

Exploring Portfolios with Illiquid Assets

Frequently Asked Questions

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This presentation and supporting research reflect the views of the authors and do not reflect the views of the Conexus Institute and the CFA Societies Australia.

This presentation and supporting research do not constitute financial advice and do not present normative recommendations for the management of funds with illiquid assets.

The purpose of this presentation and supporting research is to stimulate dialogue, discussion, and further research on the issues presented.

1. Background Information

The management of illiquid assets in a portfolio is a global problem in wealth management and management of pension funds. Our models are largely universal, but the focus is on Australian super funds.

Our aim is that this open-source work assists funds to better understand the various challenges faced when managing portfolios with illiquid assets. This work has application for investment managers, risk and governance officers, fund trustees and regulators.

The work is not prescriptive; it is best complemented by other insights, both quantitative and qualitative.

Our models provide an element of “baselining” and they can be customized to incorporate assumptions to fit a user’s requirements.

The resources are made available to:

- Be used to frame and illustrate important trustee discussions in an interactive case study structure.
- Be extended upon and incorporated into existing risk frameworks.
- Provide a baseline framework to establish reference standards for Australian super funds.

This document, Frequently Asked Questions, is intended to complement other materials:

- The Overview Presentation
- Three Case Study presentations
- The three Excel models, which include model descriptions

2. Frequently Asked Questions

2.1. High-level design and assumptions

1. [Why separate frameworks for single sector and multi-sector liquidity assessment?](#)

We assessed the cases separately to help trustees understand the nuanced mix of issues faced by both types of option. In the single sector option case study we explore unit price inequities in detail. In the multi-sector case study we explore a range of issues including portfolio quality, cost of restoring the portfolio, and unit price inequities.

2. [Can you explain the banker option in greater detail?](#)

We represent a simplified version of the banker option in the two diagrams below.

1. Operating Structure

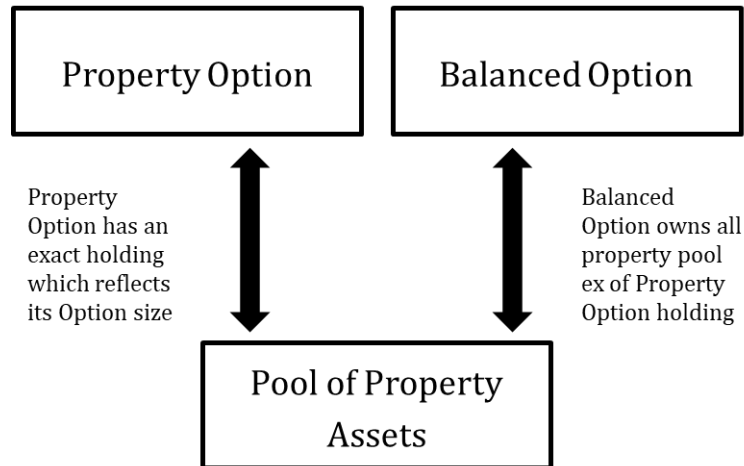


Diagram 1: Simplified operating structure for a fund with a banker option.

2. Funding a Property Option Redemption

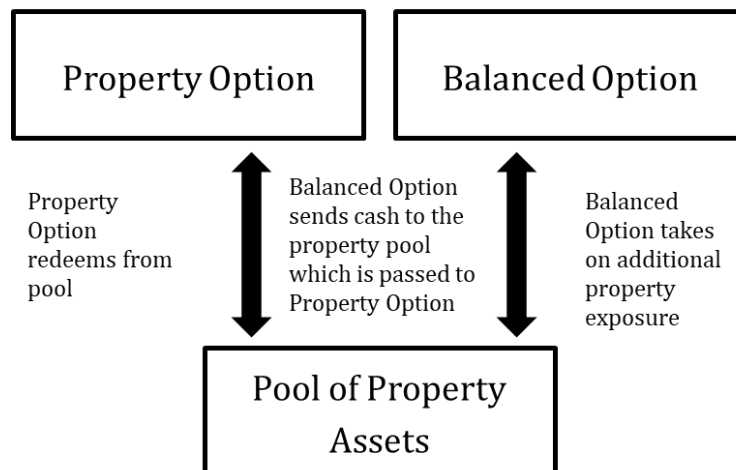


Diagram 2: Workings of a redemption out of a single sector property option, funded under a banker option structure.

The banker option is typically the largest multi-sector option. It is common for the banker option to be large relative to the illiquid single sector options as this will diminish the inequities created by the structure (this issue can be explored further by users in the Multi-Sector Case Study). Completely illiquid options offering daily liquidity would theoretically face solvency issues as the instant a redemption request is made (in the absence of leverage facilities). The redemption is funded by the banker option, which effectively is a guaranteed buyer of the illiquid asset at the marked price. This is described in Diagram 2.

Under the banker option arrangement, the day-to-day asset allocation of the balanced option is impacted by the activities of members of the property option, Again, if the balanced option is large relative to the property option, the impact is likely small.

3. Can you comment on the implicit assumption that liquid asset prices are realistic reflections of the valuation of illiquid assets?

It is appreciated that this is a controversial issue and, as previously outlined, the aim of the models and papers to promote discussion through the ability to test assumptions. We are aware of the arguments on both sides:

- Some take the view that public market pricing reflects the market's views on the value of underlying property assets sitting in listed vehicles.
- Others take the view that listed markets can over-react and that the price may not be reflective of a large asset holding.

That is why we provide users the opportunity to input characteristics of the relationship between listed and unlisted property (i.e. correlation). There is also flexibility to make more substantial changes to the models which reflect different views on the relationship between liquid and illiquid assets.

2.2. Modelling details

4. Why is all modelling performed in Excel?

All the modelling is performed in Excel for a variety of reasons:

- Excel is commonly used by most in the financial services industry.
- Users can follow how the calculations work.
- The provided models can be extended upon or incorporated into other models.

5. Why did you choose to adopt simulation modelling?

The range of outcomes is only explored for the two single sector option case studies (for the Multi-Sector case study we apply deterministic scenario-based analysis). This is an important consideration when exploring inequities.

While it is possible to apply closed form solution techniques to Case Study 1 (Single Sector Option), it is more complex for Case Study 2 when liquid proxies are used. Our preference was to apply the same technique consistently. This led us to apply simulation modelling.

The additional advantage here is that users can view individual simulations which may help to increase understanding.

6. Why only 100 simulations?

We considered 100 simulations to be sufficient to provide an indicative representation of the range of outcomes while not introducing calculation time issues. If a user wanted to convert any of the outputs into a measurement used for reporting, then we would recommend a larger number of simulations.

7. What improvements would you suggest to the models as provided?

A general suggestion would be, once any final design changes are considered, to assess methods to make the models more robust and less prone to user input error. We make some suggestions below on the individual case studies.

Case Study 1 – Single Sector Options

- Reflect on whether more simulations are required.
- Reflect on asset modelling assumptions (we assumed normal distributed returns).

Case Study 2 – Liquid Proxies

- Reflect on whether more simulations are required.
- Reflect on asset modelling assumptions (we assumed normal distributed returns).
- Reflect on the modelling relationship between unlisted asset and the liquid proxy.

Case Study 3 – Multi-Sector Options

- Reflect on the degree of portfolio detail (more or less).
- Consider whether to incorporate liquid proxies.
- Consider whether the use of discrete month-by-month inputs (we assume an event occurs linearly across each month) would improve the insights.
- Further investigate the modelled linkage between market volatility and liquidity costs.
- Consider the use of incorporating time-varying expected returns.
- Consider minimum quality criteria thresholds.

2.3. Applications and extensions of this work

8. How can this suite of resources be used by a super fund?

The initial targeted use of these resources is educational. The Overview presentation is designed for a trustee workshop / presentation environment. There is a similar application of these resources within the investment, risk, and governance functions of super funds. For funds which do not formally model the issues explored in this project, the models may provide a starting point on which to then develop and explore fund specific scenarios.

9. How can this suite of resources be used by regulators?

The educational applications of this project may be useful to relevant areas within the respective regulators. The models may provide useful insights during the development of regulations or practice guides in the areas of investment governance and valuation policy. Due to the open-source nature of this work, the resources effectively provide a baseline standard that frontline regulators can refer to.

10. How can this suite of resources be used by super fund ratings groups?

There exists a large dispersion of practices amongst superannuation funds regarding their allocation to illiquid assets and valuation practices. This needs to be balanced against the respective net inflow position of each fund. Forming a view on the various first (solvency) and second order issues (portfolio quality, liquidity associated costs, and inequities) is a complex issue for super fund ratings groups. The project resources may help ratings groups explore these issues.

11. How can this suite of resources be used by asset consultants?

Most likely, asset consultants undertake similar analysis for their clients. In this context our work provides an independent assessment of these issues and may be a useful comparator for asset consultants.

12. How can this suite of resources be used by academic researchers?

Liquidity is a broad topic area on which there exists much academic research. However, there appears to be only a moderate amount of research which considers both the first and second

order liquidity risks characterised in our work. Our models may assist academic researchers interested in exploring this area further.

13. What areas for further research do you suggest?

We see many opportunities for further research in areas related to different aspects of portfolios with illiquid assets. We detail some suggestions:

- Product design and modelling – can we modify product design to mitigate some of the issues identified in this work?
 - Could fund buy/sell spreads be variable?
 - What are fair redemption rules?
 - Should super fund products follow the same rules as retail products?
 - What is the long run impact of the inequities on retirement income outcomes? (we outline our considerations on this issue in Q20).
- Governance – can governance guidelines be enhanced to mitigate some of the issues identified in this work?
 - How should stale pricing be managed and what disclosure requirements might mitigate information asymmetries with the public?
- Public policy - how can public policy mitigate the inequities uncovered?
 - Do we have a market failure? Do we need a special organized exchange for illiquid assets?
 - What is the trade-off between maximizing the capture of the liquidity premium vs the asset allocation rebalancing costs – who should bear those costs?

14. Can you suggest other scenarios for the multi-asset case study?

We provide details for a COVID-19 case study. From the default inputs detailed in the Multi-Sector presentation, the only modifications required are in the Market Event section:

- Timeframe: 2 months
- Number of Standard Deviations: 6

We encourage users to account for fund specific scenarios across all relevant areas, especially portfolio characteristics and member flows.

15. What other considerations should a trustee of a super fund consider beyond modelling of this nature?

We acknowledge that quantitative frameworks have limitations, and it is good practice to complement insights from quantitative modelling with other perspectives. The following perspectives may also provide useful insights:

- The role of a valuation committee to oversee valuations and valuation processes of unlisted assets.
- Scenario-based role modelling of market events.
- The monitoring and internal reporting processes related to illiquidity.

2.4. Technical questions relating to case studies

16. In the Single Sector Option Case Study, can you explain the Exercises / Relationships in more detail?

Exercise (alter these inputs)	Expected Impact on Unit Price Inequity and Gapping
Expected returns (capital gains)	Positive relationship between expected capital gains and scale of inequity and gapping. If assumed capital gains are higher (lower) then the expected degree of mispricing grows with time at a faster (slower) rate.
Volatility	There is a positive relationship between volatility and the scale of inequity and gapping. If assumed volatility is higher (lower) then the breadth of mispricing increases with time at a faster (slower) rate.
Allocation to illiquid assets	There is a direct positive relationship between the level of exposure to illiquid assets and the scale of inequity and gapping. If a single sector option holds more (less) in the illiquid asset, then its exposure to the mispricing source is greater (less).
Transaction frequency	<p>There is a complex interaction between transaction frequency and valuation frequency. If they perfectly align then there is no inequity. There are two important factors to consider:</p> <ol style="list-style-type: none"> (1) The greater (lower) the transaction frequency, the greater (lower) the likelihood of experiencing a threshold level of inequity at least once. (2) The greater (lower) the transaction frequency the greater (lower) the breadth of transactions created at different time exposures to the inequity process.
Valuation frequency	There is a direct positive relationship between valuation frequency and the level of inequity and gapping. The more (less) frequent the valuation process the lower (greater) the time exposure to the inequity process, creating a broader (narrower) distribution of inequity.
Trustee concerns (i.e. threshold levels of inequity and unit price gapping)	Setting the concern levels higher will mean these concerns are less likely to be experienced but does not alter the consumer's possible outcomes. The likelihood of the concern level being reached by the inequity and gapping processes are lower (higher) if the respective thresholds are increased (decreased).

17. In the Liquid Proxies Case Study, can you explain the Exercises / Relationships in more detail?

Exercise (alter these inputs)	Expected Impact on Unit Price Inequity and Gapping
Expected returns (capital gains)	As per Question 16.
Volatility	As per Question 16.
Correlation between illiquid and liquid assets	There is a positive relationship between the assumed correlation between illiquid and liquid assets and the effectiveness of the out-of-cycle revaluation (OoCR) process. If the assumed correlation between illiquid and liquid assets is higher (lower) then liquid proxies will more (less) accurately estimate movements in illiquid assets and the overall valuation approach (incorporating liquid proxies) will be more (less) effective.
Allocation to illiquid assets	As per Question 16.
Transaction frequency	As per Question 16.
Valuation frequency	As per Question 16.
Trustee concerns	As per Question 16.

18. In the Multi-Sector Option Case Study, can you explain the Exercises / Relationships in more detail?

Exercise (alter these inputs)	Expected Impact on Unit Price Inequity and Gapping
Portfolio holdings: allocation to illiquids	<p>Negative relationship between the allocation to illiquids and some measures of portfolio solvency, quality, inequity, and cost. If the allocation to illiquids is higher (lower), then:</p> <ol style="list-style-type: none"> (1) Less (more) liquidity is available to meet cashflow requirements. (2) Portfolios will move by a greater (lesser) degree away from their targeted SAA in a crisis environment. (3) The potential size of inequities will be greater (lower), as discussed in Question 16. (4) The transaction costs to return a portfolio to its targeted SAA will be greater (lower), as per (2), portfolios will move by a greater (lesser) degree from targeted SAA.

Portfolio holdings: currency hedging	Negative relationship between directly managed hedged global exposure and some measures of portfolio solvency, quality, inequity, and cost. If the exposure to direct currency hedging is higher (lower) then cash demands in a crisis environment (where we assume that the AUD will fall) will be greater (lower). This creates the range of issues described in the second row of this table ("Portfolio holdings: allocation to illiquids").
Market event: timeframe (i.e. duration of the market event)	Negative relationship between event timeframe and some measures of portfolio solvency, quality, inequity, and cost. If the timeframe is longer (shorter) then the greater (lesser) the impact of the market event on the portfolio. This creates the range of issues described in the second row of this table ("Portfolio holdings: allocation to illiquids").
Market event: # standard deviations	Negative relationship between event severity (represented by # standard deviations) and some measures of portfolio solvency, quality, inequity, and cost. If the event severity is greater (lower) then the greater (lesser) the impact of the market event on the portfolio. This creates the range of issues described in the second row of this table ("Portfolio holdings: allocation to illiquids").
Member flows	Negative relationship between member flows and some measures of portfolio solvency, quality, inequity, and cost. If member flows are lower (greater) then all the issues described in the second row of this table ("Portfolio holdings: allocation to illiquids") are amplified.
Correlations	Lower correlation assumptions between illiquid assets with other assets increases the tracking error calculations. The correlation matrix is used to approximate the tracking error relative to targeted SAA, a measure of portfolio quality. If correlations between illiquid assets and other assets are lower (higher) then, as the portfolio becomes more distant from its targeted SAA during a market event, the calculated tracking error will be larger (lower).
Transaction costs	Positive relationship between transaction cost assumptions and the cost of selling illiquid assets to restore the SAA.

19. In the Liquid Proxies Case Study can you explain why the discounts and gapping can point in opposite directions between the scenarios where out-of-cycle revaluations are and are not applied.

As a refresher, out-of-cycle re-valuations (OoCR) are portfolio re-valuations conducted outside of the standard valuation process. In Case Study 2 (Liquid Proxies) we explore the use of a systematic approach OoCR approach based on liquid proxies. The mechanics of this approach are detailed in Diagram 3.

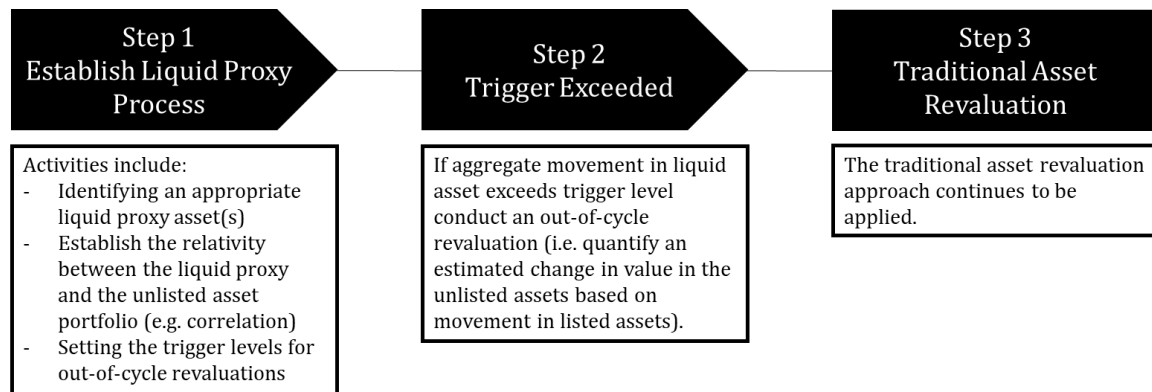


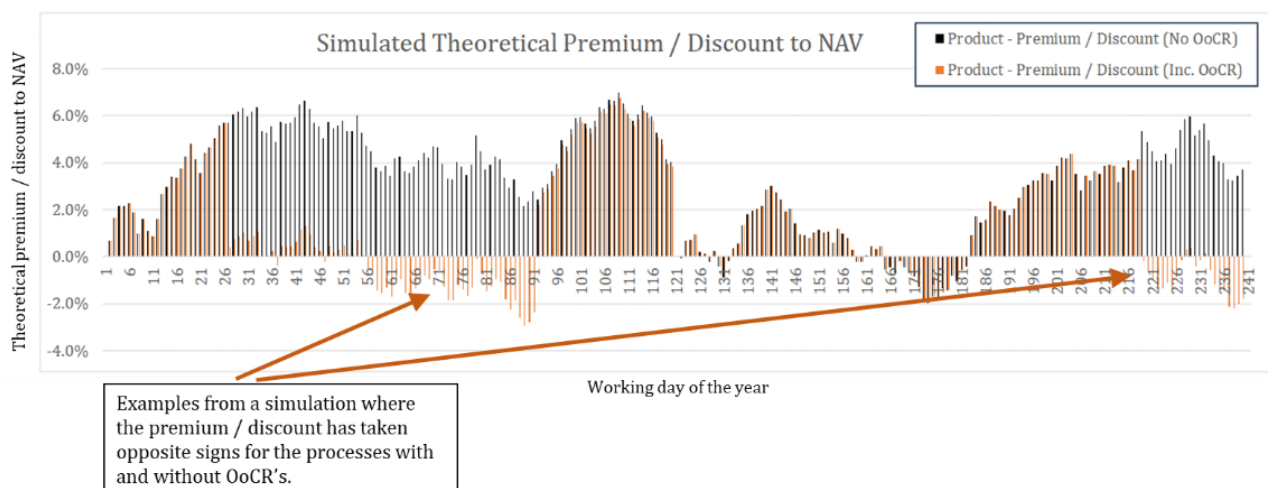
Diagram 3: Explanation of the mechanics of an out-of-cycle revaluation process based on liquid proxies.

The situation can arise whereby the discounts and gapping can point in opposite directions between the scenarios where out-of-cycle revaluations are and are not applied. An example of this issue is detailed in Diagram 4.

Interactive Simulation

Chart 1: Simulated Theoretical Premium / Discount to NAV

This chart simulates the possible daily theoretical premium / discount to NAV.



The two cases identified in Diagram 4 can be easily explained. Out-of-cycle revaluations have been undertaken because a trigger level reached, only for the degree of mispricing to then retract. For the black process (no OoCR's) in Figure 3, the degree of mispricing has shrunk. For the orange process in Figure 3 (reflecting inclusion of OoCR's) the mispricing is negative. Both processes move in parallel (except for the points where OoCR's are undertaken).

20. Is it possible to estimate the net impact on member retirement outcomes of all the issues associated with illiquid assets?

This is clearly an important question, but it is a difficult issue to address. This question focuses on members who remain with the fund over the long-term. In this respect it is important to recognise that many of the costs / benefits which accrue to those members taking short-term actions (such as switching or redeeming) are met by long-term members.

At the outset we face limitations. We do not know the true (actual) daily prices of unlisted assets. This limits the ability to undertake ex-post analysis. Further, any calculation of impact is only an estimate, and is based on many assumptions which we discuss further below.

In this setting we identify three areas, detailed in Diagram 5, which make the problem complex and multi-dimensional.

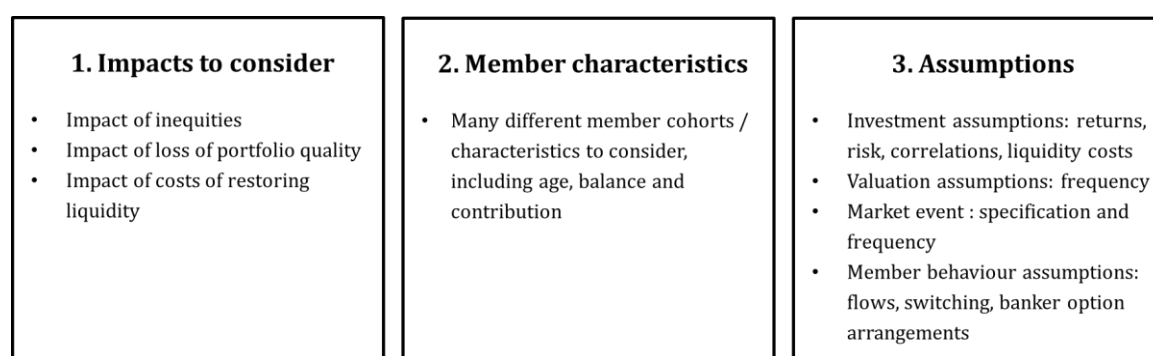


Diagram 5: Three areas which require consideration when modelling the impact of illiquid assets on retirement outcomes.

Considering some of the complexities identified in Diagram 5:

1. Impacts:

- The models developed in this project help to provide some insight into the cost of inequities. We explore this in further detail below.
- It is difficult to estimate the impact of loss of portfolio quality during a crisis event. In a hypothetical closed fund setting long-term investors experience the recovery of portfolio quality; you could argue they simply experience the total long-term performance of the portfolio. Hence, it is necessary to explore the marginal impact of changes in portfolio quality attributable to the flow activities of other fund members. While the models developed in this project help to frame the problem, we consider that further model development is required to explore the issue of quality. The incorporation of time-varying expected returns would assist.
- It is difficult to estimate the impact of liquidity-associated costs during a crisis event. In a hypothetical closed fund setting long-term investors may not need to incur any liquidation expenses. Hence, it is necessary to explore the marginal liquidity costs attributable to the short-term transactional activities of other fund members. We don't assess this cost because we don't incorporate any thresholds (e.g. minimum portfolio quality criteria) which catalyse liquidity expenses. This remains another area for model improvement.

2. Member characteristics:

- The relationship between age, balance and contribution rate is important. The impact of any costs incurred will have a different lifecycle impact on older higher balance members (where future contributions are small relative to present balance) compared with younger low balance members (where future contributions are large relative to present balance).

3. Assumptions:

- Any assessment will be dependent on investment assumptions. Expected returns, risk assumptions, correlations and liquidity costs can all affect measures of portfolio quality and liquidity.
- Valuation assumptions will affect measures of inequity, as illustrated in Case Study 1.
- The assumptions around market events will impact any assessed outcomes. The more aggressive the assumptions the greater the impact on inequities, quality and, potentially, cost during the market event.
- Assumptions relating to member flows will impact the degree to which short-term activities are subsidised by long-term members.

Case study: Initial exploration of impact of inequity on long-term members

In exploring the impact of inequity, we ignore the impacts of portfolio quality and liquidity-associated costs. To initially explore this problem, we make an important simplification:

- We only explore the impact in a crisis environment (our default GFC-style scenario) and ignore the impact in a 'normal' environment. These two scenarios could be combined and weighted by likelihood to estimate total lifetime impact.

Our initial research reveals the following relationships in an extreme environment:

- Inequities:
 - Member switching: in our GFC-style scenario we found that the cost to remaining members of switching members (where switching includes exiting or switching options) exiting at overstated prices was cumulatively 6bp (over 18 months).
 - Banker option provision: in our GFC-style scenario we found that the cost to multi-sector members of funding members redeeming from the single sector illiquid option at overstated prices to be cumulatively 1bp (over 18 months).
 - In normal environments we expect the impact of member switching and banker option provision to generate small positive benefits for members in the multi-sector (banker) option. Positive expected returns mean that the multi-sector unit price is expected to be understated in between valuations.

21. Why make this work open source?

By making this work, including models, open source, we believe it has a better chance of being considered, used, and extended. It may assist any super funds which have not undertaken any modelling in this area.

3. Further questions

Further questions are welcome. These will be included in updated versions of this FAQ document.

Please send to David.Bell@TheConexusInstitute.org.au .