Optimal Matching Adjustment

How to construct an optimal matching adjustment asset portfolio under Solvency II

Standard Life Investments

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Introduction

With the January 2016 implementation date for Solvency II moving increasingly closer, European insurers are focused on ensuring their asset portfolios are appropriately aligned with this landmark EU directive.

An important element of this directive is the Long-Term Guarantees Package (LTGP) which requires insurers to make an active decision on which options to adopt for their guaranteed long term savings businesses.

One of these options, the matching adjustment (MA), determines the insurance discount rate as the risk-adjusted yield earned on the assets backing insurance liabilities within the portfolio. It is mainly applicable to UK-style annuities.

It is recognised that the calculation of the MA is not straightforward and is likely to be a focus for many insurers. However, this paper argues that this should not be the sole focus. A critical consideration should be how to optimise MA asset allocations. In this paper, we quantify the size of the gains available to insurers prepared to consider actively constructing optimal MA asset portfolios.

In this paper, we frame the underlying problems associated with the calculation of the MA and the issues involved in constructing an optimal MA asset portfolio. We also provide a high-level case study illustrating how these problems can be addressed and an optimal MA asset allocation established. Most importantly, we detail the benefits available to insurers in terms of both Best Estimate Liability (BEL) and the Solvency Capital Requirements (SCR).

While complex in construction, the decision to build an optimal MA asset portfolio can be shown to deliver extremely significant benefits and deserves to be a core focus for insurers.

Background

After many years of delays and political wrangling, the Solvency II Omnibus 2 Directive finally passed into European law in the spring of 2014. As well as confirming the Solvency II implementation date of 1 January 2016, Omnibus 2 provided further details on the LTGP. This was designed to allow insurers to continue offering long-term savings and pensions products that provide some form of investment guarantee, while also delivering an appropriately prudent Solvency II regulatory regime.

As we outline, much of the detail about how the LTGP will be implemented in practice is, however, still not yet clear. Clarity will only emerge as European insurers and supervisors start to actually implement Solvency II and solve the many remaining practical problems along the way.

Matching adjustment benefits

One very important component of the LTGP is the MA.

This is a measure of the additional return, in excess of the risk-free return, that insurers can earn on illiquid assets when following a buy-and-maintain strategy to match illiquid insurance liabilities.

The types of illiquid assets that the MA is designed to cater for include infrastructure, commercial mortgages and direct lending to smaller and medium sized enterprises (SMEs), all assets that European governments are very keen to support to help drive and promote economic growth in Europe.

As insurer liabilities are often highly illiquid, for example UK-style annuity liabilities, this leaves insurers very well placed to capture the MA excess return available on such illiquid assets, using a buy-and-maintain investment strategy.

As an additional benefit, when illiquid assets are held to maturity, it can be argued that the balance sheets of insurers are no longer subject to spread risk capital on these assets and insurer capital requirements should be reduced to reflect this. This is because the risk of an insurer being a forced seller of illiquid assets at times of market stress, when credit spreads are wide, is effectively eliminated.

MA requirements and approval

Insurers must apply to their supervisor for approval to use the MA and, in addition, meet a number of onerous asset eligibility and cashflow matching requirements before they can use the MA. We describe these requirements in more detail in the following section.

It is also important to note that supervisors can start receiving insurer MA applications from 1 April 2015. Further, they need to have built up their MA asset portfolios before they can apply for this approval. Additionally, in the UK, the Prudential Regulatory Authority (PRA) is running an MA pre-application process in Q1 2105 to test the readiness of insurers and also their own approval processes.

The upshot of this is that insurers are under pressure to build their MA asset portfolios now if they are to be ready in time to apply for approval from 1 April 2015.

Optimal MA portfolios — a constrained optimisation problem

In building an optimal and compliant MA asset portfolio, insurers need to consider what their ultimate objective is.

For example, do they want to:

- maximise the MA excess return (or effectively minimising Solvency II technical provisions)?
- minimise capital requirements?
- optimise a prescribed measure of risk-adjusted performance?

All of these objectives will also be subject to various potential constraints such as:

- the quality of the cashflow match
- duration exposure
- exposures to credit rating, sector, issuer, individual bonds, currency, class of asset
- behaviour of the asset portfolio under credit spread stress testing.

In short, this is a very complex asset allocation optimisation problem.

However, as we will demonstrate, the benefits to insurers of finding and sourcing an optimal MA asset portfolio are, we believe, very material indeed.

Footnote: full details of the Solvency II Omnibus 2 Directive can be found using the link below:
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0051&from=EN

The business problem

The MA business problem is effectively defined by the very detailed and technical Solvency II regulations that have taken years to develop and agree. In this section, we describe the business problem using high-level descriptions of the most pertinent sections of the Solvency II rules.

Article 77b of the Omnibus 2 Directive sets out the various MA asset eligibility requirements and the MA business management requirements that are relevant to this paper. Article 77c explains how the MA should be calculated.

There are other MA requirements in Omnibus 2 and also elsewhere in the voluminous Solvency II texts. However, these are of less relevance to the subject matter of this paper and will not be discussed. For example, we will not discuss how the MA must be treated in insurers' Own Risk and Solvency Assessments (ORSA), or how its effect must be disclosed publically.

Asset eligibility and cashflow matching requirements

In this section, we discuss the main requirements that must be satisfied by an MA portfolio, which result in various practical difficulties and constraints.

Note that many of these requirements apply at the portfolio level, rather than at individual asset level, and this can often make them easier to manage. For example, floating rate assets that might otherwise be ineligible can be converted into fixed-rate assets at the portfolio level using derivatives and then become eligible at portfolio level.

We outline the main requirements below.

- Asset cashflows must be fixed nominally, or relative to inflation, and must closely cashflow match MA liabilities to ensure that any mismatches do not result in material risks.
- MA asset cashflows cannot be changed by issuers, or third parties, unless insurers receive sufficient compensation to preserve the cashflows that they would have received if the asset cashflows had not been changed.

  For example, callable bonds which include a Spens clause are considered eligible if the Spens clause provides adequate compensation on call.
- The assets must be assigned to the matching insurance portfolio and held throughout the lifetime of the portfolio, unless changes are required to maintain the cashflow matching integrity of the MA portfolio. A buy-and-maintain investment strategy must therefore be broadly followed and with some scope to manage assets for cashflow matching and risk management purposes.
- The MA assets must be identified, organised and managed separately from the rest of the insurers' business and must not be used to cover losses arising elsewhere on non-MA business.
- MA business is generally restricted to single premium insurance business that is subject to longevity, expense and mortality risks and where surrender values cannot exceed the value of the underlying assets valued in accordance with Solvency II rules.

  In practice, this generally means single premium annuity and guaranteed bond type savings business.

As can be seen, the MA asset eligibility requirements are quite light on operational detail and further clarity is only expected to emerge as these requirements are actually implemented in practice.

How to calculate the matching adjustment (Article 77c)

Article 77c of the Omnibus 2 Directive sets out how the MA excess return is calculated from the MA portfolio of assets and liabilities according to the Solvency II rules.

Broadly, it is the additional return, in excess of the risk free return, that is expected to be earned on the MA assets, after having allowed for the expected costs of default and downgrade. The expected cost of default and downgrade is called 'the fundamental spread' and will vary by asset class, credit rating and duration. It is calculated and published by the supervisor EIOPA.

MA solvency capital requirements (SCR)

In describing MA SCR, we need to differentiate between insurers that use their own risk models, internal model insurers, and those that use the Standard Solvency Capital Requirement which is prescribed by the Solvency II rules.

- **Internal model insurers**
  For insurers that are authorised to use their own internal models to calculate their Solvency II SCRs and available Own Funds (capital), the stresses and methodologies that they use are bespoke to each insurer, having been approved by their group supervisor.

  Consequently, the capital performance of internal model MA portfolios will vary by insurer and will largely depend on how much spread-risk capital insurers feel is needed to cover spread risk with a buy-and-maintain MA asset portfolio,

- **Standard SCR insurers**
  For insurers that use the Standard SCR approach to calculate their Solvency II SCRs and available Own Funds, the stresses and methodologies that they will use are substantially prescribed by the Solvency II rules. The Standard approach is likely to be more prudent than an internal model approach that is tailored to fit individual insurers' specific risk profile.

Practical uncertainties and challenges

As can be seen from the earlier sections of this paper, there are a large number of practical uncertainties and challenges that make the construction of an 'optimal' Solvency II MA asset portfolio far from straightforward.

We describe some particular challenges below.

1. Identifying, and then sourcing, from the entire investment universe, individual assets that are eligible for inclusion in the MA asset portfolio. This might require, for example, taking legal advice on the precise terms and conditions of each individual asset to check how these stack up against the Solvency 2 MA eligibility requirements.
2. Selecting from the identified eligible assets those assets that maximise the MA at the level of the MA portfolio or, equivalently, finding the cheapest asset portfolio in the market that meets MA requirements.

   For example, going down the credit curve may not necessarily increase the MA excess spread, depending how the fundamental spread moves as more credit risk is taken.
3. Selecting from the identified eligible assets those that minimise the insurer's capital requirements. This minimisation could be done at the level of the MA portfolio itself, or at the level of the insurer's total balance sheet. The minimisation will clearly depend on whether the insurer is using the Standard SCR or its own internal model.
4. Defining an appropriate level of cashflow matching of the MA assets and liabilities to allow the portfolio to qualify for supervisory approval. Cashflow matching could be defined relative to how well assets and liabilities are cashflow matched across individual time buckets or, alternatively, it could be based on cumulative asset and liability cashflows.

   We need to define an appropriate measure of cashflow mismatching and an acceptable tolerance level within which assets and liabilities are considered to be appropriately cashflow matched.
5. Managing and adjusting the MA asset portfolio over time as the actual behaviour and performance of both assets and liabilities diverges from initial expectations and assumptions. For example, if the MA assets suffer fewer defaults than expected, the resultant MA surplus can be released from the MA portfolio, provided that there are sufficient MA assets to cover MA best estimate insurance liabilities at all times.

Solvency II MA case study

Previously in this paper we have introduced the MA asset allocation problem and have described the practical uncertainties and challenges that insurers face in attempting to construct a MA asset portfolio that is 'optimal' in some sense. In this section, we illustrate one potential way of tackling this problem using a specific asset allocation optimisation case study.

While this formulation of the problem is not the only one possible, it does show how setting up the asset allocation problem as an optimisation problem allows insurers to find broadly optimal asset allocations in a structured manner. The case study also shows the very significant benefits that we believe are available to insurers following an optimisation approach. The broad approach described is certainly one that we have used with our insurance clients to generate real value.

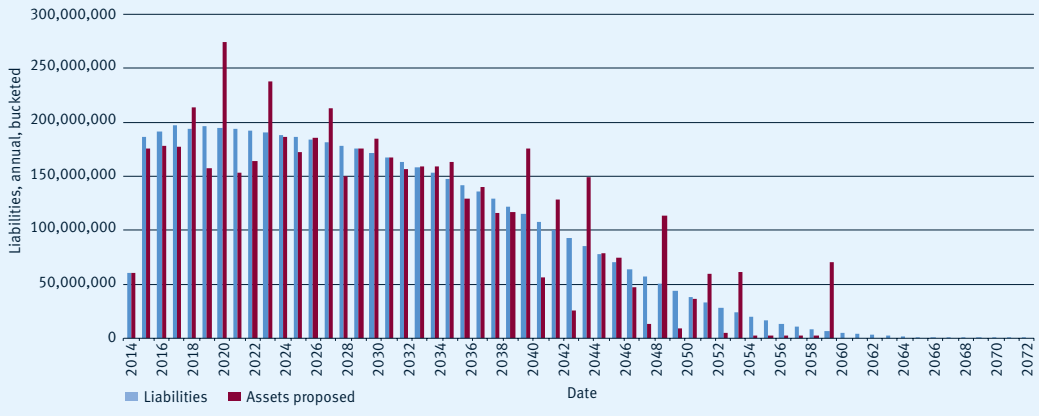
Asset and liability cashflows

The asset and liability cashflow profiles shown in Figure 1 below are taken from an actual insurance annuity liability profile and an asset portfolio that has been chosen to broadly cashflow match the liabilities.

Figure 1 shows that the asset cashflows match the liability cashflows in most time buckets well, with some spikes of misfit at certain durations. It is not immediately clear if this is a 'good' cashflow fit, or if it is 'optimal' in any sense, compared to all of the other possible asset portfolios that might provide an acceptable asset cashflow fit to the liability profile.

This is why it is helpful to define the MA asset allocation problem as an optimisation problem, where we explicitly measure the cashflow misfit, and can solve the problem with some rigour and precision using software tools developed specifically for the purpose.

Figure 1 : Bucketed annual cashflows of assets versus liabilities



Source: Standard Life Investments, February 2015

Defining the cashflow matching optimisation problem

Setting up and solving the MA asset allocation problem as an optimisation problem is not straightforward for a number of reasons.

- If the objective and constraints are not designed with care, the problem can very easily become intractable and insoluble.
- Searching through all permutations of the entire eligible investment universe will be highly time consuming when, as expected, closed form solutions of the optimisation problem may not be available.
- The constraints under which the optimisation is carried out can be multi-dimensional and complex, for example if close cashflow matching is defined using Solvency II SCR calculations.

Our objective

In our case study, our objective will be to maximise the MA generated by the asset allocation over all potential eligible asset portfolios. Put more simply, we are aiming to find the 'cheapest' asset portfolio that meets all MA asset eligibility and cashflow matching requirements.

Our cashflow matching metric

In Figure 2, we show a graph of the same data as in Figure 1 but this time presented as cumulative asset and liability cashflows. This does seem to indicate that that the asset and liability cashflows are fairly well matched.

Note that the discrete jumps in the cumulative asset cashflows correspond to coupon receipts and asset redemptions as the asset portfolio matures. One potential way to assess the fit of the asset cashflows to the liabilities is to look at the differences between the cumulative asset and liability cashflows at each time point along the curves shown in Figure 2. This is the measure that we will use in this case study. In other words, we measure cashflow fit by how closely the two curves in Figure 2 are 'squeezed' together and the closer the 'squeezing', the better the fit.

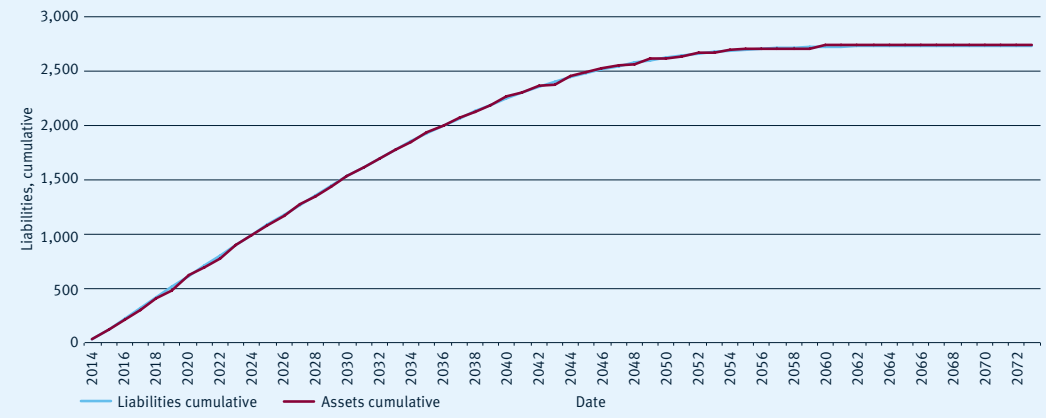
In 'squeezing' the two curves together, we may also be prepared to allow the two curves to diverge within prescribed tolerances in order to find 'cheaper' asset portfolios that still provide a reasonable cashflow match fit to the liability profile. It is these 'cheaper' assets which help us to maximise our objective, the MA earned by the allocated asset portfolio.

Other constraints

However, it is important to remember that we are doing this 'squeezing' by searching through a very large number of potential individual assets. These are also subject to the MA asset eligibility conditions and any additional constraints that the insurer wishes to impose.

There will, in addition, be further constraints that will apply at the overall portfolio level, both from MA requirements and also from the insurer in respect of its broader credit risk management requirements. In order to solve such a large and complex problem, dedicated software tools must be developed specifically for this purpose.

Figure 2: Cumulative cashflows of assets versus liabilities



Source: Standard Life Investments, February 2015

Solving the asset allocation optimisation problem

The high dimension, multiple constraints and wide choices of potential objective mean that the formal framing of the problem is critical to a tractable and practical solution. Through careful consideration of the various aspects, it is important to specify the problem in a form that can be solved in a robust and efficient manner.

Critically, we ensure we specify constraints to define a convex feasible region which, along with a convex objective function, ensures that the optimal solutions found are global optima. With careful careful choice of objective function and variation of appropriate constraints, one can construct an 'efficient frontier' of potential solutions.

In Figure 3, the Y-axis measures closeness of the cashflow match fit for specific eligible asset allocations. Higher values correspond to poorer fits. The X-axis measures the optimality of each asset allocation by showing the Best Estimate Liability (BEL) of our liability profile, calculated using the MA earned on each specific eligible asset allocation, relative to the BEL with a zero MA (the 100% point on the X-axis).

The lower percentage points on the X-axis are therefore more optimal in the sense that they correspond to higher values of our objective, the MA. As we move along the X-axis to the left, asset allocations become more optimal in terms of maximising MA and, generally speaking, the cashflow match becomes poorer as we might expect.

If the insurer is prepared to accept cashflow matches within the tolerance range indicated by the dashed line in Figure 3, the optimal asset allocation portfolio is the one furthest to the left and just before the dashed line is breached.

The shaded elliptical area in Figure 3 indicates the area of the Figure where, based on our experience, insurers may feel comfortable with the level of cashflow mismatch in their MA asset portfolios.

It is important to note that optimising the MA in this manner has the potential to reduce an insurer's annuity BEL by a significant amount. Of course, the circumstances of different insurers will vary and the actual benefit realised dependant on the market conditions prevalent at the time the portfolio is constructed. However, research undertaken by Standard Life Investments indicates a reduction in an insurer's annuity BEL, relative to no MA, of approximately 10% could be achieved, making a very material contribution to an insurer's Solvency II Own Funds. For example, on an annuity book of £1 billion, £100 million of Own Funds, or capital, could be created.

Based on our own experience of optimising MA asset allocations, the benefit of optimised asset allocations within eligible cashflow matched MA asset portfolios can be material.

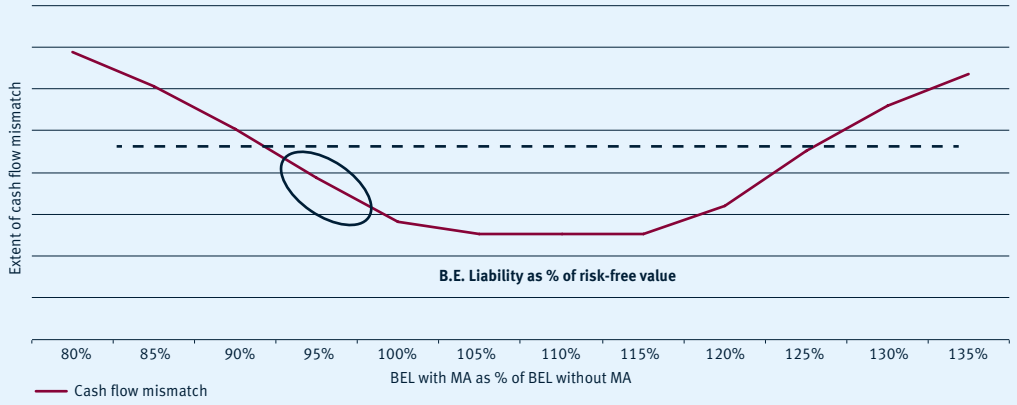
The SCR benefit
In choosing the optimal MA asset allocation, insurers will also wish to bear in mind the associated SCR benefits generated by potential asset allocations.

The cashflow matching constraint in our optimisation problem will ensure that the Solvency II SCR interest rate, currency and inflation-risk capital charges will always be small, with these charges falling further as the Figure 2 curves are squeezed together more tightly.

As described earlier in the paper, it can also be argued that, with a buy-and-maintain portfolio, spread-risk capital requirements will fall substantially relative to a more actively traded asset allocation.

Figure 3 below illustrates the results of our optimisation approach.

Figure 3: Asset allocation optimisation - the efficient frontier



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Conclusion

As Solvency II implementation moves ever closer, and with insurers working hard on building their MA asset portfolios for supervisory approval, it is imperative that firms should consider how best to optimise MA asset allocations to realise and maximise the very material benefits that are available with the MA.

Optimal asset allocation methods like the one described here, particularly when combined with the ability to source and structure MA-eligible illiquid assets like infrastructure and commercial real estate, will, we believe, greatly help insurers to construct appropriate and optimal MA asset portfolios.

We believe this will benefit all of the insurer's stakeholders, including customers and shareholders, as well as the issuers of the illiquid debt that the MA is designed to encourage insurers to invest in.

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