis. If retirement insecurity is sensible even for people who have the latitude to switch between a DB and DC scheme anytime they want, the insecurity level may be much higher for individuals who have no choice but to be locked in a DC scheme due to national pension policy.

With respect to the control variables, *Income* has opposite effects on subjective income replacement rate and income sufficiency. While it decreases citizens' perceived income replacement rate, having more income now makes citizens worry less about future income sufficiency. Wealth, proxied by *Home Ownership*, has similar impacts as well. These combined results suggest that being wealthier is associated with a lower income replacement rate, but not necessarily the feeling of insufficient income. On other social and demographic variables, *Education* also shows mixed results. Higher education level decreases an individual's income replacement rate but increases one's content on future income sufficiency. One possible reason is that educated people also have higher financial literacy and thus are better at gauging their future income sufficiency. Male in general feels more secure than female. As expected, *Age* has a negative relationship with the perceived income replacement rate. Contrary to the fact that people with full-time job experience tend to have less job insecurity, being employed full-time in this data increases retirement insecurity, regardless of the proxy used. The positive association between full-time employment and retirement insecurity makes sense after we explore what "full-time job" means for citizens. Compared to part-time workers or citizens with non-standard jobs, having a full-time job means constant and steady income flows throughout one's working life. It also means a more sudden drop in income after one's retirement. When holding income level constant, income earners would be more worried about retirement than non-income earners as income earners have more to lose after retirement. Therefore, we see a positive correlation between employment status and retirement insecurity across proxies and model specifications. The opposite associations between full-time employment and retirement insecurity and with job insecurity also illustrate that economic insecurity is a multi-dimensional concept and each dimension requires separate attention. Last, as predicted, risk-takers are generally less worried about future retirement. However, household composition, in terms of having a spouse or not, has no association with future retirement insecurity.

Treatment Model Result

In the empirical analysis, one essential concern is the selection bias. Because the choice to enroll in either a DB or a DC scheme is made by each individual, there

is a self-selection process into the defined contribution pension scheme. For example, risk-seeking people may choose a defined contribution arrangement because higher investment risk generates higher yields as well. If selection bias exists, the estimated coefficients would be biased and inconsistent. To address the concern for the possible selection bias, I employ a treatment effect model and account for the self-selection process.

We need to identify the groups that are more likely to select into a defined contribution pension scheme first. One possible factor is an individual's income level. Higher income earners are more willing to put a portion of their earnings into the risky financial market. Another factor might be an individual's party identity. Since pension privatization, along with other privatization measures, is the Conservative Party's policy goal, those who identify themselves more as Tories should have a higher probability of enrolling in a defined contribution scheme. Last, risk-loving people are also more likely to take risky actions. A defined contribution scheme, by definition, entails greater market risks, so it should be an attractive choice for risk-loving people.

The results of the treatment effect model are presented in Model 3 and 4 of Table 4. Income turns out to be a strong predictor of whether an individual will self-select into a defined contribution scheme. The estimated result from the treatment effect model is very similar to that from the logit model. Moreover, the estimated ρ , which is the statistic to test the existence of selection bias, is not statistically different from zero, rejecting the possibility of selection bias.¹⁶ In other words, even if the pension scheme choice is a self-selecting process, it does not systematically affect an individual's insecurity level.

Difference-in-Differences Analysis

Because BHPS is a longitudinal survey, I utilize its panel feature and conduct difference-in-differences tests to trace attitude changes toward retirement of the same individual. The strongest advantage of tracking the same individuals over time is to hold time-invariant unobservable factors constant so that we may tease out the effect of time and that of pension plans. However, the accompanying shortcoming is that it is necessary to have information on one's pension plans and retirement insecurity in both waves to trace any impact of the pension plan on the attitude changes toward retirement. I lost many observations, more than half, when exploring the panel feature of the dataset. Observations were lost due to the following reasons: respondents leaving the labor force (e.g., retirement, unemployment, etc.), respondent attrition, or missing answers in one of the variables. The information loss was not random; further investigation shows that those left out have a higher proportion in DC pension schemes and higher plunges in their retirement security over time (with statistical significance). As a result, I have only a truncated sample now, so the difference-in-difference test results

¹⁶ A selection bias problem happens when the correlation between the error term ε_i in the regression equation and the error term μ_i in the selection equation is nonzero. This violation can make the estimated coefficients biased and inconsistent. Treatment effect model accounts for this problem and generate consistent estimates. In the treatment effect model, the estimated ρ used to test whether $\text{Corr}(\varepsilon_i, \mu_i)$ is zero or not. If $H_0: \rho = 0$ is rejected, there is a selection bias problem and treatment effect model is preferable. Otherwise, there is no concern for selection bias problem and this advanced model is not needed. In the analysis, the p value for testing $H_0: \rho = 0$ is 0.75, indicating that there is no selection bias.

can only be suggestive and complementary to the econometric analysis. We should proceed with caution when interpreting the outcome.

I separate the respondents into two broader groups: those who stay in the same pension plan (either in a DB or a DC plan) and those who changed plans between 2001 and 2006 (either from a DB to a DC plan or from a DC to a DB plan). The difference-in-difference results are in Table 5. I separate the results by the dependent variables and the programs in which the respondents were enrolled in 2001. The cells show the number and the percentage of respondents feeling secure about their retirement, either through the subjective income replacement rate or the feeling of income sufficiency. With the truncated sample, none of the changes passed the two-tailed t-test.

On average, more people felt insecure about retirement in 2006. Regarding the feeling of income sufficiency, the results fit my conjecture. A higher proportion of respondents who changed their pension programs from DB to DC began to feel more insecure about their retirement. Compared to DB-to-DC pensioners, DC-to-DB pensioners felt less insecure about retirement. Instead, one more respondent expressed the feeling of income sufficiency in 2006. However, there is not much difference between pension switchers when it comes to the subjective income replacement rate. Moreover, for people who stayed in the same program throughout the period, about an equivalent share of people experienced the loss of retirement security. Given the truncated nature of the subsample, it is hard to make any further conclusion from the difference-in-difference tests.

Table 5 Difference-in-differences analysis

	Sample Size	2001	2006	Difference
DV: feeling of income sufficiency				
Individuals who were in a DC plan in 2001				
DC → DC	142	18 (13%)	14 (10%)	-4 (-3%)
DC → DB	122	20 (16%)	21 (17%)	1 (1%)
Difference				5%
Individuals who were in a DB plan in 2001				
DB → DB	589	83 (14%)	66 (11%)	-17 (-3%)
DB → DC	108	19 (18%)	14 (13%)	-5 (-5%)
Difference				-2%
DV: subjective income replacement rate above 75%				
Individuals who were in a DC plan in 2001				
DC → DC	96	27 (28%)	23 (24%)	-4 (-4%)
DC → DB	78	29 (37%)	21 (27%)	-8 (-10%)
Difference				-6%
Individuals who were in a DB plan in 2001				
DB → DB	359	94 (26%)	82 (23%)	-12 (-3%)
DB → DC	75	23 (30%)	16 (21%)	-7 (-9%)
Difference				-6%

Conclusion

This article teases out the importance of retirement insecurity and provides the first empirical test of its root at the individual level. One big advantage of the paper is to study the subjective dimension of retirement insecurity and approach the concept through both the subjective replacement rate and the feeling of income sufficiency. Compared to most existing research that relies on actuarial tools to project income replacement rates and hence the objective level of retirement insecurity, this paper provides the first analysis that utilizes citizens' subjective projection of future replacement rate, closer to how people really feel about retirement. Moreover, the paper supplements the subjective income replacement measure with the feeling of income sufficiency, another proxy of retirement insecurity. As the feeling of income insufficiency is only minimally correlated with the subjective replacement rates, this paper shows that the assumed 70% replacement rate might not lead people to feel secure about retirement, resonating with recent studies (Macdonald et al. 2016). Under a more fluctuated financial market, being in DC programs is associated with higher retirement insecurity, either proxied by the subjective income replacement rate or the feeling of income insufficiency.

The empirical analysis from the UK case showed that retirement insecurity is a function of the interaction between pension schemes and market fluctuation. The combination of a DC plan and increasing market volatility yields higher retirement insecurity. Given that people in the United Kingdom can self-select into a riskier DC plan, it is more difficult to find empirical evidence for my argument. If we can find empirical support in the UK, we can assume that retirement insecurity might be even higher for people in other countries who are mandated to enroll in a DC scheme. Moreover, the available data are before the 2008 global financial crisis. If people were already primed by and reacted to the scary financial market before the subprime crisis, we should anticipate even higher retirement insecurity ever since.

Nevertheless, the empirical findings of this paper should still be interpreted with some caution. First, given the data availability issue, I can only rely on two waves of data (2001 and 2006) to draw a conclusion. Two waves are certainly not ideal for making inference about a growing trend; however, the BHPS houses valuable items on retirement insecurity, providing a unique opportunity for the first empirical analysis of this argument. As a result, this paper is only the first step. Future research would require a more nuanced proxy for market volatility. Second, the paper does not try to claim causality. With the wave dummy as proxy for growing market volatility, I am fully aware that the wave dummy might capture other wave-specific factors that are beyond market volatility. Instead of making a causal claim, the paper aims to show the negative association between retirement insecurity and the DC pension scheme, moderated by the growing market volatility. To build causality, one next step is to utilize an experimental setting and prime DC and DB pensioners with different levels of market volatility and see how that factors into their retirement insecurity.

The findings of this paper have two significant implications for the micro-foundation of welfare states. First, adding to the emerging literature disaggregating economic insecurity (Osberg and Sharpe 2009; Hacker et al. 2010, 2011), this paper points out the inter-temporal characteristic of retirement insecurity, and how biased attention to the financial market volatility affects individual evaluations of long-term insecurity. This

inter-temporal characteristic distinguishes retirement insecurity from other dimensions of economic insecurity.

Moreover, since the success of any social policy relies on the support of the people (Brooks and Manza 2007), uncovering the root of rising retirement insecurity worldwide suggests the possible unsustainability of the DC plan in the long run. Even though it is left to future research to link increasing retirement insecurity to pension policy outcomes, recent developments seem to lend support to my argument. Thirty years after the big pension privatization wave, we are starting to witness countries switching back to defined benefit schemes (Wilson Sokhey 2017). In the United Kingdom, the 2007 Pension Act also abolished the contracting-out to DC option. Starting in April 2012, people can only choose to contract out to an occupational defined benefit scheme (Pension Policy Institute 2012: 12). Just as the UK is not the first country to switch back to a DB program, it surely will not be the last.

Compliance with Ethical Standards

Conflict of Interest Wei-Ting Yen declares that she has no conflict of interest.

Informed Consent Informed content was obtained from individual participants included in the study.

Ethical Treatment of Experimental Subjects (Animal and Human) This article does not contain any studies with human participants or animals performed by the author.

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