CDC Design in the UK: Cross Subsidy, Shared Indexation and Alternatives to Longevity Pooling

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Introduction

This Briefing Note examines various issues that relate to the way that Collective Defined Contribution (CDC) schemes attempt to pool longevity risk. These issues have been identified by King's College London[1] (KCL), who have developed a model of CDC. Alongside an illustration of the mathematical principles involved, the policy implications of these issues will be explored.

The first section will explore what these issues are. The first issue is an intergenerational cross subsidy effect, which can be particularly pronounced in some CDC designs. The second issue is the impact on smoothness of benefits that arises from attempting to pool investment risk across generations.

The second section will make a comparison between CDC and Career Average Revalued Earnings Defined Benefit (CARE DB) schemes. The issues identified in the first section exist in DB as well as CDC. However, they exist to a lesser extent, and have mitigating factors which do not apply to CDC.

Finally, the third section will explore an alternative longevity pooling vehicle designed by KCL. This alternative scheme only attempts to pool longevity risk, and not investment risk. A key part of the research conducted by KCL is a mathematical proof that it is impossible to share investment risks between generations in a mutually beneficial way.[2] The mathematical proof shows that sharing investment risk as proposed in existing CDC designs cannot be of benefit to all members.

This new model is referred to here as "Collective Drawdown". The third section will demonstrate modelling results of CDC and Collective Drawdown are compared to show how this translates in practice to member experience.

This work is part of an ongoing project sponsored by the Nuffield Foundation, and carried out by King's College London (KCL) and the PPI. Two previous Briefing Notes have been published as part of the same project.

The first Briefing Note gave the findings of a large number of interviews with a wide variety of CDC experts and stakeholders, establishing the current state of CDC in the UK.[3] The second revealed some preliminary findings from the KCL model, showing the relative performance of Single-employer and Multi-employer CDC, alongside that of a comparable DC alternative.[4] It also expanded on a particular cross subsidy issue in Multi-employer CDC which arises when systemic longevity inequality between groups is not accounted for.

The Nuffield Foundation is an independent charitable trust with a mission to advance social wellbeing. It funds research that informs social policy, primarily in education, welfare and justice. The Nuffield Foundation is the founder and co-funder of the Nuffield Council on Bioethics, the Ada Lovelace Institute, and the Nuffield Family Justice Observatory. The Foundation has funded this project, but the views expressed are those of the authors and not necessarily the Foundation.

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Shared Indexation CDC Schemes

This Briefing Note explores issues within CDC, as it is envisaged in the UK. UK CDC schemes use a **"shared index"**. This means that this design pools the effect of market shocks between members by changing a shared prevailing level of indexation across generations.

2: The mathematical proof assumes a technical condition that the market is "complete". This means assuming that investment risks can be hedged. It is only possible to create mutually beneficial contracts when one faces risks that cannot be hedged by either insurance or trading. Existing shared-indexation CDC designs claim to be able to share investment risk even in complete markets, so the result can be applied to understand these designs.

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The first part of this section will cover cross subsidy in a particular type of shared indexation CDC scheme called **flat-accrual CDC**. This is the type of CDC most commonly associated with single employer CDC in the UK, and aims to replicate some features of a CARE DB scheme. KCL research identifies a particularly pronounced cross subsidy issue in this type of scheme.

This section will also cover another type of shared indexation CDC known as **dynamic-accrual CDC**. This type of CDC attempts to be actuarially fair and can accommodate multiple employers. KCL also identifies cross subsidy in this type of scheme, for different reasons and to a lesser extent.

Finally, this section will explore side effects in all shared indexation CDC designs, that arise as a result of shared indexation itself. These side effects have implications for the predictability of future benefits, and the behaviour of the scheme in poor economic conditions.

Cross Subsidy in Flat-Accrual CDC

This section explores the features of flat-accrual CDC that give rise to a particularly pronounced cross subsidy effect between generations. These features are intended to create a particular kind of equitability among members, which is the same equitability that exists in a CARE DB scheme. For CDC schemes, there are multiple different ways to define equitable, and the chosen definition of equitability affects what a member buys when they make a contribution to the scheme.

What does a member receive when they make a contribution in a CDC scheme?

In a CDC scheme, when a member makes a contribution, they should receive something in return that will convert into pension payments when they retire, and reflects the size of their contribution. It should also be uprated in a way that accounts for inflation. However, the benefit that the member buys can be conceptualized in two ways: what it will be worth at retirement, or what it is worth now.

A flat-rate accrual CDC scheme achieves its definition of equitability by making a best attempt to give everybody the same retirement benefit when they retire for the same contribution. This is intended to replicate the behavior of a CARE DB scheme as closely as possible. It does this by offering, in technical terms, a nominal benefit at retirement. This is hard to conceptualise, but it means that at the time of contribution, the member's retirement benefit is specified to produce a target income at the time of retirement, which is the same retirement income that is targeted for any other member who makes the same contribution. As time goes on, the retirement benefit that the member has accrued is uprated, in the same way that retired members' benefits are uprated. This means that, although the aim is to give the same retirement benefit to everybody, what members get when they actually retire can vary depending on economic experience.

By contrast, a dynamic-accrual scheme targets a different definition of equitable by seeking to offer everybody a benefit that is worth the same when they buy it – in other words, by attempting to create actuarial fairness. This means that members who have more time before retirement will see their benefit grow more and so will receive a greater real-terms income in retirement for a fixed contribution than members who have less time to retirement.

This can be illustrated with an example involving two employees, 20 year old Alice, and 60 year old Bob. In a flat-accrual scheme, they both make a contribution of £100, and in return, they each receive a benefit at retirement of £5 a year. This £5 a year follows the shared index of the scheme, so it will not be £5 by the time they retire. However, the scheme aims to give them both something equivalent to £5 a year once inflation is accounted for in the year each one reaches retirement age – i.e., £5 in real terms. This means that, subject to scheme performance, the pension that Alice and Bob receive for their £100 contribution are roughly equivalent.

In a dynamic-accrual scheme, when they both make their £100 contribution, something different happens. The scheme gives each of them a small entitlement, which both have the same value in current terms. They cannot access it yet, and must wait until retirement. As time goes on, the small entitlement grows with the shared indexation of the scheme. However, Bob made his contribution at 60, and retires at 65. In these 5 years, his small entitlement grows slightly in real terms, because the scheme has generated some investment return. Alice, on the other hand, must wait 45 years to start claiming her pension. By the time she retires, her entitlement has grown much more in real terms, because she has

effectively gathered 45 years' worth of investment return. This means that Alice receives a significantly higher pension than Bob, for the same £100 contribution, even after inflation is accounted for.

Why does cross subsidy arise in flat-accrual CDC?

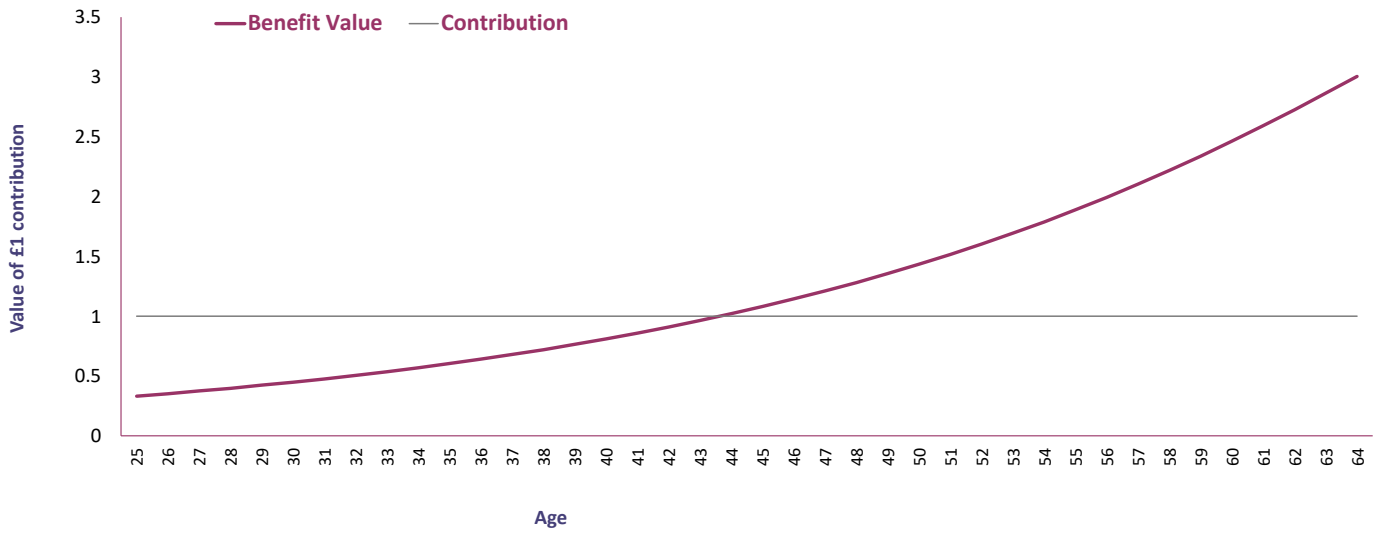
The above example highlights a clear difference between young and old members. There is a longer time between the point at which younger members start to contribute to the pot, and the point at which they take money out of the pot. This means that the younger a member is, the more investment return will be generated as a result of their participation in the scheme.

Flat-accrual schemes use the first definition of equitability. The desire is that, if two contributing members work for the same employer, for the same amount of time, with the same salary, then they should be entitled to the same pension, as far as scheme performance allows. However, in doing so, it does not take into account this difference between contributions from younger and older members. What this means, in effect, is that to give all members a similar pension, members who only contributed later in life are given a pension that would not be affordable without the more valuable contributions of younger members. In other words, younger members subsidise older members. Because of this, a 64 year old member's pension will be more valuable than a 25 year old member's by a factor of 10, under KCL modelling assumptions.

Flat-accrual CDC may not represent good value for money for younger members

Value of a £1 contribution for members of each age in a flat-accrual CDC scheme in a Black-Scholes model

Pensions Policy Institute PPI



There are two implications for this level of intergenerational cross-subsidy in a flat-accrual scheme. Firstly, this has especially significant implications for workers who are only active members of the scheme early in their career – for example, somebody who joins the scheme at 22 and then leaves their employer and stops contributing at 30. The pension they accrue may not represent good value for money, as other savings vehicles may make similar investments, but without subsidising other members.

The other implication is that, when the scheme first starts, anyone who joins immediately and is already close to retirement will also be subsidised. This initial subsidy is paid for gradually by all subsequent generations. This is similar to the way to which one can spread out repayments on a loan over an arbitrarily long time period by making interest-only payments. As a result, all subsequent generations have a lower retirement income compared to dynamic-accrual CDC. The last generations have a further reduced retirement income as this initial subsidy must eventually be paid off in full.

What can flat-accrual schemes do about cross subsidy?

It is not clear what cross subsidy will mean for flat-accrual schemes in practice. Although it exists in DB, it is more pronounced in flat-accrual CDC, and there is therefore little historical precedent for how to mitigate cross subsidy. If this issue is not addressed, it could create dissatisfaction among members, or lead to a selection bias from older members having more incentive to join.

The remainder of this section will explore the possible mitigations that a scheme designer may need to consider in the future in a flat-accrual CDC scheme.

High employer contributions can give young members an incentive to join CDC schemes

One simple and effective measure to ensure that young members still have an incentive to join the scheme is for the employer to make high contributions. Even if a young member is losing money by subsidising older members, they may still be better off in a flat-rate CDC scheme with high employer contributions, than they would be by contributing to their own optimal Defined Contribution (DC) vehicle without employer contributions. In the flat-accrual scheme modelled by KCL, using the assumptions in their paper and the technical appendix, it is demonstrated that for every 33p paid by a 25 year old employee, the employer would need to top this up to £1 to provide 33p of benefit. That is, the employer contribution would need to be double that of the employee contribution.

Historically, a large part of the strong reputation of DB pensions was not due to any aspect of the scheme design, but simply that employers typically made high contributions. As flat-accrual CDC is often intended to provide a similar alternative in cases where DB is no longer viable, employers may be prepared to make similarly generous contributions to the scheme. This would solve the immediate problem that younger members would not have an incentive to join. Younger members would still receive a less valuable pension than older members for the same level of contribution, but they would now be being offered a better pension than they could find elsewhere. This would protect the employer from complications of potentially encouraging employees to join the scheme against their best interests, and may make the cross-subsidy effect feel insignificant compared to the generosity of the employer contributions. However, the large employer contribution would still be subject to investment return, so cross subsidy would be exacerbated by increasing the employer contribution.

In the case of employers who currently operate DC schemes, the need for high contributions may deter them from replacing their current DC scheme with a new flat-accrual CDC scheme, as they may currently only be making the minimum contributions required by automatic enrolment. However, in the case of single employer flat-accrual CDC, it is acknowledged that there are already reasons why this may not be an attractive option for most employers with a DC pension scheme. One of the biggest reasons is the difficulty and cost of authorizing a new CDC scheme.

Scheme designs can mitigate cross subsidy by introducing age-related accrual

So far, the flat-accrual design discussed involves all members making the same contributions and accruing the same nominal benefits at retirement. This design could be modified to remove this constraint, and in doing so, reduce the cross subsidy and the effect of over paying the first generations on subsequent generations.

KCL modelling explores the different parameters that such a design would need to select, and the extent to which cross subsidy would be reduced. These results are available in their paper.

Cross subsidy creates communication challenges

One of the biggest remaining uncertainties is how cross subsidy would be received by members. Every version of CDC already faces challenges around communication and understanding, as it is generally a complicated idea which is difficult to explain. All CDC schemes, of any design, will need to ensure that members understand certain key points before they are allowed to join the scheme. However, cross subsidy presents a new communication challenge which differs from these existing communication challenges.

For example, it has already been identified that members will need to understand that their retirement benefit may decrease in real or even nominal terms. Members who are familiar with the State Pension or DB may assume that a CDC

scheme carries a similar guarantee against inflation. Schemes may also have to explain any complications around members leaving a scheme. Whether or not schemes are required by law to explain these key points, it will still be important to protect the scheme from member grievances in the future. This is especially important in CDC, as the scheme performance may be more unpredictable than members may assume, and communication failures could remain dormant until members are surprised during a period of poor scheme performance. That is, a member may not realise their benefit can decrease until they receive a large cut in retirement.

For this cross subsidy issue, there are equally strong ethical and practical arguments for explaining the issue to members. Members may change their retirement and career plans in light of this information, and may feel aggrieved if they discover it later. The scheme may also want to pre-empt any grievances and explain that this cross-subsidy is a deliberate choice intended to achieve the equitability of giving all members the same retirement benefit regardless of age.

However, cross subsidy represents a higher level of communication challenge. It is relatively easy for a member to understand that their benefit can go down as well as up, because this only relates to their own benefit, and they do not need to understand the operation of the scheme itself. Cross subsidy, on the other hand, is different, and for a member to understand it they would need more understanding of the scheme as a whole. Many members may not have the financial literacy to be able to understand cross-subsidy, and highlighting it will create many opportunities for misunderstanding. It is not clear if, or how, schemes could communicate the disadvantage that cross subsidy creates without explaining the technical reasons why it exists.

This leaves difficult choices for schemes and regulators. Solutions could involve requiring a member to acknowledge that they understood the issue before joining the scheme. Projections of pension value, and possibly even comparisons with projections of alternative products, may aid member understanding. However, these solutions would require a level of member engagement that is not currently required from existing workplace pension schemes.

As it stands, there is not enough evidence around how to approach these communication challenges. CDC is still at an early stage in the UK, and while cross-subsidy exists in DB, it exists to a lesser extent and there has therefore been less need to communicate it to members. In order to properly assess potential solutions to these communication challenges, further research is needed, if not evidence from the future experience of CDC schemes.

What does cross subsidy mean for members?

The issue of cross subsidy means that, if mitigations such as making a high employer contribution are not in place, then a member may be better off by opting out of the scheme and arranging their own alternative pension. This would be a very serious issue for the scheme, and would also mean that these members would have been served poorly, as their own alternative arrangement would involve complex decisions and may not be any more adequate than a typical workplace DC pension.

However, although cross subsidy has the potential to make some CDC schemes inadvisable for young members, these members must also balance the advantages of CDC to understand whether they should join the scheme. A young member may still prefer to join a flat-accrual CDC scheme with high employer contributions, than to save into a DC pension.

Cross Subsidy in Dynamic Accrual CDC

Although the cross subsidy issue is most pronounced in flat-accrual CDC, KCL research highlights that cross subsidy also exists in dynamic-accrual CDC, to a lesser extent, and for different reasons.

A dynamic accrual scheme aims to minimise cross-subsidies by ensuring that the additional pension received in exchange for a given contribution has a present value equal to that contribution. The standard pricing formula for dynamic accrual prices benefits on the assumption that future benefits will be uprated on average by the prevailing indexation rate.

The analysis performed by KCL shows that this assumption leads to incorrect pricing in dynamic accrual schemes whenever the CDC design also has a feature known as “guard rails”. Guard rails have been proposed in consultations on future CDC legislation.[5] A scheme with guard rails has a rule that the indexation must stay within certain bounds – for

example, the benefits can never be uprated by more than 5%, or less than -5%. If there is ever a period of particularly strong or weak economic performance that would require the benefit to be uprated by a value outside of these bounds, then the scheme will instead uprate the benefit by the closest permissible value, and then balance any remaining discrepancy between assets and liabilities by providing a one-off bonus or cut to benefits. This ensures that, at any given point, the price of benefits will always be reasonable.

The presence of the guard rails skews the long term average of the indexation level away from the prevailing indexation rate. As a result, the assumption that benefits will be uprated on average by the prevailing indexation rate is not fully accurate. These pricing errors particularly affect the youngest generation who, in a given year, can be under or overcharged by as much as 50% according to KCL's analysis.

In their paper, KCL explores pricing in more depth, and shows how the pricing formula can be improved to better price benefits and hence minimize cross-subsidies.

Smoothing in Shared-Indexation CDC

Separate from the issue of cross subsidy, KCL have identified issues surrounding the effect of shared indexation on the predictability of projected retirement income, and the performance of CDC in different economic circumstances. This section explores the effects of pooling investment risk by using a shared index.

Risk reduction through shared indexation

The UK's vision of CDC has a notable absence of devices such as funding gates, buffers and reserves, which have been used in other countries to smooth the effect of particularly poor periods of scheme performance. These devices have been criticised for compromising scheme fairness and transparency. For example, in the Netherlands, the financial crash of 2008 resulted in many schemes taking emergency measures to stabilise scheme funding levels in Defined Ambition schemes. These measures included the use of such devices, but were poorly received by members and generated controversy.[6]

The absence of these devices means that some other mechanism is needed to smooth pensions. The flat-accrual and dynamic-accrual schemes attempt to distribute shocks across generations through the mechanism of "shared-indexation". Shared indexation refers to the fact that benefits are uprated in the same way across all generations. Superficially, this appears the same as the way the uprating of DB benefits, or the triple lock, which also affects all generations equally. However, in flat-accrual and dynamic-accrual schemes the level of indexation is varied from year to year in order to absorb market shocks.

Because shocks are passed on in this way, members who are retired, or close to retirement, will experience less volatility in their pension, or projected pension, than members who are a long way from retirement. This is because changes to indexation are compounded and so will have a larger effect if there is more time until a member receives a given payment.

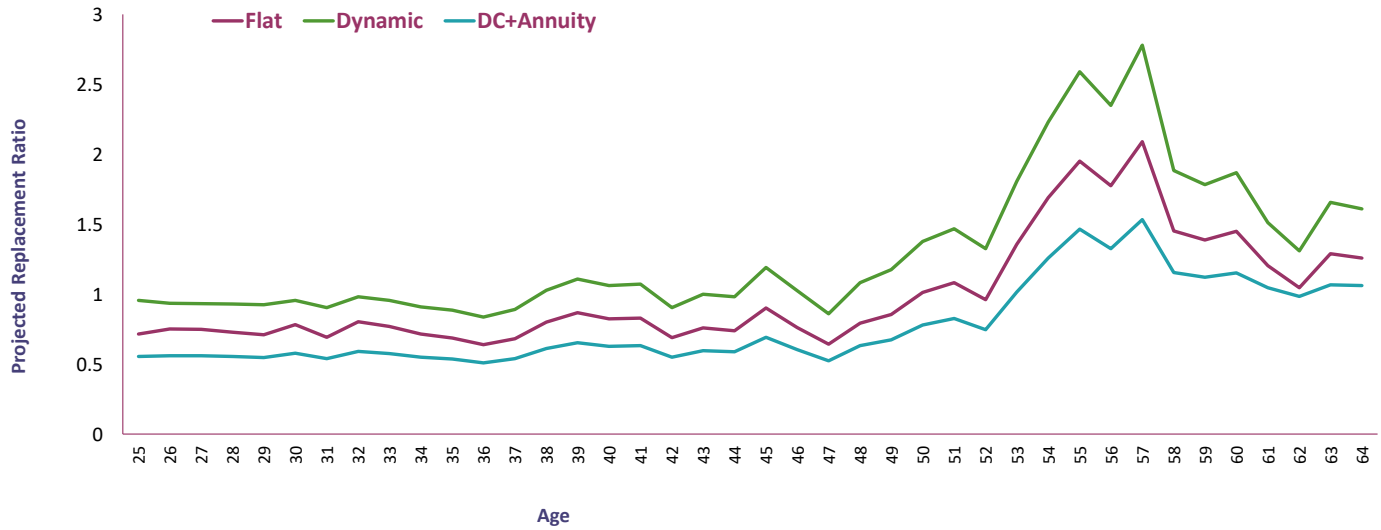
As a result, flat- and dynamic-accrual schemes are able to smooth benefits in retirement without using funding gates, buffers or reserves. For this reason we call these schemes shared-indexation schemes.

KCL's research confirms that shared indexation reduces the volatility of benefits in retirement. However, they also find that it makes only a small difference to the volatility of projected benefits before retirement.

The results of KCL modelling demonstrate that, shortly before retirement, CDC schemes have a comparable volatility in projected benefits to DC + annuity approaches. This contradicts some findings in the literature which suggest that CDC schemes result in much more predictable pensions. One reason that the smoothing benefits of CDC schemes may have been overstated is a confusion between projected benefits and nominal benefits. Projected benefits are the estimates of the average pension you will actually receive, calculated using simulations. Before retirement, nominal benefits do not have any clear interpretation, which is why they are referred to as nominal. They are simply the name of the term used in the formulae of the operation of CDC funds. Only at retirement do they become equal to benefits received. Projected benefits are more volatile than nominal benefits as projected benefits feel the effects of market shocks immediately, while nominal benefits change gradually.

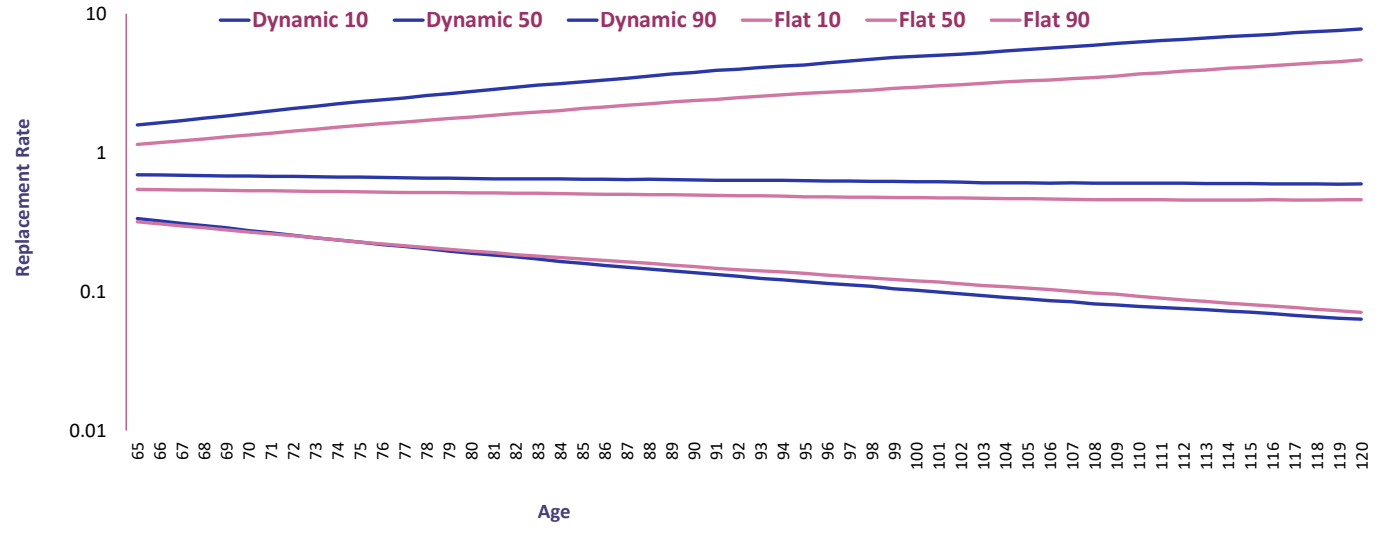
CDC schemes do not offer a more predictable retirement income compared to an equivalent DC arrangement

Projected retirement replacement ratio before retirement, in a Black-Scholes model of flat-accrual CDC, dynamic accrual CDC, and annuity bought with a DC pot



UK CDC scheme designs provide a retirement income that may decrease with age

Percentiles of replacement rate on a logarithmic scale at each age provided by flat-accrual and dynamic-accrual CDC schemes in a range of economic scenarios



Protection against poor economic performance

CDC is sometimes described as providing an "income for life". The use of this term is sometimes challenged, because of the lack of guarantee, the possibility that commercial CDC will not take hold in the UK, and the risk that any established schemes will wind up shortly after starting. However, this phrase does capture an appealing aspect of CDC: similar to DB, it could provide members with a steady, reliable retirement income, without the longevity risk or complex decisions associated with DC pensions.

However, this assumption is also challenged by the results of KCL's modelling. Using an Economic Scenario Generator, shared indexation CDC schemes can be modelled in a range of plausible economic futures which are based on historical data. It was found that, in scenarios with below-average scheme performance, members may experience a retirement income that steadily decreases. It should be noted that, where figures which display an income in retirement are given, they use a logarithmic scale.

Comparison of Shared Indexation CDC and Defined Benefit schemes

This Briefing Note demonstrates two issues in CDC, which are cross subsidy, and side effects on retirement income of pooling investment risk across generations by using a shared index. This section highlights the degree to which these issues also exist in Defined Benefit schemes, and explains why they have not been an issue historically.

Cross subsidy in DB schemes

The issue of subsidy of older generations by younger generations arises because all members, regardless of age, buy a retirement benefit at the same price, and this price does not factor in that younger members' participation generates more investment return for the scheme. This fact is true of DB schemes as well as CDC schemes. This issue was even identified by the Independent Public Service Pensions Commission in their final report, otherwise known as the Hutton report[7]:

A high accrual rate and prices indexation scheme therefore benefits those members who accrue service later in their careers, and is less valuable to those who accrue service earlier in their careers. The balance of indexation level and accrual rate will therefore have a direct impact on fairness between scheme members; for example, in a high accrual and prices indexation CARE scheme a public servant who works five years in the public sector at the start of their career will receive significantly less than a public servant who works five years in the public sector at the end of their career. At the extreme, the scheme could offer so little value for a young member relative to the employee contributions paid, that it would be rational for them to opt out as they could receive a better return on their contributions from a different savings vehicle.

However, historically cross subsidy has not been an issue for DB schemes. A key reason for this is that CDC schemes invest in riskier assets than DB schemes. This is because a DB scheme guarantees member benefits at a specified level, and if the scheme experiences poor returns, the scheme sponsor must provide extra funding so that the scheme can still pay member benefits. For this reason, DB schemes choose to invest in low-risk, low-return assets such as bonds, to minimise the risk for the scheme sponsor. There is no such guarantee in CDC, and in times of poor economic performance, the member benefit is reduced. CDC schemes take advantage of this by investing in high-risk, high-return assets, which means that even though the benefit becomes less predictable for a member, the overall income in retirement may be higher for the same amount of contribution.

It is this high-risk, high-reward investment strategy that amplifies the cross subsidy issue in CDC. While a 64 year old member's contribution is more valuable than a 25 year old's by a factor of 10, in a DB scheme which invests in low-risk bonds, this factor would be around 2.5.

As well as reducing the intergenerational unfairness itself, the reduced exposure to growth assets in DB minimises the effect of the initial subsidy that is accrued after paying the first generations. In a DB scheme, the interest rate for paying off this initial subsidy is low enough that it is compensated for by wage growth.

However, even with a reduced cross subsidy, there are other factors that have historically mitigated the issue for DB schemes, in a way that may not apply to CDC schemes.

One factor is that, when DB schemes were most prolific in the private sector, the rate of changing jobs was lower and it was relatively likely that employees might stay at one employer for a long time or even for their entire career. If members stay in the scheme for their whole career, then a large amount of the cross subsidy is "cancelled out" as members take turns to both subsidise and then be subsidised. This may still apply to some employers or employment sectors, but a modern CDC scheme will have to consider much more carefully the extent to which this effect exists.

Another factor is that DB schemes were provided as part of a culture of more paternalistic employers, which also entailed the particularly generous contributions that are associated with DB. As with CDC, high employer contributions can outweigh the money lost to any cross subsidy.

Another is that, before automatic enrolment, there was no obligation for an employer to provide a pension at all. This, combined with generous employer contributions, may have meant that an employee or trade union would have felt fortunate to have a DB pension and be relatively unconcerned by any cross subsidy.

Shared indexation in DB schemes

As with cross subsidy, there are similarities between CDC and DB, and it is useful to examine how the issue differs with DB while exploring the issue in CDC. When it comes to volatility and "income for life", the most apparent difference is that a DB pension's indexation is linked to some measure of inflation, and guaranteed by the employer, so a member of a DB pension does not have to worry about these issues. Similarly for the employer, because they must guarantee member benefits, they will select an investment strategy with minimal risk.

Before 1997, DB schemes were able to make "discretionary indexations", that is, uprate member benefits as they saw fit.[8] This freedom, along with many other freedoms that historical DB schemes had, reflects the attitude at the time, which was that employers were going "above and beyond" by providing generous pension schemes, and that placing too many constraints on these schemes might discourage this generosity.

The freedom to make discretionary indexations was removed in order to guarantee fairness. Other constraints were also placed on DB schemes, such as stricter requirements about funding levels. This, along with less favourable bond prices and increased longevity, contributed to the decline of private sector DB.

However, even once DB schemes were required to use shared indexation, there are key differences between DB and CDC that mean it is not an issue in the same way. Firstly, the indexation in DB is known ahead of time. The indexation of a DB scheme will follow some measure of inflation that, in the long term, can be predicted to a sufficiently accurate degree. On the other hand, a CDC scheme's indexation may vary from year to year in an unpredictable way, as indexation is sensitive to year-on-year changes with no way to absorb short-term shocks.

Secondly, in a DB scheme, there will be less volatility in investment performance as the scheme will invest more heavily in bonds. Finally, even if there is enough volatility to threaten member outcomes, the scheme sponsor will still step in to shield the member from it, so shared indexation will not have any impact on member outcomes, as long as it is manageable for the scheme sponsor.

Alternatives for Longevity Pooling: Collective Drawdown

KCL have shown a mathematical proof that in a Black Scholes model, investment risk cannot be shared in a mutually beneficial way between generations. Beyond this theoretical proof, the issues identified in this Briefing Note show some practical issues that arise from pooling investment risk in CDC in simulations that use more sophisticated economic models.

There are clear benefits to pooling longevity risk, and many hope that the UK pensions landscape can be reformed to create greater access to collective pensions. There are also clear practical benefits to some investment pooling, such as an increased ability to invest in illiquid assets and less need for daily pricing, which can be achieved in a wide range of collective designs with or without smoothing features such as shared-indexation.

To further illustrate the distinctions between different types of risk pooling, KCL have developed an alternative model, which preserves the longevity pooling aspect of CDC, but does not include shared indexation between generations, or attempt to pool investment risk. This section describes this model, which KCL call 'Collective Drawdown', and demonstrates its performance through modelling results of different example schemes.

Scheme design

In Collective Drawdown, each member has a "lifetime benefit fund" associated to them personally. This is an individual portfolio of assets. The value of this portfolio is known at all times but is presented to members in terms of their projected benefit in retirement. This is because a total fund value is very hard to interpret. Firstly, members are likely to under-estimate how large a pot is needed to achieve a reasonable income in retirement. Secondly, the total fund value gives a very misleading impression of risk. If a pension were invested entirely in index-linked gilts so that the benefits in retirement could be essentially guaranteed, the total fund value will still fluctuate considerably from year to year as gilt prices fluctuate as interest rates change.

Each member has an associated investment strategy and consumption strategy. The strategy presented below is an illustrative strategy, but there is considerable flexibility for a scheme designer to tailor the available strategies to the needs of members. In particular, it is possible for the scheme to offer more than one strategy that members can choose between: for example a high-risk and a low-risk strategy.

The strategy presented below was found using machine learning techniques. Instead of selecting the strategy directly, a metric was created to measure the performance of the funds. One can then use machine learning to find the optimal strategy according to this metric. To accommodate individuals with different risk preferences and consumption preferences, the metric used to compare outcomes included a "risk" parameter and a "satiation" parameter. By varying the values of these parameters one can find a large number of different strategies. The strategy shown below was chosen because it statistically out performed shared-indexation CDC.

Providing a set of pre-designed strategies is an important feature of the Collective Drawdown design and is the first difference between this approach and individual DC with drawdown. Most members would find it difficult to choose how much of their savings to consume each year, and the chosen strategies answer this challenging question for them.

The second key difference between Collective Drawdown and individual DC with drawdown is the use of mutual longevity insurance. This is provided by a "tontine" mechanism . This mechanism could equally be described by using the concept of "longevity credits", but throughout this Briefing Note, the term tontine will be used in order to be precise about the nature of longevity credits in this model. At the end of each investment period, the remaining funds of deceased members are distributed among the survivors. To work out how to distribute funds, one calculates the "contribution" of each member by multiplying the probability of a member dying at the start of the period by the value of their fund at the end of the period. The assets are distributed among survivors in proportion to their contribution. This would mean that members would need to be underwritten upon joining the scheme.

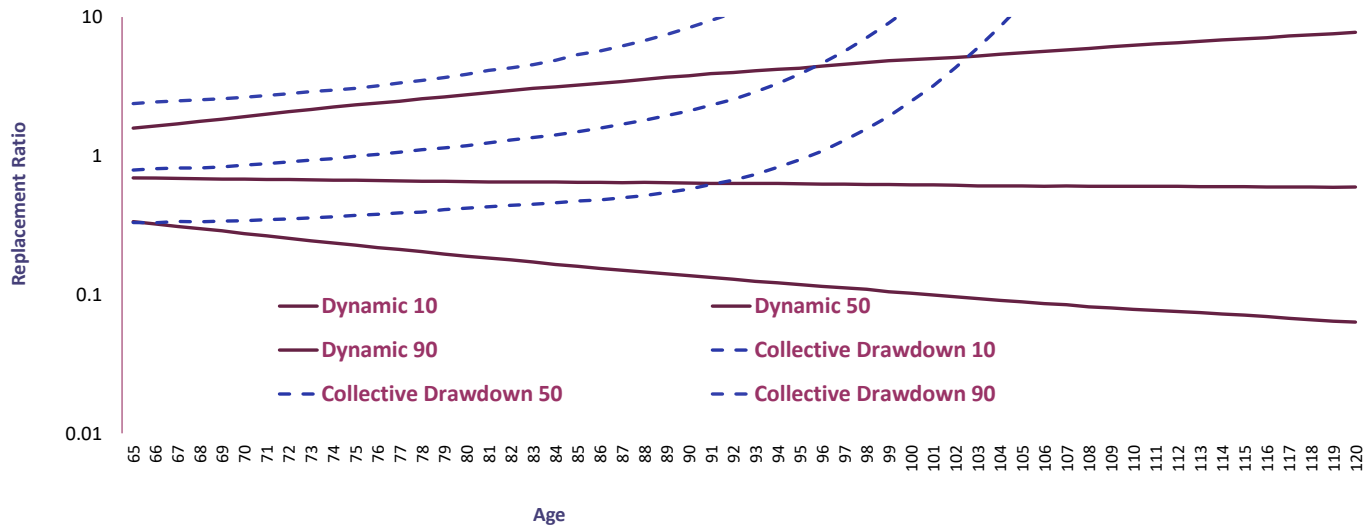
This approach is actuarially fair and ensures that members with longer life-expectancies do not benefit disproportionately. It also separatees the investment risk from longevity risk, so that it is not important that some members are invested in riskier assets than other members.

A final difference between a collective scheme and a DC scheme with drawdown is that the fund managers can make efficiency savings by netting trades across the members to reduce transaction costs. They may also require that funds are invested for longer periods to allow for investing in illiquids and other alternative investments. The investment strategy presented below requires members to take high-risk positions early in retirement which would require frequent rebalancing. However, as the fund as a whole does not need to take a highly leveraged position, once positions are netted the transaction costs can be greatly reduced.

Results

CDC schemes can be outperformed by schemes that do not pool investment risk

Percentiles of replacement ratio on a logarithmic scale provided by Collective Drawdown and Dynamic Accrual CDC schemes, in a range of economic scenarios



Comparison with CDC results

KCL demonstrates an example Collective Drawdown scheme where the parameters are chosen to provide a similar retirement income to a CDC scheme. We see that this scheme outperforms a modelled dynamic-accrual CDC scheme in two key ways. Firstly, when simulating in a range of economic scenarios, the median income from the CDC scheme in each year from each economic scenario decreases, with the 10th percentile of scheme performance decreasing with age at an even higher rate. Collective Drawdown, on the other hand, does not do this, even in the 10th percentile of performance

Secondly, we see that this instance of a Collective Drawdown scheme provides a higher income in retirement overall at each age, in the 10th, 50th, and 90th percentiles of performance.

Together, this suggests that Collective Drawdown offers two attractive advantages over CDC: protection against poor economic performance, and a higher retirement income overall.

Care should be taken when interpreting these results. Firstly, the Collective Drawdown scheme illustrated is only an example, and many comparable schemes with different parameters could also be demonstrated.

Secondly, illustrations of percentiles of performance from a large number of economic scenarios produce images of smooth lines that are useful to understand the resilience of schemes against future economic performance, in a way that cannot be easily understood by examining individual economic scenarios. However, these smooth lines should not be taken as an indication that the experience of any modelled scheme would be smooth in an individual economic scenario. Analysis of volatility in individual economic scenarios confirms the smoothing effect of shared indexation, which is an advantage of CDC.

It may appear counterintuitive that Collective Drawdown can outperform shared-indexation CDC in this way, providing a greater average return for a similar level of risk, when both are investing in the same market. The reason this is possible is that shared-indexation CDC is not designed through a process of optimization and so does not use optimal investment strategies. It provides a given average level of return in an inefficient manner which introduces unnecessarily high risks.

By taking an optimal investment approach, it becomes possible to achieve higher average returns without increasing risk. Notice also that while all the plotted percentiles of retirement income are higher for Collective Drawdown, there will be some individual scenarios where shared-indexation CDC gives better results. Collective Drawdown outperforms shared-indexation CDC in a statistical sense but not in all scenarios.

Policy considerations for Collective Drawdown

These results suggest that a model that operates on a Tontine principle offers several key benefits over a CDC design. This section addresses why Tontine-based models have not achieved more widespread use, even outside the context of an alternative to CDC.

Lack of historical precedent for Tontines

The design of flat-accrual shared indexation schemes is intended to mirror many aspects of the design of existing DB schemes. This is to minimise the number of legislative changes needed for such a scheme to be implemented in the UK, and to create consistency for employees of an employer who switches from DB to CDC. The nominal benefits received each year for a given level of contribution are the same regardless of age, which mirrors the fact that in a DB scheme the benefits received for a given contribution are the same regardless of age. The scheme could target benefits which increase in line with inflation, mirroring the fact that DB schemes provide index linked benefits. The regulations surrounding authorisation of CDC schemes is also based on that of DC Master Trusts. The design is also influenced by international experience, for example, emphasising transparency by not having funding gates.

By contrast, Collective Drawdown has many features that do not have the same level of historical precedent. While they are similar to DC schemes during their accrual phase, the design of the drawdown phase is new, having considerably more flexibility for scheme designers than other scheme designs with pooled funds.

There is similarity to DB and CDC in that the funds of deceased members are shared among surviving members, and that the scheme aims to provide protection against inflation and longevity risk. However, unlike shared-index schemes, the Collective Drawdown scheme only pools longevity risk. It does this by repeated use of a tontine mechanism over each investment period. The use of such a tontine mechanism within a pension design has little recent precedent in the UK. There are limited historical examples of stand-alone tontines from the 19th century, although these suffered from a lack of accurate mortality information, as well as being more susceptible to fraud. These served to make tontines very risky to administer at the time but would not be issues today.

UK law currently makes some Tontine designs illegal, with the precise distinction between a legal and illegal Tontine not being clear.9 They are listed as a regulated activity under The Financial Services and Markets Act of 2000.[10] Historically there were concerns that members might be incentivised to kill each other, and in insurance law there are concerns about whether members have an insurable interest, meaning that many Tontine designs may not be permitted under the Life Assurance Act of 1774.[11]

Historical Tontine designs may also have suffered from issues that arise from attempting to pool longevity without appropriate mitigations in place. A scheme that pools longevity between a small number of members who know each other, or does not admit new members on a rolling basis, may encounter issues around a sense of directly profiting off the deaths of other members. For example, if a member had a particularly untimely death, or a deceased member's dependents encountered financial difficulties, this could create animosity among surviving members who might pressure each other to support the dependents out of their own pocket. There is also the danger that members who live longest may be the wealthiest, and so longevity pooling could be seen as enabling transfer of wealth from the poor to the rich, especially without accurate underwriting.

The use of a tontine structure as part of an overall pension scheme design, as proposed by KCL, can be argued to be essentially equivalent to other longevity pooling vehicles, and so to raise no additional issues beyond those already seen in DB and shared-indexation CDC. However, given the lack of focus on Tontines in recent history, the legality of a model such as KCL's Collective Drawdown model is not well established compared to flat-accrual shared-indexation schemes which have specific enabling legislation.

The perception of stakeholders on the use of longevity pooling will depend upon how communications are handled and how the operation of the scheme is described. In the discussion of shared-indexation schemes the role of longevity

pooling is often not emphasized and the focus is instead on investment risk-sharing. In a Collective Drawdown model there is no investment risk-sharing, so attention is more likely to be focused on longevity pooling, and the discussion of this topic would need to be handled carefully. For example, framing the scheme in terms of members benefiting from others death would make a scheme unattractive, while framing in terms of mutual insurance and a reliable pension income might not.

To illustrate how Collective Drawdown might be communicated to members, KCL have supplied an illustrative communication to a member of a Collective Drawdown scheme, which is available in the appendix. This explains the aspects of the scheme operation that concern a member, but also demonstrates one possible way that the Tontine mechanism could be framed without creating an unappealing image of longevity pooling. As with the communication challenges around cross-subsidy, these communication challenges do not have established solutions, as they concern complex topics that do not have precedent in the UK pensions landscape. As a result, this sample communication is for illustration purposes only, and as with CDC, navigating these communication challenges will require significant amounts of further research.

Policy considerations for collective pension schemes

Finally, when considering Collective Drawdown as a potential scheme design in the future, it is worth highlighting that it shares many common policy challenges with CDC. Developments in CDC legislation could determine the nature of these challenges for Collective Drawdown schemes, and the experience of CDC schemes may provide useful evidence. The common aspects between CDC and Collective Drawdown that may create policy challenges include governance, selection risk, differences between regulators, and inheritability and taxation.

Transfers in and out will also need to be considered but are likely to be less of an issue in Collective Drawdown, because an individual's fund value is always known. There is more flexibility in Collective Drawdown than in CDC, including the possibility of partial inheritance and these aspects would raise additional policy considerations.

The Collective Drawdown model described here has not previously been proposed in any of these contexts, so further publications and discussions may identify the policy challenges in a more exhaustive way.

Collective Drawdown as a Decumulation product

It is possible that Collective Drawdown could be used as a decumulation only product. This would take advantage of the features of Collective Drawdown that make it useful for providing an option that is compatible with guided retirement proposals. As a decumulation product, it may be an FCA regulated retail product rather than a trust based scheme. Currently, only modelling results for lifetime Collective Drawdown models are given, but this may also be an area for future research.

Conclusions

This Briefing Note explores two issues with CDC in the UK. The first is that, in flat-accrual CDC schemes, there is an issue that young members will subsidise older members, representing a particularly serious issue for members who are only active in the scheme early on in their career. This issue has previously been identified as an issue in DB, but is more pronounced in CDC, primarily because of CDC's ability to pursue high risk investment strategies. For flat-accrual schemes, this issue may be mitigated with high employer contributions. This will not remove the cross subsidy, but will mean that the scheme still represents good value for younger members.

The second issue is that, for all types of CDC scheme, shared indexation between generations of different ages has undesirable effects on retirement income. Retirement income may be volatile and susceptible to poor performance in unfavourable economic conditions. To illustrate that shared indexation is the cause of these issues, an equivalent Tontine-based model is demonstrated, referred to as Collective Drawdown, which does not involve shared indexation.

Finally, the Collective Drawdown model is examined in its own right, and evaluated as a genuine alternative to CDC. This illustrates the distinction between attempting to pool investment risk and longevity risk simultaneously, and only attempting to pool longevity risk.

Many of the arguments around CDC centre on the idea of fairness, pooling of risk, and an "income for life". In this Briefing Note, we see that these concepts are hard to achieve in a way that satisfies every possible expectation. Exploring

the Tontine idea highlights how CDC meets these expectations in some ways but not others, and challenges employers, members and all other stakeholders to evaluate what they believe it is that an employer pension scheme should provide.

Appendix

Summary of Modelling assumptions

The simulations in this paper were performed using one of two stochastic models.

- The first model is the PPI's standard economic scenario generator which uses stochastic risk factors for equities, bonds, inflation and wage inflation. This model was used for the main comparison charts showing the overall performance of funds.
- The second model is a Black-Scholes model in which only equities are stochastic and where bonds, inflation and wage inflation all have constant deterministic rates of indexation. This model was used when we calculated cross subsidies. The reason for using the Black-Scholes model in this case is that it is possible to compute an entirely objective value for a pension in this model.

Similar results were obtained using both models. Collective Drawdown outperforms shared-indexation schemes in both models, but the outperformance is greater using the richer economic model. This is because the shared-indexation design is quite rigid and designed independently of the economic model, so it cannot exploit all the information that is available about the economy.

Both models were calibrated to have the following long-term levels of indexation:

Risk factor	Long-term median
Stock growth	7.73% p.a.
Wage growth	3.83% p.a.
CPI growth	2.00% p.a.
Index-linked bond growth	4.36% p.a.

In all simulations we assumed that members join the scheme at 25 and leave at 65 and that there are sufficient members for us to be able to perfectly hedge individual longevity risk. Mortality is deterministic and given by current Institute and Faculty of Actuaries mortality tables.

Each year the combined contribution of the member and the employer is equal to 8% of salary. All members have the same salary, growing with wage inflation.

Full modelling details can be found in the pre-print "Intergenerational cross-subsidies in UK collective defined contribution (CDC) funds" (Armstrong, Dalby, Donelly, 2025). The only difference in the models between this Briefing Note and that paper is the use of an 8% combined contribution in this Briefing Note. This explains the higher replacement ratios in this Briefing Note.

The modelling assumptions in this paper are also slightly different from that of our previous Briefing Note[12] as we have reduced the working lifetime from 18-66 to 25-65 and have used a contribution rate of 8%. This explains the higher replacement ratios in this Briefing Note and the improved performance of the flat-accrual scheme. The longer the working life, the greater the intergenerational cross-subsidy and so the worse the performance of the flat-accrual scheme.

An academic paper describing in more detail how the Collective Drawdown strategy was identified is forthcoming.

Illustrative member-level explanation

The following is supplied by KCL and is intended to be an example of a communication to a member of a Collective Drawdown scheme. This highlights the features of the scheme that would be most important to a member, and offers a potential way to frame the operation of the scheme that avoids framing the tontine mechanism in a way that might create an unfavourable image of longevity pooling. The sample provides a starting point to illustrate what might be possible, but any wording should be fully tested and researched.

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"Each year you are in work, the contributions you and your employer make to your pension are added to your personal lifetime benefit fund. This fund will be used to provide you with a pension for the whole of your life. The scheme is designed to provide you with the maximum possible benefit for as long as you live without leaving a surplus behind.

The money in your lifetime benefit fund is invested in a mixture of assets which are chosen to balance investment returns and risk. Because the future growth of assets is uncertain, it is not possible to guarantee exactly what you will receive in retirement. Every year we will send you a statement describing your projected benefit in retirement. This will fluctuate from year to year depending upon how your investments perform.

In retirement, we will draw down from your lifetime benefit fund to pay you a pension. During retirement we will invest in less risky assets to ensure that your pension does not fluctuate too much from year to year. However, we will still invest in some risky assets to ensure that your fund benefits from economic growth throughout retirement.

We will choose your pension payments to make sure that you have an income throughout the whole of retirement. If you were to manage your own fund you would need to set a lot of money aside in case you live for a long time. In a collective draw down scheme, members insure each other against the risk of living longer than expected. This means that in a Collective Drawdown scheme you do not need to set aside money in the same way. This means you can receive a larger pension without having to worry that you may run out of money.

The strategies we use is designed so that you can expect to receive a pension that will be able to keep up with inflation, though there will be some fluctuation from year to year. The scheme is also designed to ensure that it is fair to all members, so that you can expect to receive a total pension that is worth the same as the value that you invest. This applies, in particular, to the mutual insurance within the fund. If you were to buy similar insurance from a third party, they would expect to make a profit from offering you insurance, but in a Collective Drawdown scheme all the profits from insurance are shared fairly among the members. As a result, all members will receive a more valuable pension than you could achieve by investing outside of such a scheme. This is the reason for joining together in a collective scheme."

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