



FROM PAYSLIP TO PENSION:

LIFE COURSE IMPACTS ON RETIREMENT
SAVING AMONG LOW EARNERS

2025

PART TWO: PRACTICALITY OF SAVING FOR LOW EARNERS

This report is the second part launched in the *From Payslip to Pension: Life Course Impacts on Retirement Saving Among Low Earners* series.

It explores pension saving among low earners.



ABOUT THE PPI

We're the UK's leading independent authority on pensions and retirement policy. We conduct rigorous, impartial, evidence-based research that shapes better retirement outcomes for everyone.

ABOUT THIS SERIES

The *From Payslip to Pension: Life Course Impacts on Retirement Saving Among Low Earners* series will deliver a longitudinal analysis into the life-courses of people who experience low earnings at some point. The series, which will run until summer 2026 will consist of five themed individual outputs.

We will investigate not just their paid work, but their wider circumstances including life events and the households in which they live. The research focusses on how low earners interact with workplace pension savings and aims to identify potential interventions and model their impact both before and after retirement.

This report is part two in the From Payslip to Pension series.



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Contents

	Page
Section One: Background to the research	2
Section Two: Which factors might affect the decision to save?	4
Section Three: How can we determine which factors matter to which people?	6
Profile One: Persistent low earner, high household income	9
Profile Two: Persistent low earner, low household income	11
Profile Three: Early low earner, with high income later	13
Profile Four: Hourly paid low earner	15
Conclusions	17
Technical Appendix	18
References	20

Section 1: Background to the research

Introduction

This report is the second part in the **From Payslip to Pension** series sponsored by a grant from The Nuffield Foundation, which explores pension saving among low earners. This comes as the Pensions Commission investigates pensions adequacy among low earners, for whom reforms to automatic enrolment policy may lead to a better balance of pensions adequacy, and working-life financial security.

In this report, a low earner is somebody who earns less than the full-time equivalent of a living wage, which is £24,570 per year. When considering policy, this research is mostly concerned with the design of automatic enrolment. This is policy that requires employers to provide a pension scheme to their employees, but which has several features designed to exclude low earners, or reduce how much they contribute.

[Part One: Persistent Low Earnings](#) published in July 2025, filled a crucial knowledge gap regarding low earners, which is the persistence of low earning in the UK. Persistent low earners are people for whom low earnings are part of a long-term career pattern. There had previously been a lack of quantitative evidence around how persistent different low earners may be. This makes it difficult to design policy around their needs, as it is not clear to what extent low earners' incomes need to be protected in working life, and to what extent their pensions adequacy is at risk.

Part One identified that many groups can expect to be persistent low earners in the future, particularly women, with some female low earners being projected to spend over 20 years of their career low earning. This demonstrates that, for many people, low-paid work makes up significant parts of their career. This makes policy harder to design, as it is relatively easy for transient low earners to rely on higher earning periods to build pension savings, and focus on maximising working-life income during lower earning periods. For persistent low earners, balancing pension saving needs and working-life income is more challenging. It is therefore necessary to investigate further, and identify the factors that may affect whether saving is appropriate for persistent low earners.

Summary of findings

This report explores the practicality of saving by exploring life courses that represent different groups within the low-earning population. These life courses contain information on their household circumstances, income, employment, and pension scheme membership, which make it possible to assess whether they choose to save, and what this means for policymakers. These life courses are intended to cover common profiles among the low-earning population, as well as different circumstances that might affect the practicality of saving. The modelled individuals are:

- A low-earning mother with a high household income;
- A low-earning mother with a low household income;
- A highly qualified woman who earns little at first, before moving on to higher pay; and
- A man who works in precarious employment, before moving on to higher pay.

This is done using the Understanding Society dataset. This is a longitudinal dataset which contains many variables relating to finances, demographics, household makeup, career information, and more.

The findings are that these different modelled individuals all have unique factors that affect their saving. Some may be members of a pension scheme throughout their life, while others will not save during some years of employment, either because they are ineligible for automatic enrolment or because they are not members of their employer's scheme. Key factors that are identified are household income, and also hourly pay as a proxy for precarious employment. Their likely reasons for their pension saving status, and the policy implications of these, are discussed in detail for each model individual.

Modelling approach

The modelling approach of this report builds on the approach of the last. The previous report estimated persistence of low earning for different groups by building a "roadmap" of states that a person could transition through along the course of their career. These states were created by identifying the variables in the Understanding Society dataset that best predicted future low earning at each age, and analysing the probability of respondents moving between states as they aged. Once these states and transition probabilities are established, it is possible to estimate the most likely outcomes for individuals in terms of low earning. In the first report, this allows persistence to be defined as the total number of expected years as a low earner. In this report, representative life courses can be selected by choosing paths with high probabilities, and analysing the populations that fit the definitions of that life course at each age. Further details on how life courses are selected are available in the technical appendix.

Section Two: Which factors might affect the decision to save?

As a heterogeneous group, low earners have many reasons to save, and many reasons not to. Out of the several potential justifications for saving or not saving, it may not always be possible to understand which factors most influence saving decisions in these life courses. Important factors in the decision to save could be affordability, stability, age, expected lifetime earnings, and pension saving options.

Affordability may be the most important factor for policymakers to consider. Many low earners can afford to save, especially if they have a high household income. Those who live with people on higher incomes, such as partners or parents, may be effectively shielded from poverty, regardless of their own individual income. Equally, low earners who contribute a significant amount of the household income may not be able to afford to save. Affordability will be largely determined by the earnings of other members of the household, but is also affected by other factors such as housing costs and existing savings.

Stability may make the decision to save difficult for an individual, and also create situations that are hard for policymakers to account for. People with unstable incomes may not have the confidence in their immediate working-life finances to feel secure in putting money towards a pension. People who are self-employed, on zero-hours contracts, have multiple low-paid jobs, or have many short-term job tenures, may not be automatically enrolled, even though someone with a comparable income would be if they worked in a long-term, full-time role for a single employer.

The decision to save also varies according to the stage of life of the saver. A young saver has less certainty about what their retirement needs will be, lower earnings, and may be prioritising other saving goals such as buying a home. As the saver progresses in their career, earnings generally increase, and they may gain increased certainty as they buy property, and are able to better predict their circumstances and desired standard of living in retirement. However, as they approach retirement, they also have less to gain from compounding investment returns.

The lifetime earnings that a low earner expects may change the significance of their potential contributions during low-paid employment. The previous report in this series identified low earners with particular risk factors that can expect to spend over 20 years low earning across their career. However, it is important to highlight that their outcomes can vary significantly depending on what they do outside of those 20 years: they can spend the remaining years being a high earner, or not earning anything. Savers who have previously accumulated large pots, or who expect to return to high-paid employment, may see their potential contributions as a low earner as making less of a difference to their retirement outcomes. Low earners who have no savings, or do not expect to earn significantly more in the future, have less ability to defer pension saving decisions, and will need to assess more carefully how to balance living standards in working life and retirement.

Finally, the conditions of an employer's pension scheme may affect the decision to save. The most relevant example of this may be Defined Benefit (DB) pension schemes, which are most likely to be offered by public sector employers. These schemes are especially generous, and may have been a significant factor in choosing the employer in the first place. A saver who has the opportunity to contribute to a DB scheme may appreciate that they get more in return for their contributions than from other employers. As well as providing an incentive to save when a DB scheme is available, having DB savings could also boost low earners' retirement prospects, and reduce the pressure to save later

in working life. This is especially relevant for low-earning women: although women's pension wealth is generally lower than men's, the fact that women are more likely than men to work in the public sector, and that public sector jobs are more likely to offer DB pensions, reduces the Gender Pension Gap by 10%.ⁱ

Section Three: How can we determine which factors matter to which people?

Representative life courses

With these potential factors identified, the PPI's model can be used to gain insights into which factors affect low earners, which affect their decisions, and which ones may be most important for policymakers to consider when trying to encourage ideal saving behaviour. This is done by identifying representative life courses, meaning a career trajectory which broadly represents significant amounts of the saving population. For each life course, a representative individual is described. This is an individual that is created by taking averages of the population that are described by the life course. However, it is important to highlight that this representative individual is only an example. Other individuals may differ in terms of the precise timing of life events, such as moving home or having children, or precise income levels, but still be represented by these groups. This section will show the rationale for selecting the life courses in this report.

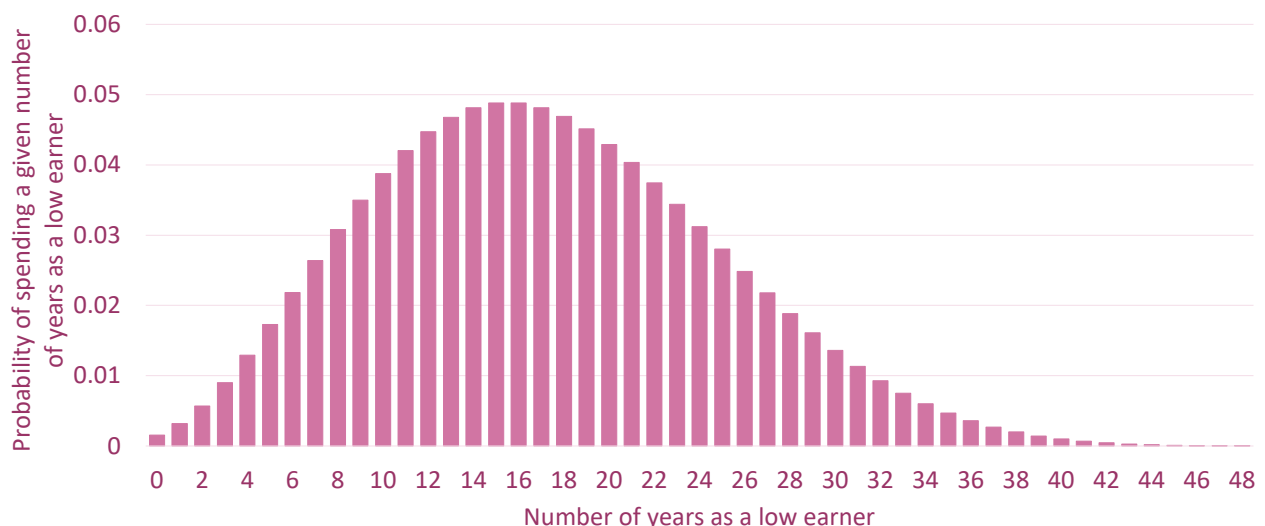
Selection of life courses

The first life courses this report explores are those that represent the most persistent low earners. This group is most sensitive to policy that targets low earners, and is likely to be illustrative of other low earners, even if they are slightly less persistent. While the previous report identified an expected number of future years of low earning for different groups, this same modelling approach can also be used to find a distribution of projected years of low earning. This finds that, among women, the top decile of persistent low earners spend 28 years as a low earner. For this reason, a persistent low earner in this report is regarded as having 28 years of low earning. It is worth noting that the outcomes of this modelling are sensitive to the choice of threshold for low earning. The previous report explored the impact of using alternative thresholds, and, when using the automatic enrolment trigger income of £10,000, lower numbers of expected years as a low earner were observed.ⁱⁱ

The length of time spent as a low earner is widely distributed among women

Probability distribution of number of years spent as a low earner between the ages of 18 and 66

Pensions Policy Institute
PPI



The most likely career trajectory for a woman with 28 years of low earning involves being an high earner initially, before having children, and remaining a low earner for the remainder of working life. This will be explored in detail in the next section, but one of the most significant aspects of this life course is that it involves an above average household income throughout life. This is a common scenario for persistent low earners, and is important to understand from a policy perspective, as somebody like this may be able to save more than they currently do under automatic enrolment policy.

However, this creates a need for another persistent low-earner life course, which does not have a high household income. The second life course that this report investigates represents this group. This contrasts with the first life course, showing that this low earner and their household are in danger of poverty, and that the earnings of the low earner have a significant effect on total household income. This life course also involves having children, but at a younger age than the first life course, and having low earnings earlier in life, before leaving the workforce altogether relatively early. As a result, although this life course has the same number of years as of low earning, the low-earning period effectively makes up this individual's entire career.

Together, these two life courses represent the wide range of circumstances among mothers, which are a key low-earner group. However, the previous report identified that women are at a higher risk of low earning than men, even after motherhood is accounted for. For this reason, this analysis will also consider a life course of a woman who does not have children. This life course is especially informative, as it involves low earning at the beginning of working life, followed by high earnings until retirement. This contrasts with the previous two life courses.

The fourth and final life course that is analysed represents a man who is paid hourly, rather than salaried, during a low-earning period early in his twenties and early thirties. As well as being male, this life course illustrates a reduced predictability of earnings.

These life courses are estimated to represent 5%, 5%, and 9% of women, and 1% of men, respectively. Details of how this estimate is calculated are available in the technical appendix. The fact that a particularly low number of men are represented by this life course may reflect the fact that fewer men are low earners overall, but also that male low-earner life courses do not follow a small number of identifiable age-based trajectories to the same extent that female low-earner life courses do. The previous report ⁱⁱ identified that self-employment is a risk factor for low earning among men, but that for self-employed men, the likelihood of low earning at each age is more uniform, while employed men are more likely to be low earners at the beginning and end of working life.

It would also be possible to represent higher proportions of men with low-earner life courses that featured very short periods of low earning at the very beginning and/or very end of working life. However, these low earners would be less sensitive to policy interventions targeting low earners, so are not explored in this report.

	High-household-income mother	Low-household-income mother	Highly qualified woman	Precarious man
Affordability	High	Low	High	Varied
Stability	High	High	Mixed	Mixed
Low-earning period	Late career	Whole career	Early career	Early career
Lifetime earnings	Medium	Low	Medium	High
Works for a Defined Benefit (DB) employer during career	Possible	Possible	Unlikely	Unlikely

The next section will explore the lives of each model individual in more depth, and analyse the circumstances that affect their saving behaviour. For more detail on how these life courses were selected, please see the technical appendix.

Profile One: Persistent low earner, high household income

Overview

This group is defined by being a woman and having high earnings early in life, and then becoming a low earner in motherhood, but having an above average household income throughout. This pattern is broadly representative of about 5% of all women. A representative woman from this group has high earnings early in her career followed by low earnings up to retirement, but lives in a household where equivalised household income is above the median throughout her working life. She has a high probability of working in the public sector, for instance in education. She becomes a mother in her thirties, after which she begins part-time working, becoming a low earner. Upon transitioning to low earning, there may be an immediate drop in disposable household income, but this quickly recovers. She is a member of her employer's pension scheme throughout her life and never returns to high earnings.

Do people like this save?

This life course shows consistent saving on the part of the low earner, even during a brief period where their household income is significantly lower compared to previous years. For this woman, the factors affecting the decision to save would be as follows:

- She will have built up some savings already, as a result of having relatively high earnings early on in life and being a member of her employer's pension scheme.
- She has a high household income at most points in her life, so she can be confident that she can save without risking poverty. Even during a brief period of low household income, she may be relatively confident in her financial security from a mix of savings and employment prospects of her and her partner. She may also not be aware that she has the option to opt out.
- She has job security, working in a stable industry, and is likely to be able to work at the same employer for long periods of time.
- She is likely to work in public sector jobs such as education, so there is some chance that she is a member of a Defined Benefit (DB) scheme. This would give her an extra incentive to remain in the scheme.

Should people like this save?

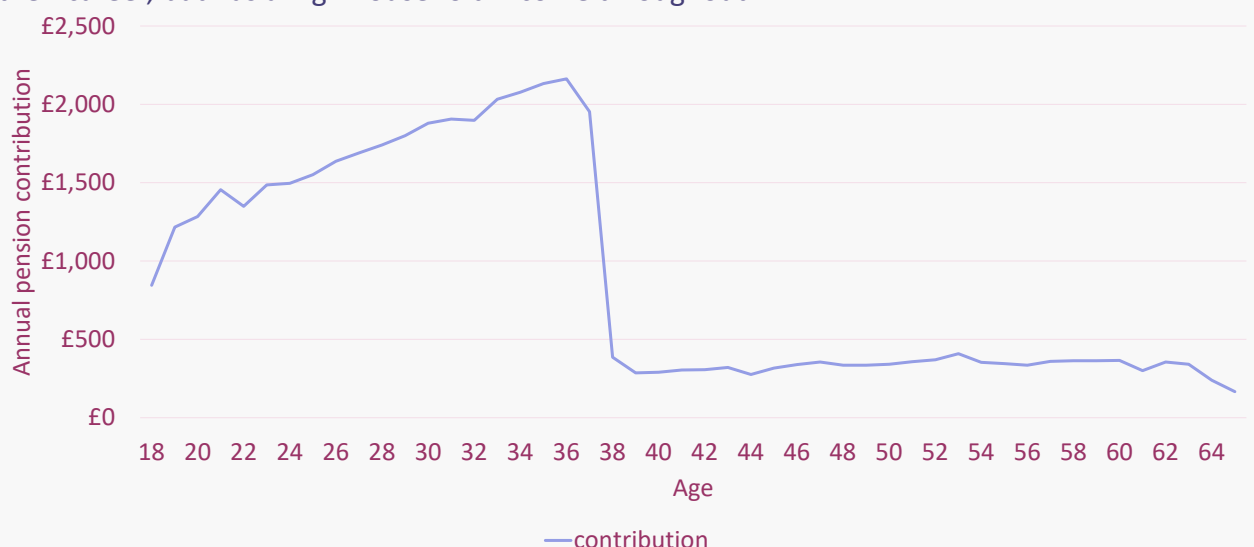
From the point of view of policymakers, this woman is already eligible for automatic enrolment, as she earns slightly more than the trigger income, even when she works part time. However, the amount she contributes to her pension will be significantly reduced by the Lower Earnings Limit (LEL). This means that during her part-time work, she would be encouraged to contribute a small amount under current policy and automatic enrolment minimums, never exceeding £500 per year. As a result, when policymakers consider an individual like this, they should consider:

- The household that this low earner retires in has a significantly higher than average income at most points in life, and as a result, will have a high standard of living to maintain in retirement. Currently, her contribution to the household income in working life is proportionally greater than it is to the combined pension pot of this household.

- The household has a high degree of financial resilience, and she is probably able to contribute more to a pension without being at risk of poverty.
- There is a brief period where household earnings are lower than average for this household, and, depending on circumstances, could create a situation where her and/or her partner consider opting out of saving for the sake of short-term financial resilience. If it improves her working-life financial security, then policymakers should ensure that she is aware that she has the option and possibly encourage her to take it. At the same time, if she does opt out, it is important that the implications of this decision are made clear, and that she is not inadvertently left opted out for longer than she needs to be.
- Her household pension savings may be significant, but having a higher proportion of pension wealth belonging to the higher earner creates reliance on her partner in terms of pension savings.
- At the same time, her partner may be eligible for a higher rate of tax relief, which would make it more economically rational to save into the partner's pension from a household perspective.

Low earners with high household incomes may not contribute enough to achieve an adequate pension

Pension contributions for a model low earner who has low earnings later in their career, but has a high household income throughout



Profile Two: Persistent low earner, low household income

Overview

This group is defined by being a mother and having low earnings across their entire career, and by having a below average household income throughout their life that borders on relative poverty, even after factoring in any benefit income. This life course is broadly representative of 5% of women. A representative individual from this group has no earnings for the first few years of working age, and has two children in her early twenties. In her late twenties she enters the workforce and works part time. She may change sectors, but continues to be a low earner, until she leaves the workforce in her fifties as a result of poor health. Her household income and individual income are both low throughout her life. Her equivalised disposable household income is below the threshold for relative poverty, which is 60%ⁱⁱⁱ of the median, at the beginning of working life, and, although it rises above the threshold later, is still below the median and close to 60%. She joins her employer's pension scheme in her thirties.

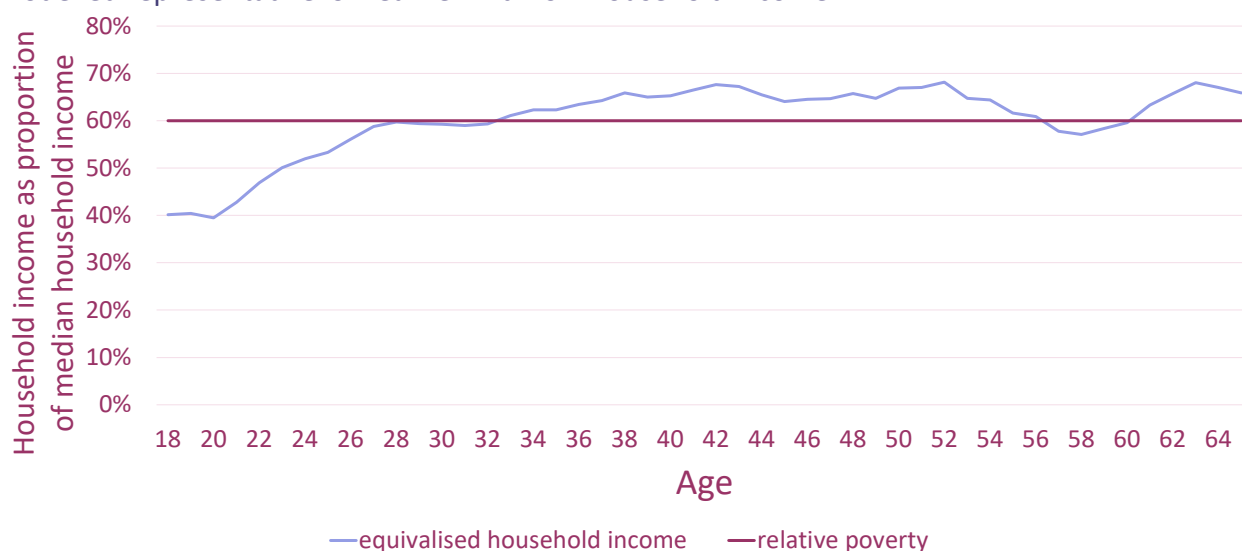
Do people like this save?

This individual does not save during the first few years of her employment, but later becomes eligible and joins the employer's pension scheme. There are several factors to consider when analysing why this might be:

- Her earnings are around the trigger income of £10,000, and whether she is a member of the scheme may be a question of automatic enrolment eligibility, rather than a conscious decision on her part.
- Her joining the scheme appears to line up with no longer being in relative poverty, as well as automatic enrolment eligibility. As a result, it is also possible that joining the scheme is indeed a conscious decision based on affordability.
- Her income is a relatively high proportion of the total household income. Compared to the previous life course, she must consider working-life finances more carefully.
- There is also a relatively high chance that she is offered a Defined Benefit (DB) pension, as she may work in sectors where they are prevalent.

Pension contributions may lead to poverty or oversaving for some low earners

Household income as a proportion of median household income for a modelled representative low earner with low household income



Should people like this save?

For policymakers, this individual represents an especially sensitive case. Encouraging this individual to save poses a significant risk of reducing working-life income that is needed immediately. As well as the risk of working-life poverty, there is also the risk of oversaving. That is, if the household receives two State Pensions, or retirement benefits such as Pension Credit, there is a chance that the household retirement income will be higher than the household working-life income. If this is the case, there is no reason for the household to save into a pension. For this reason, it is important for policymakers to consider:

- This individual, or people in this household, may claim benefits in working life or retirement. Where benefits and the pensions system interact, they should not incentivise the wrong savings behaviour, and the way that they interact should be made clear. For example, it should be clear that Universal Credit disregards pension contributions.
- This individual leaves the workforce before State Pension age (SPa), and any pension that they do build must cover a longer period. This is unlikely to be because they are financially able to do so, but rather involuntarily as a result of poor health.
- Even if this individual does build some pension, a high proportion of their retirement income is likely to come from the State, especially if they do not have access to DB schemes. The period between leaving the workforce and reaching SPa is therefore likely to be particularly financially insecure for this household, and a large part, if not all, of their private pension savings may be used to cover expenses in the period before becoming eligible for a State Pension.

Profile Three: Early low earner, with high income later

Overview

This group is defined by having high qualifications, and being a low earner in their early career, before moving into higher-paid work later, and is broadly representative of 9% of women. A representative individual from this group obtains a degree, but does not immediately enter her vocational field. During her twenties, her living arrangements are a mixture of living with parents, and living away from home with housemates or a partner. In her thirties, her pay increases significantly as she moves into a sector related to her degree. She also marries a high-earning partner, and together, their equivalised household income is especially high. This is in part because they do not have children, which lowers their household costs compared to other profiles.

She consistently saves into her employer's pension during her high-earning years. During her low-earning period, she is a mix of ineligible, enrolled, or not a member of her employer's pension scheme, while having the option to join. She is also likely to be paid hourly rather than salaried. This is significant, as individuals that are represented by the two previous life courses are most likely to join their employer's pension scheme whenever they have the option, regardless of age. Young earners with unstable pay who are not members of their employer's pension scheme were identified in similar Department for Work & Pensions (DWP) research:^{iv}

"This decision [to opt out] was also observed among younger people in temporary roles with variable hours who felt more financially vulnerable, that pension saving was not yet relevant, or prioritised alternative investments."

Do people like this save?

This low earner is a member of her pension scheme whenever it is available to her, which is after she becomes eligible at 22. She remains a member consistently all the way through working life. There are two factors that may influence her decision to save during her early low-earning period:

- On the one hand, with vocational qualifications, it is relatively easy to be confident in future earnings. Even if she is a low earner in her youth, a high degree of confidence in future high earnings may make it easier to defer pension saving.
- On the other hand, with very little existing pension savings, and the expectation of high living standards later, there is little risk of oversaving. Even though her precise retirement needs are still uncertain, she may still be confident that pension saving is a wise decision.
- If she is motivated to save, it may not necessarily be towards a pension, as there are likely to be other saving goals such as saving for a home, and less chance of having access to a Defined Benefit (DB) pension compared to the previous life courses.

Should people like this save?

For policymakers, this individual represents a specific challenge: young peoples' future lifetime earnings are the least predictable, and so it is harder to know whether they should be saving. There is still uncertainty around future relationships, children, living costs, and retirement needs. However, in this case, saving is relatively likely to be safe for this individual. and the challenges for policymakers may be:

- Identifying indicators that can reliably predict the future outcomes of young low earners. The previous report ⁱⁱ identified that low earning itself becomes a better predictor of future low earnings after the age of 22, and that low educational qualifications are a risk factor for persistent low earning.
- Exploring innovative new approaches that encourage young people to build saving habits, or gain flexibility with their pension savings, so that there is less incentive to deprioritise pension saving.

Profile Four: Hourly paid low earner

Overview

This life course represents a man who is paid hourly during his low-earning period and is broadly representative of 1% of men. In his late teens and early twenties, he experiences a mix of low-paid work and unemployment. In his mid-twenties to early thirties, he works in an hourly paid job, before moving in to higher paid work in a different sector. He moves in with a partner and has a child in his thirties. During his high-earning period, his household earnings are above the median and gradually climb with age. However, he is the primary earner of the household. When he first becomes a high earner, his equivalised household income may not be as high as the other representative individuals identified in this report, and may only be above the median by a relatively small margin.

Similarly to the previous life course, he saves consistently as a high earner, but during his low-earning period, rarely saves as he is ineligible or not a member of his employer's pension scheme.

Do people like this save?

This life course, like the last, shows a young low earner on hourly pay who may not save as a result of ineligibility or not being a member of their employer's pension scheme. This highlights youth and precariousness as two particularly strong factors that affect saving. Although this life course is similar to the last in many ways, it is important to note:

- The household income is particularly sensitive to this low earner's individual income. Although he still saves reliably when he has high earnings, for this man deciding to save may be complicated by the fact that he cannot rely on other household members to ensure a high standard of living in the same way as other identified individuals. In this sense, this low earner may not be able to compensate for low savings during his low earning years to the same extent as the previous life course.
- There is a pay gap between this individual and the previous individual, as this individual's salary is likely to peak at a higher amount than in the previous life course. Gender may be an important factor in this gap. This highlights the importance of lifetime earnings, as the living standards that will need to be maintained by a pension, and the significance of potential savings during low-earning periods, depend on earnings during high-earning periods.

Should people like this save?

The fact that hourly pay is an indicator of not being a member of a workplace pension scheme, even when one is available, is significant from a policy perspective. Firstly, it is information that is available to an employer, and therefore a viable parameter to use when setting automatic enrolment policy. However, it also highlights that uncertainty around immediate working-life income may be a driver of the decision not to save. Previous PPI research^v also identified that low earners who have no identifiable safety net, such as a high household income or owning property, are more likely than other low earners to be paid hourly.

During interviews with low earners, the Department for Work & Pensions (DWP)^{iv} also identified that those working in stable jobs were more likely to say they felt informed by their employer about pensions. Those working in precarious jobs (e.g., temporary, seasonal or gig-based contracts) described more ad hoc relationships with employers and poor communication about benefits, including pensions. As a result, it is important not to infer that hourly paid workers who are not

members of their employer's pension scheme are necessarily making a conscious decision to opt out, but are rather less likely to save for a number of reasons.

Although this life course uses hourly pay as a proxy for unpredictable income, it is likely that the self-employed are also likely to need to protect their working-life income to a greater degree than other workers. Self-employed male low earners would, in practice, represent a significant group of precarious low earners. However, as the self-employed are not currently eligible for automatic enrolment, it is not possible to analyse their pension scheme membership in the same way.

Conclusions

The range of circumstances presented in these life courses demonstrates the challenges involved in designing pensions policy for low earners. Low earners that may appear similar by many measures may have significantly different needs in terms of pensions, and a significantly different risk of poverty to manage when deciding whether to contribute money to a pension.

On the one hand, some of the life courses investigated in this report have comfortable standards of living in working life, and will need a relatively large pension to sustain their standard of living in retirement. Current policy encourages these low earners to save modest amounts, when they may in fact need to be saving more to build an adequate pension.

On the other hand, one of the life courses investigated in this report has low standards of living throughout working life, which may be low enough to qualify as living in poverty. These low earners may already be contributing too much to their pension, in circumstances where even a modest pension contribution may significantly impact working-life living standards. Even if it may be possible to contribute to a pension while avoiding the threshold for poverty, the possibility of oversaving may mean that making pension contributions is still inadvisable.

Finally, this research identifies that some low-earner life courses may not be members of their employer's pension scheme when they are young and paid hourly. Other profiles identified in this research are either ineligible, or members of their employer's pension scheme, at all points in their lives. This highlights that youth and precariousness are two potential factors that may decrease the likelihood of saving among low earners.

To understand what the best course for future pensions policy is with regards to low earners, more evidence is needed. The next publication in this series will produce this evidence, by projecting pension outcomes for groups such as those presented in this report. While this report presents data about the current circumstances of low earners, further modelling can show how much savings they can build, and what their retirement outcomes may be.

Technical Appendix

Modelling approach

The modelling approach used to generate the findings in this report is built on the modelling approach from the previous report.

The algorithm used in this modelling approach is based on grouping responses from multiple waves of Understanding Society by age, creating distinct states at each age, and then observing how multi-wave respondents transition through these states as they age, so that probabilities of transitioning through an entire working life can be derived. It is important to note that no respondent has been in the survey for the entirety of their working life. This “roadmap” of working life should not be seen as representing the complete life histories of respondents, but rather the lives that people would be expected to live if policy, and all other variables, remained the same as they are today.

For each age, the first step of the algorithm is to analyse all the responses from respondents who were low earners at some point (and possibly filtered by some other variable, for example, having A-level qualifications). This means that states where they were high earners, or not earning, are still analysed, so their transitions in and out of low earning are still captured. The algorithm identifies which variables are the best predictors of future low earning, so that states are created with as much variance in expected future years as possible. To do this, the algorithm starts with the oldest age, where expected future years of low earning are either 1 or 0, and then iterates backwards.

At each age, the optimal variables to use are identified by first clustering the responses in that age group. This is done by calculating a Gower distance matrix between each response, to account for the mix of continuous, ordinal and Boolean variables in the survey. The clusters within the age group are then identified using agglomerative clustering.

Once the clusters have been identified, a decision tree is used to identify the clusters as closely as possible. A score is assigned to each solution, which takes into account the tightness of the clustering, the accuracy of the decision tree, and the deviation in expected years among states, weighted by the membership of each state. This simultaneously ensures that states are roughly equal in size and that the variables identify different low-earner outlooks as well as possible.

Once the variables that determine states have been identified, the algorithm then fills in the states with all respondents, regardless of whether they were ever low earners, so that transition probabilities and state sizes represent the whole population.

This was previously used to generate figures of expected years of future low earning for each state for the first publication, but in this publication, individual paths with high probabilities are selected. In this case, a Viterbi search was used to find the transitions from age 18 to 66 with the highest probabilities of occurring. In some cases, additional constraints were placed on the search algorithm, to return the most probable outcomes which also satisfied other criteria. These were:

Individual one: women only, no additional constraints

Individual two: women only, household income below median during low-earning years

Individual three: women only, no children and a qualification equivalent to a degree

Individual four: men only, hourly pay during low-earning years

After taking an individual path, it is possible to analyse the respondents in each state at each age to derive averages and build a model life course. These averages are used in the graphs that are presented, but may be misleading if presented in too much detail, as they may downplay the variance of individuals that are broadly represented by each of the four life courses.

When commenting on things such as the median equivalised household income, or the gender pay gap, statistics are generated entirely using Understanding Society to keep the modelling approach internally consistent. Figures such as median household income are generated from Understanding Society, but then checked against other published sources to ensure that they are broadly consistent.

When estimating the proportion of the population that is represented (for example that individual three represents approximately 9% of women), this is based on an approach that clusters similar life courses together and assigns a total probability to each cluster based on the probability of following each individual path within the cluster. This is because the network of states and transitions is large enough that the probability of following any individual path exactly is very low, so it is necessary to group broadly similar paths in some way to get a meaningful measure of representativeness. A silhouette score is used to find the optimal number of clusters, and similarity between paths is measured using a Levenstein distance.

The modelling only analyses respondents who responded to the survey after the introduction of automatic enrolment. However, it is important to factor in that some respondents responded to the survey when automatic enrolment was not fully rolled out, and not being a member of their employer's pension scheme does not necessarily reflect that they opted out after being automatically enrolled. These results are still useful for analysing saving patterns, but care must be taken before drawing conclusions about saving behaviour within the parameters of automatic enrolment.

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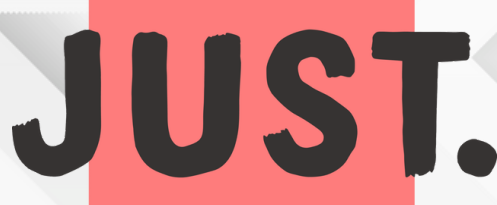
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