ALLOCATING AND MANAGING ILLIQUID ASSETS THROUGH TIME

A framework for an investor's capacity to harness the benefits of illiquid assets, given significant uncertainity of returns and illiquid asset cashflows.

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CONTENTS

EXECUTIVE SUMMARY

- Allocation to illiquid (private) assets is an important strategic consideration for Railpen that plays a significant role in achieving long-term client objectives. In this note, we focus on the illiquidity aspect of private investments and assess **what level of illiquid assets is strategically compatible with client objectives and circumstances.**

- To be able to evaluate this strategic portfolio choice, we develop a **'Liquidity Allocation and Management Framework'** incorporating key multi-asset portfolio assumptions, client long-term objectives and unique illiquid asset cash flow properties.

- As a foundational principle of the framework, **we recognise that a single 'private asset' label is not sufficient** in describing the unique aspects of the different private investments. We therefore pay particular attention to modelling various types of private asset cash flow patterns and the uncertainty linked to them to better capture the underlying liquidity profile of a given portfolio in a wide range of scenarios.

- Given a range of potential client needs, it is critical to define relevant measures against which illiquidity capacity can be measured. While the exact definition may vary between clients, an overarching goal is having a private asset portfolio with **an acceptable medium-to-long-term risk of being forced to make unattractive and costly portfolio decisions to create needed liquidity**.

- We apply the framework to three illustrative clients to showcase that **assessing illiquidity capacity requires a holistic investment process**. Recognising unique client requirements, ensuring that the illiquid asset portfolio has the commensurate level of flexibility (or "portfolio steerability"), and having the right governance setup to efficiently implement portfolios are all critical components to determining the appropriate level of illiquidity.

INTRODUCTION

Portfolio liquidity risk is a key risk for multi-asset investors, and ultimately their clients, that have meaningful allocations to private markets. However, a typical approach to liquidity risk in the industry focuses on managing the shorter-term risk of running out of money to meet the different types of cash flows during an extremely stressed scenario. This aspect of liquidity management is critically important for any portfolio. However, we think there are also significant benefits to better understanding the longer-term more strategic illiquid asset properties and how they interact with broader client objectives.

To address this, we develop a framework to guide our thinking on what amount of illiquid assets clients can reasonably carry in their portfolios to meet their strategic objectives. The framework incorporates key aspects of a multi-asset portfolio, such as asset expected returns and liquidity profiles of different asset classes, combined with liquidity needs of a particular client. By putting these elements together, we can better evaluate how robust different portfolios are in terms of providing the needed liquidity profile to meet client objectives.

A key feature of the framework is detailed modelling of the individual private market (PM) asset classes that Railpen invests in. This is driven by the fact that different types of illiquid assets have several unique aspects that would be challenging to capture with a single 'private asset' label. An important part of illiquid asset modelling is incorporating investment uncertainty coming through not only fluctuating returns on capital, but also through uncertainty around how that capital is deployed and distributed over time. This cash flow uncertainty plays a crucial role in driving the overall liquidity profile of a given client's portfolio.

We implement the framework exploring three different cases covering distinct illustrative clients: a Railpen closed Defined Benefit (DB) scheme, a Railpen open DB scheme and a "Canadian DB pension fund". An example Canadian DB pension fund is used to illustrate the impact that (generally) net cash flow positivity, stable mandate, and sophisticated implementation can have on an investor's capacity for illiquidity. These case studies illustrate that it is critical to recognise the unique circumstances under which a client portfolio operates. An illiquid asset allocation that is suitable for one portfolio, might be completely unfit for another due to a different configuration of strategic client considerations.

For Railpen, factors such as generally net cash flow negative schemes and continuously evolving strategic client requirements imply a strong need for an illiquid asset allocation that has the commensurate level of flexibility to manage illiquidity vis-à-vis these unique constraints. In comparison, for an illustrative "Canadian pension fund" with a long-term investment horizon and little risk of significant strategy change, a key consideration becomes the need for adequate liquidity reserves to robustly manage the overall portfolio over the long-term and organisational capabilities to manage complex illiquid investment programmes.

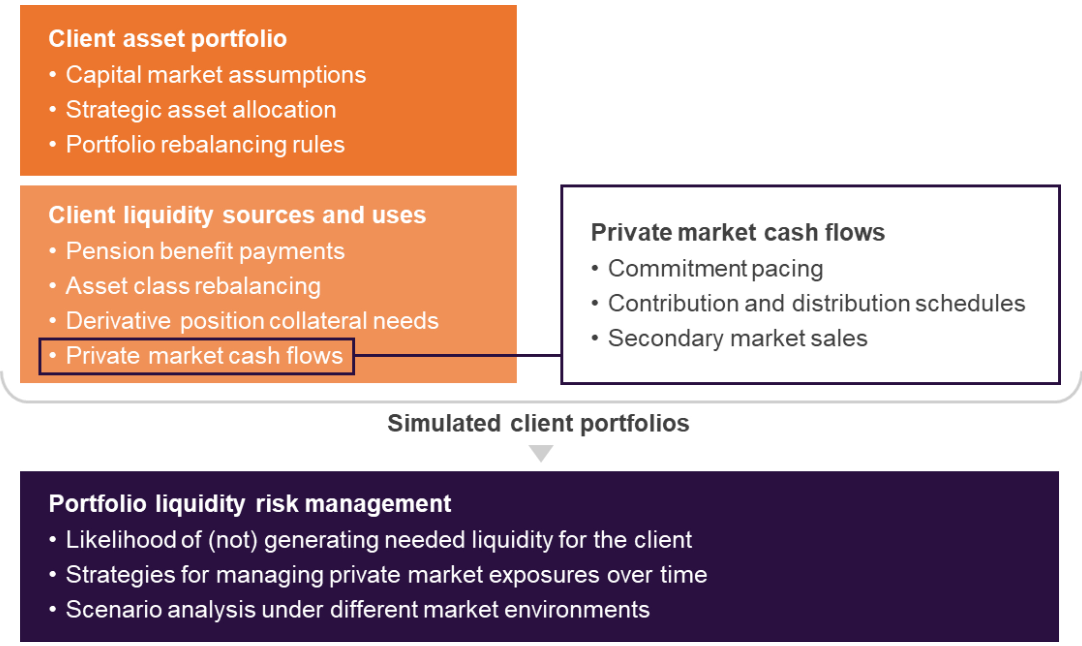
LIQUIDITY ALLOCATION AND MANAGEMENT FRAMEWORK

To be able to assess the liquidity profile of a portfolio and consistently compare it across different types of clients, we bring together several elements to create a coherent framework:

- **Client asset portfolio.** This includes defining the opportunity set, expected returns and risk, client strategic asset allocation and portfolio rebalancing rules. To capture the basic properties of a multi-asset portfolio we model a Public Growth asset class (proxied by public equity), a Matching asset class (proxied by safe fixed income), and a set of private market assets described in detail in the next section.
- **Client liquidity sources and uses.** Each client faces a unique set of liquidity events that we need to explicitly consider. Some of the most important liquidity sources and uses in a multi-asset portfolio context include pension benefit payments, asset class rebalancing, derivative position collateral needs, and private market cash flows.
- **Private market cash flows.** More specifically for private markets, the framework incorporates asset class-specific cash flow profiles to capture unique liquidity characteristics that these investments exhibit.
- **Portfolio liquidity risk management.** The previous three components generate client portfolio dynamics over time for a set of assumptions on asset portfolio, expected liquidity needs and private market cash flows. However, to complete the picture we need to define relevant metrics against which client liquidity is measured, evaluated and managed. The exact measures may differ by client; however, the general principle is focusing on managing medium-to-long-term risk of being forced to make unattractive and costly portfolio decisions to create needed liquidity.

With all the building blocks in place, we can run simulated portfolios to generate a probabilistic assessment of portfolio liquidity and what-if analyses under different assumptions, as illustrated in Figure 1. Using a building block approach allows us to flexibly incorporate specific client liquidity needs and private asset properties as needed.

Figure 1. Liquidity allocation and management framework outline



Private market cash flows

A crucial input in the framework is how private market cash flows and exposures evolve over time. This section provides more detail about the key types of private assets we focus on, cash flow modelling approach and asset class level exposure management.

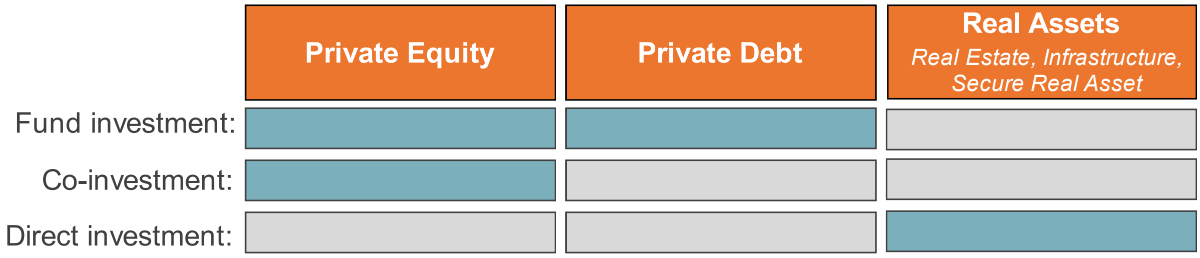
Railpen invests in a range of private market asset classes and uses different investment structures to get the intended exposure. These assets and investment structures can have complex cash flows with commitment pacing, corresponding capital calls, investment returns and distributions driving the overall investment profile. This means that a single 'private asset' label is not sufficient in describing the unique aspects of the different asset classes and structures that Railpen's client portfolios are exposed to. Figure 2 outlines some of the most important differentiators that matter for private market investments.

Figure 2. Select private asset differentiators

To capture these differences, we individually model the main private asset classes that Railpen invests in: Private Equity (PE), Private Debt (PD) and Real Assets (RA), which is further split into Real Estate (RE), Infrastructure (Infra) and Secure Real Assets (Secure RA). Secure RA refers to a long duration lower cash flow risk infrastructure-type asset with little residual value. This type of asset is prevalent in UK DB pension schemes as a part of pension liability cash flow matching strategies[1].

In addition, Railpen currently accesses these asset classes using different implementation approaches which we also reflect in our modelling. As shown in Figure 3, Railpen invests in PE and PD predominantly through indirect structures such as funds and co-investments. In contrast, Real Assets are mostly implemented through a direct ownership of assets.

Figure 3. Railpen's main private asset class investments and their implementation



[1] For more details, see guidance on DB pension matching assets provided by the UK Pension Regulator.

To model these investments, we base our approach on a well-established model by Takahashi and Alexander (2002) that summarises an asset with a parsimonious set of key parameters (described in the next paragraph):

1	$\mathbf{Contribution_t} = \text{Uncalled capital}_{t-1} \times \text{Contribution rate}(\text{Asset age}_{t-1})$
2	$\mathbf{Distribution_t} = \text{NAV}_{t-1} \times (1 + \text{Asset return}) \times \text{Distribution rate}(\text{Asset age}_{t-1},\ \text{Asset lifespan},\ \text{Bow}) + \text{Regular Income}_t(\text{Target yield})$
3	$\mathbf{Distribution\ rate}(\text{Asset age}_{t-1},\ \text{Asset lifespan},\ \text{Bow}) = \left(\frac{\text{Asset age}_{t-1}}{\text{Asset lifespan}}\right)^{\text{Bow}}$
4	$\mathbf{NAV_t} = \text{NAV}_{t-1} \times (1 + \text{Asset return}) + \text{Contribution}_t - \text{Distribution}_t$
5	$\mathbf{Uncalled\ capital_t} = \text{Uncalled capital}_{t-1} - \text{Contribution}_t$

In the model, *Contributions* at time *t* are driven by the amount of *Uncalled capital* a given asset has and *Asset age* (e.g., for fund investments we assume most of the capital typically gets called over the first three to five years, depending on the type of fund).

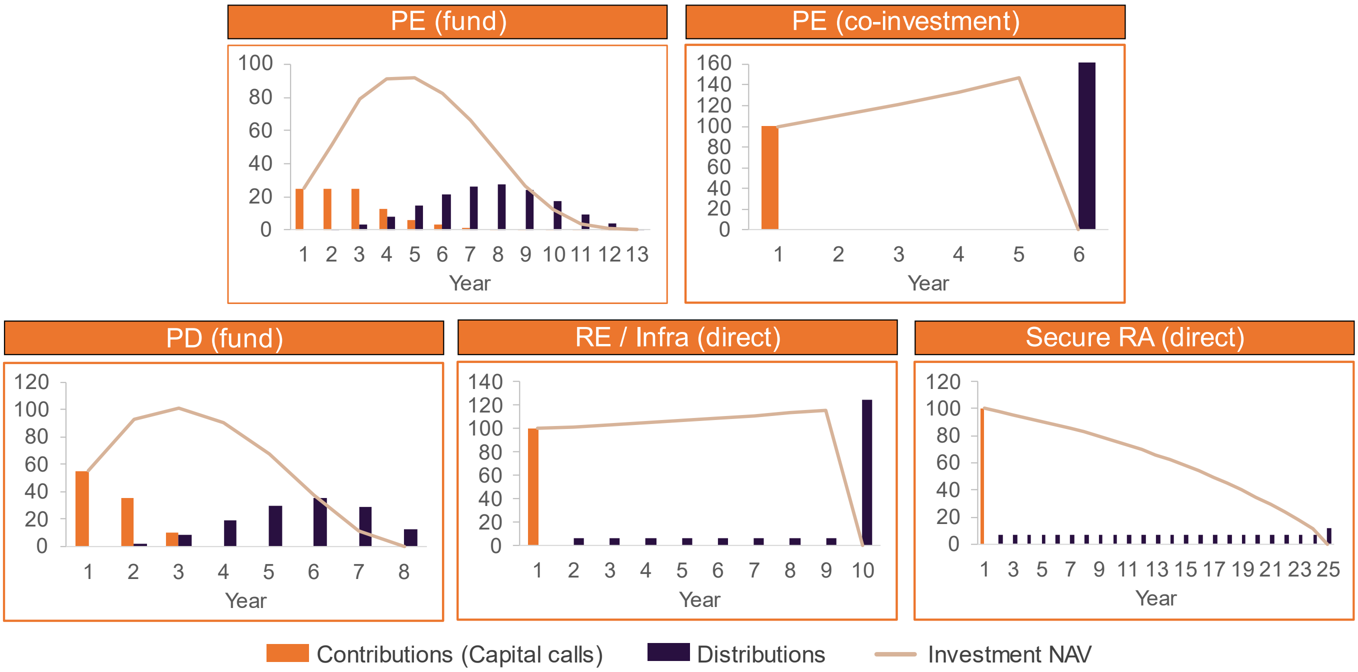
Distributions are driven by *Asset return*, *Asset age* and *Bow* parameter which controls the speed at which capital is returned to an investor (the higher the *Bow* value, the more back-loaded distributions are). We modify the original Takahashi and Alexander distribution function by separately including a *Regular Income* component to accommodate the types of direct assets producing regular cash flow streams.

Net Asset Value (NAV) through time is a function of NAV at the start of the period, *Asset return* in that period and the net cashflow (*Contribution – Distribution*). The net cashflow is assumed to occur at the end of the period.

The resulting base-case asset cash flow profiles for each of the investments are shown in Figure 4. For PE fund investments, capital is deployed over a number of years as a fund's General Partner (GP) calls capital to make new investments. As portfolio assets mature and go through the value-creation phase, capital is returned to the investor resulting in a rather back-loaded cash flow profile. PE co-investments proxy for individual company investments alongside a GP with capital drawn upon a transaction and typically with no/low intermediate cash flows until company exit. A key distinction relative to a fund investment is that an investor has discretion over an investment decision (although much less discretion over a company exit). A generic PD fund has a similar profile to a PE fund, albeit with a somewhat shorter lifecycle typically and potentially some intermediate cash flows through the pass-through of underlying interest payments.

Turning to real assets, for RE and Infra we assume operational investments with capital deployed immediately and intermediate income being generated throughout an investment lifetime. In practice, Railpen develops many of the new real asset investments we make, which adds planning and development uncertainty. However, this is typically a small part of the overall investment programme. An important assumption for these types of assets is that there is an implicit target holding period upon which a scheduled asset sale is executed. In the framework this is treated as a natural source of liquidity as the sale is assumed to be built into the asset investment case. See value creation section. Finally, a Secure RA is assumed to be a fully amortising asset that continuously distributes cash flow over a relatively long horizon with minimal/no residual value at the end.

Figure 4. Base-case private asset cash flow profiles



While Figure 4 illustrates cash flow profiles that are fully determined by a selected parameter set (this includes a fixed asset return), in practice there is a lot of cash flow uncertainty that private market investments exhibit. To address this, we modify the base-case model through a number of adjustments.

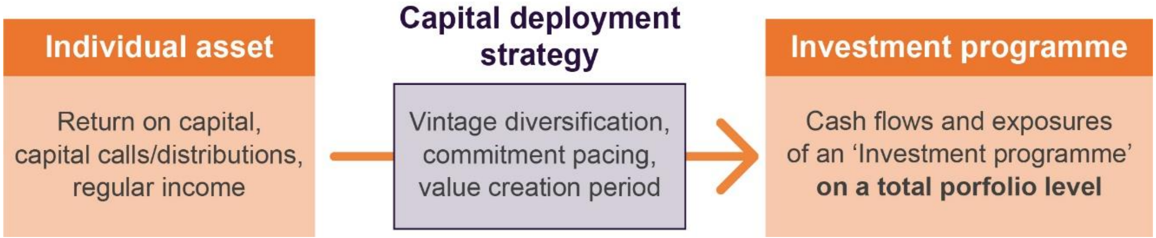
The first adjustment we make is introducing an uncertain investment return ($Asset\ return_t$) which directly impacts how invested capital grows and correspondingly the size of distributed of cash flows. Furthermore, we assume that the actual investment horizon is not fixed for a given asset class and introduce a distribution around the expected investment lifetime. We also recognise the fact that during "market downturns" (e.g., when a public equity market experiences more than a 15% drawdown) distributions from an existing illiquid asset portfolio are likely to slow down. We incorporate this in the model by extending an asset investment lifetime for up to five years relative to the base-case assumption and increasing the bow parameter by a factor of 1.5 which drags out distributions over a longer time frame (See Table 6 in Appendix for more details).

With these changes we introduce some of the uncertainty surrounding how private asset cash flows and exposures evolve over time, which is a critical consideration when managing these assets in practice. These adjustments also allow for additional scenario analysis and a better understanding of how a private market portfolio might behave in, for example, stressed conditions when expected cash flows are not coming through.

Implementing private market investment programmes

The previous section described key characteristics of different individual private assets. To simulate a complete client portfolio, we need a process for implementing a portfolio of investments in each asset class (i.e., an 'investment programme'). How private market portfolios come together is a function of both the underlying characteristics of these assets and investment principles of an investor captured via capital deployment strategy, as illustrated in Figure 5. In this section, we outline some of the key guiding investment principles that matter the most for Railpen's portfolio implementation.

Figure 5. Private asset class portfolio construction process



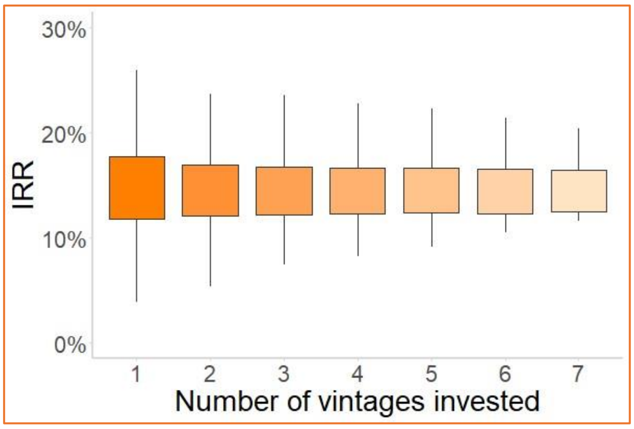
Managing vintage risk with time-diversification

A key consideration for robust private market programme implementation is the level of investment diversification over time. One of the common ways of measuring this is the level of vintage diversification, i.e., the spreading of capital deployment over time to have portfolio investments that are exposed to different economic and market environments.

As Figure 6 illustrates, ability to consistently deploy capital over a number of years is critical to limit the vintage-specific risk and ensure that an investment programme captures the underlying fundamental asset class performance.

However, at the same time the portfolio needs to have an appropriate level of flexibility to manage private asset allocations over time. In other words, there is an implicit trade-off between having a more time-diversified implementation of private markets, and being able to adjust exposures quicker. In the framework, we balance this trade-off through commitment pacing assumptions.

Figure 6. Historical US PE buyout fund performance dispersion



The chart shows US PE Buyout fund realised IRR dispersion for investment programmes with different levels of vintage diversification over a seven-year investment period. Based on data from 1995 to 2022. Reader should focus on dispersion rather than absolute levels of return due to likely survivorship bias. Source: PitchBook.

We reflect this trade-off for the different types of investor goals as shown in Table 1. For an investor seeking to maintain a stable allocation over time, we assume fairly stable commitment pacing to ensure the appropriate level of vintage diversification with some level of flexibility to manage allocations over time.

We assume more flexibility in pacing for an investor transitioning to a new target allocation so that it can be achieved within a reasonable timeframe.

We also consider an investor looking to fully liquidate their illiquid exposures, in which case the composition of the private market portfolio becomes a secondary consideration and therefore the investor does not commit new capital anymore and is in a 'run-off' mode.

Table 1. Commitment pacing assumptions

Goal	Commitment
Maintain a steady state allocation	Vary commitment level between **75-125%** of steady state level when portfolio weight is 2pp above/below target; aim for minimal vintage risk, robust market relationships, with ability to capture dislocation opportunities.
Move to a new target allocation	Vary commitment level between **50-150%** of steady state level when portfolio weight is 2pp above/below target; need more flexibility to get to a new target but also want to maintain quality of portfolio once there.
Fully liquidate allocation	**0%** commitment level to achieve full liquidation of the portfolio; portfolio composition is a secondary consideration.

Steady-state commitment level corresponds to a fixed share of NAV committed to new investments each period to maintain a stable portfolio allocation over time.

Commitment pacing is mostly relevant for fund investments that require multiple periods of time to deploy capital. For direct investments, we assume that deployed capital is equal to new commitments in each period, i.e., commitments are drawn fully at the initiation of a new investment. New direct investments are made when an asset class portfolio weight goes below a specified threshold and we assume that a limited number of new investments can be made in each period. This reflects the fact that it takes time to source and execute new investments and, as a result, getting back to strategic target is a multi-period process.

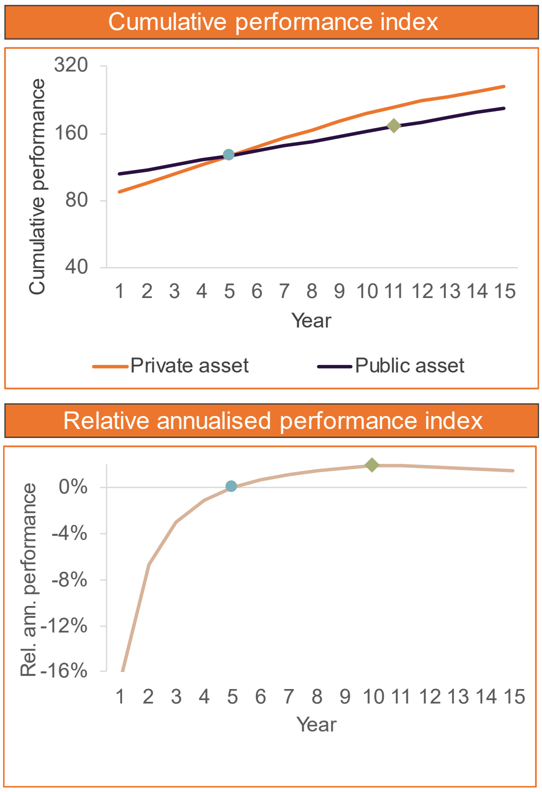
The importance of identifying the value creation period

In addition to vintage diversification, strategy implementation should also be commensurate with an investor's views on how private assets create value relative to an equivalent public asset[2]. Equivalence can be challenging in some markets that offer very different return drivers to public markets. For assets like infrastructure the public market equivalent might be a mixture of equity and credit with a broadly similar level of absolute risk.

Figure 7 provides a general example comparing how asset value might develop for a comparable public and private asset. The public asset generates a consistent return profile over time implying that a decision to liquidate it can be made at any point in time without impacting holding period return[3].

In contrast, the private asset performance typically has a "J-curve" (driven by e.g., setup costs, management fees and other expenses) which implies that initially the private asset would underperform the public one, assuming there are no other differences in investment characteristics. However, as the value creation phase progresses the private asset takes over (blue point) and annualised performance relative to the public asset peaks at Year 10 (green point) in this example.

Figure 7. Illustrative private asset value creation schedule



[2] The relative value creation is predicated on an assumption that a private asset has a positive excess return over a comparable public asset; it is often referred to as an "illiquidity premium".
[3] This focuses on average asset return, and abstracts from market volatility which would impact holding period return.

This dynamic illustrates that even if it is *possible* to liquidate a private asset on a secondary market at any point in time, it is not necessarily compatible with generating maximum value from the investment, especially when considering the opportunity cost relative to a public market asset.

In the framework we capture this by assuming that the investment cases for certain private assets play out over a pre-defined number of years and therefore they are not available for sale over that period (the first 10 years of the investment in the example) in the baseline framework implementation.

APPLYING THE FRAMEWORK

To complete the framework and to be able to assess client capacity for illiquidity, we need to define relevant client requirements that impact their illiquidity tolerance. As Figure 8 illustrates, the capacity for illiquidity is a function of multiple client-specific factors including investment horizon, probability of strategy change, regular liquidity needs (size, variability and how critical they are to the mission), willingness/ability to transact on the secondary market and capacity for operational complexity.

Figure 8. Factors influencing client capacity for illiquidity

Increasing capacity for illiquidity →

Investment horizon	Shorter	Longer
Probability of strategy change	Higher	Lower
On-going liquidity needs	Higher	Lower
Secondary market transactability	Weaker	Stronger
Operational complexity capacity	Lower	Higher

Given a set of unique circumstances that a client faces, their private asset portfolio should have an appropriate level of strategic “portfolio steerability” to correspond to these needs. As it is clear from Figure 8, what constitutes an appropriate level of the “portfolio steerability” might differ a lot between clients. To showcase these potential differences in capacity for illiquidity, we pick three distinct types of illustrative clients to apply the framework to:

1. **Railpen closed DB scheme**: a cash-flow negative scheme closed to new entrants with a key long-term objective to lock-in its members’ benefits through e.g., a buyout transaction with an insurance company. This type of transaction typically requires having a fully liquid portfolio, implying a shrinking illiquid asset investment horizon. As a result, for this type of client we focus on the likelihood that private asset exposure can be liquidated smoothly (e.g., without relying on unscheduled secondary market sales) over a pre-defined period of time. This illustrative client might also be relevant for a closed DB scheme looking to ‘run-on’ but wanting to maintain flexibility to transact with an insurer in the future.

2. **Railpen open DB scheme**: a slightly net cash-flow negative scheme still open to new entrants. Open schemes have a longer investment horizon than closed schemes and therefore have the ability to hold more illiquid assets (i.e., there is no imminent point at which these assets need to be sold). However, this does not imply an unlimited illiquidity budget. One key criteria for an open scheme is having an illiquid asset allocation that can be robustly managed on a steady-state basis with an appropriately setup governance and implementation model. This entails thinking what level of portfolio churn, relative risk, and portfolio diversification are required to have a robust portfolio. An open scheme may also be exposed to a non-trivial probability of a strategy change (e.g., scheme closure). This implies a need to have an illiquid asset allocation that permits timely transition to a new target.

3. **"Typical Canadian DB pension fund"**: a net cash-flow neutral/positive fund open to new entrants with a long investment horizon, similar to a Railpen open scheme. However, we assume that it does not face a material risk of an externally imposed strategy change which allows it to pursue a current investment strategy with greater certainty. As a result, setting the appropriate level of illiquidity is primarily based on having sufficient liquidity reserves to robustly manage the overall portfolio. Canadian pension schemes also typically have sophisticated implementation models with more exposure to direct assets and a greater ability to proactively transact on secondary markets if needed.

Framework case studies

Client portfolio setup

In this section we apply the framework for the three illustrative clients introduced previously: a Railpen closed scheme, a Railpen open scheme and a "Canadian pension fund". We run the analysis with Public Growth, Matching and six types of private market assets introduced in the previous section. We simulate client portfolios over a 10-year horizon with quarterly frequency using Railpen capital market assumptions (summarised in Table 5 of Appendix).

We set portfolio objectives for the illustrative clients to reflect the specific circumstances they face. For the closed scheme we assume that it has a goal to liquidate the entire private market exposure over a 5-year horizon to get buyout-ready. For the open scheme, we explore two portfolio objectives. With the first one we aim to run a steady-state target exposure with adequate portfolio metrics. The second one recognises the risk of significant strategy change and assumes that a scheme needs to move to new lower target illiquid exposure over a 5-year horizon. The "Canadian pension fund" has a goal to maintain a high steady-state illiquid exposure while keeping enough liquidity reserves to ensure smooth overall portfolio functioning[4].

Corresponding to different general risk tolerances, the illustrative clients also run different private market portfolios. The principal difference is that the closed scheme has the largest allocation to Secure RA (typical in the UK) while the open scheme and the "Canadian pension fund" are tilted more toward riskier private investments. The asset mixes selected are based on Railpen's current approach and a review of typical allocations for Canadian pension schemes, but the analysis could easily be adapted for different strategic asset allocations. We assume stable, mature portfolios for all private asset classes at portfolio initiation. Figure 9 summarises the private market portfolios implemented in the framework, scaled to 100% for easier comparison.

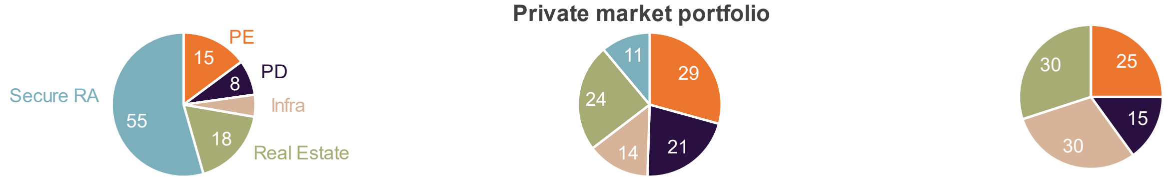
[4] This is vitally important for Railpen DB schemes too. However, it is less critical for setting their illiquidity capacity given higher liquid asset reserves than the illustrative "Canadian pension fund".

Finally, to better understand how different levels of illiquidity impact client outcomes, we test a range of alternative private market allocations in a client's total portfolio. For instance, for the closed scheme we run four different portfolios with a private markets allocation ranging from 10% to 30% of the total portfolio. Of course, in practice it is too late for these schemes to materially adapt their private markets allocations but this might give some insight into the impact of an open DB scheme closing and needing to run-off with the "wrong" private market programme from a liquidity perspective.

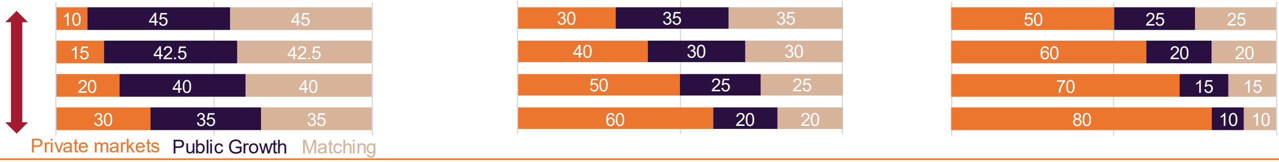
Figure 9. Private market portfolio setup for the illustrative clients

Railpen closed scheme	Railpen open scheme	"Canadian pension fund"
	Portfolio objectives	
- Able to liquidate entire private market exposure over a 5-year horizon (e.g., getting buyout-ready).	- Maintain target exposure with adequate portfolio metrics. - Be in a position to move to new target exposure over a 5-year horizon (e.g., strategy change).	- Maintain target exposure with appropriate liquidity buffer to ensure smooth overall portfolio functioning.

Private market portfolio



Alternative total portfolio allocations



Railpen closed scheme

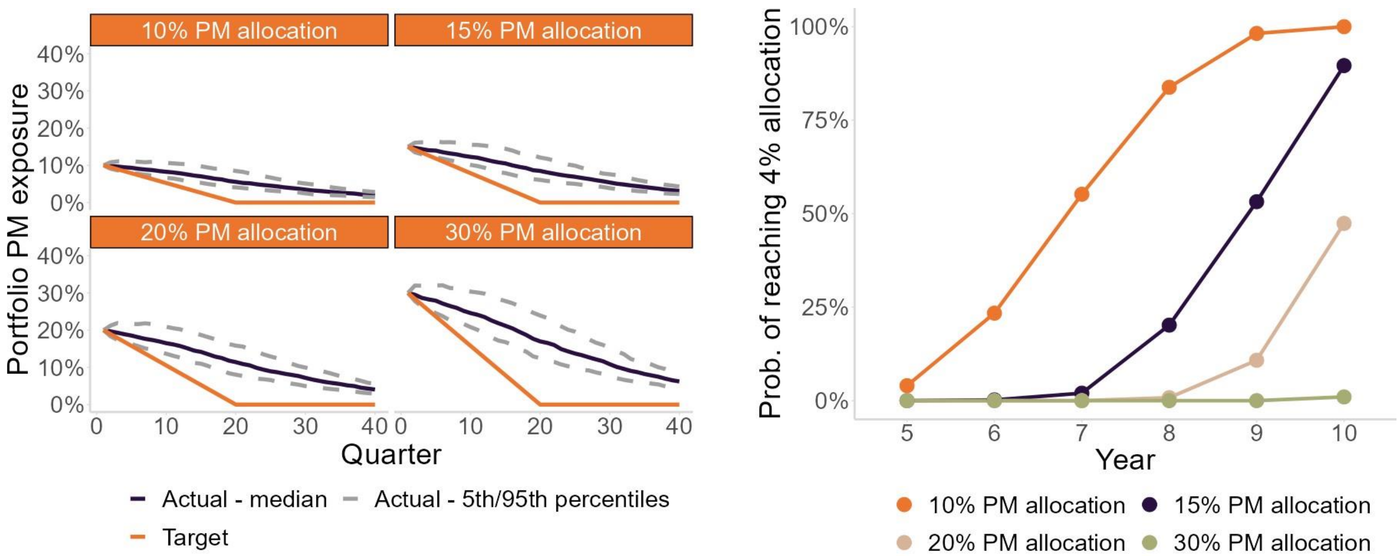
In the closed scheme analysis, we run a portfolio with a goal to liquidate the entire private market exposure within a 5-year horizon. In this scenario, we assume that no new capital is committed, and exposure is run-down through naturally occurring liquidity. As Figure 10(a) illustrates, in the absence of secondary sales, fully liquidating the portfolio in 5 years is not achievable. It is not surprising since we assume that a closed scheme portfolio is heavily exposed to Secure RA investments which on average have longer duration cash flows. This implies the need to either extend the transition period or tap into secondary markets to create the needed liquidity.

Figure 10(b) provides more detail on how the likelihood of running the private market exposure down to some minimum acceptable level (for illustration we assume 4% of the total portfolio) changes with the extension of the transition period. While for moderate allocations of up to 20% the likelihood increases significantly by extending the transition time frame, it highlights that for larger starting allocations, achieving the needed liquidity just through naturally occurring liquidity is still most likely out of scope and is fundamentally not compatible with client liquidity requirements.

Figure 10. Transition to fully liquid portfolio for illustrative Railpen closed scheme

(a) Portfolio private market exposure transition paths

(b) Probability of transitioning private market exposure to minimum acceptable level



We build on these results further and relax the "no secondary sales" condition to assess an expected portfolio cost in a scenario where all the remaining exposure is liquidated on the secondary market at different transition points. To calculate this cost, we need to incorporate NAV discounts[5] that different types of assets would be transacted at. While each private asset is unique, we assume an average discount that a typical asset would have in normal and "stressed" conditions based on previous research and our investment teams' expert judgement as shown in Table 2. The discounts shown generally assume that the investments would be considered "tier 1" investments that would be attractive to a potential buyer. Very old private market vintages or "tier 2" real assets are often difficult and costly to sell.

Table 2. NAV discount assumptions for secondary market transactions

	NAV discount to transact on secondary market under:	
	Normal conditions	"Stressed" conditions
Private Equity	15%	30%
Private Debt	5%	10%
Infrastructure	5%	10%
Real Estate	2%	5%
Secure Real Asset	5%	10%

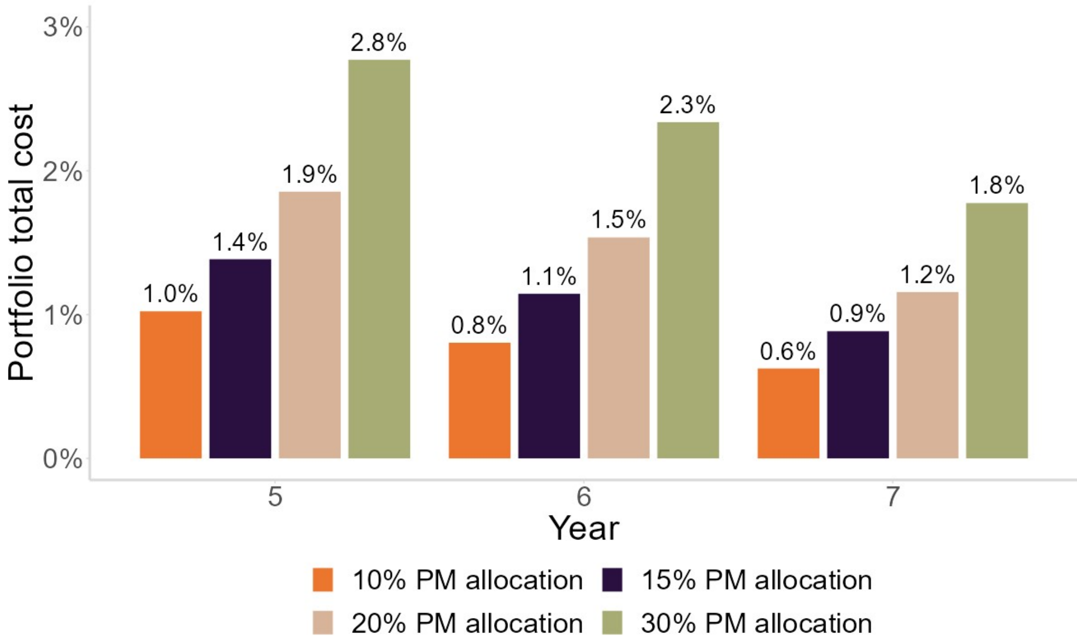
Stressed conditions refer to simulation periods with a public equity annual market drawdown of at least 15%.

By combining the NAV discounts with the remaining illiquid exposures at different points of the transition, we can estimate total expected portfolio costs as shown in Figure 11. For example, if private assets are fully liquidated at Year 5 of the transition, the estimated portfolio cost is significant – the required "break-even" excess return over public markets to justify holding private assets in the first place is approx. 2% p.a.

[5] This includes both the typical valuation discount and transaction costs incurred in a secondary market transaction.

The estimated portfolio cost drops significantly with the extended transition horizon due to the fact that more illiquid exposure is naturally run down. This illustrates that the assumed level of private investment benefits (e.g., excess return over public markets) and the transition period can have significant implications for how much illiquidity a portfolio can reasonably contain. In some cases, the benefits of investing in private markets might be offset and potentially *reversed* by the need to pursue needed liquidity on the secondary market.

Figure 11. Total estimated portfolio cost to liquidate illiquid exposures at different times



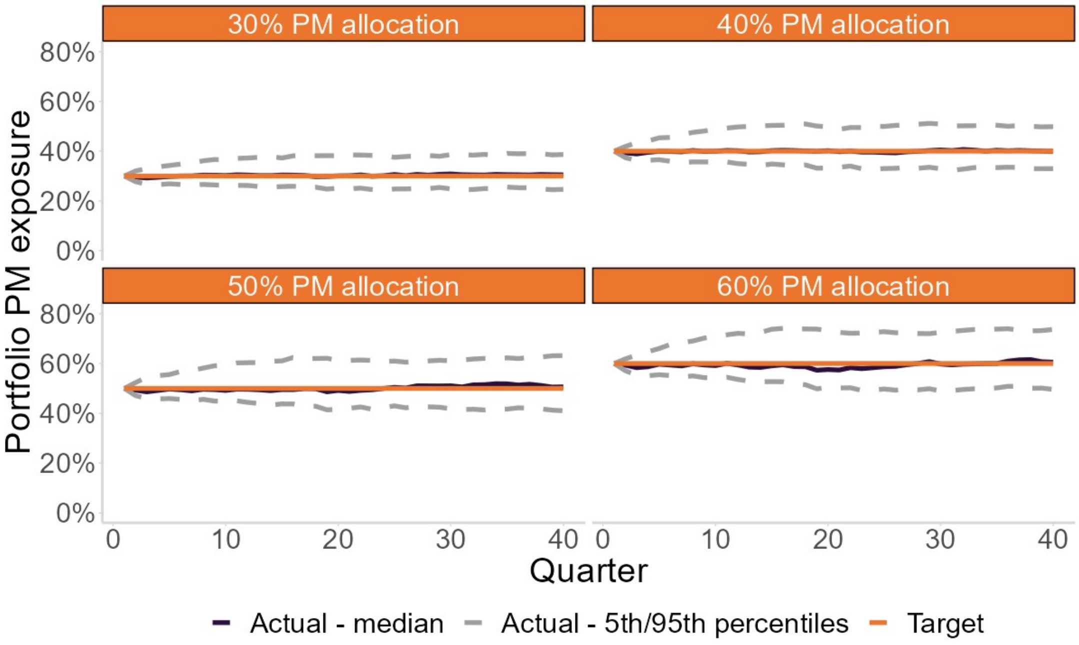
An important additional lever for multi-client pension schemes, such as Railpen, is the ability to potentially take advantage of an internal market for illiquid assets. The internal market could be particularly helpful for mature closed schemes in exiting their illiquid investments[6]. Operationalising this concept requires considering several factors such as fair treatment of clients, internal transaction pricing principles and the relative distribution of internal liquidity providers and users.

Railpen open scheme

We first look at an open scheme on a steady-state basis, i.e., maintaining target private market exposure over time. As Figure 12 illustrates, while private market allocation is close to target on average for all alternative portfolios, increasing exposure to private markets naturally leads to higher dispersion around target in adverse scenarios.

[6] We illustrated this in Figure 10(b) by setting the 4% minimum acceptable level of illiquidity for a closed scheme with an implicit assumption that the remaining illiquid exposure could be liquidated on Railpen's internal market.

Figure 12. Steady-state allocation for illustrative Railpen open scheme



To complement the analysis, Table 3 shows key portfolio management metrics. Correspondingly to Figure 12, it shows that for portfolios with higher illiquid market exposures, the overall allocation can drift significantly further away from target. At the same time, the probability of needing to adjust the base-case commitment pacing also goes up for these portfolios. While this helps bring exposures closer to target, having to frequently vary commitment pacing can introduce some vintage risk, negatively impact market relationships, and generally requires a more sophisticated implementation and governance model. Our research indicates that private market allocations approaching 50% would require almost constant (67%) varying of commitment pacing to prevent the illiquid exposures from drifting too far away for the target.

Table 3. Portfolio management metrics for illustrative Railpen open scheme

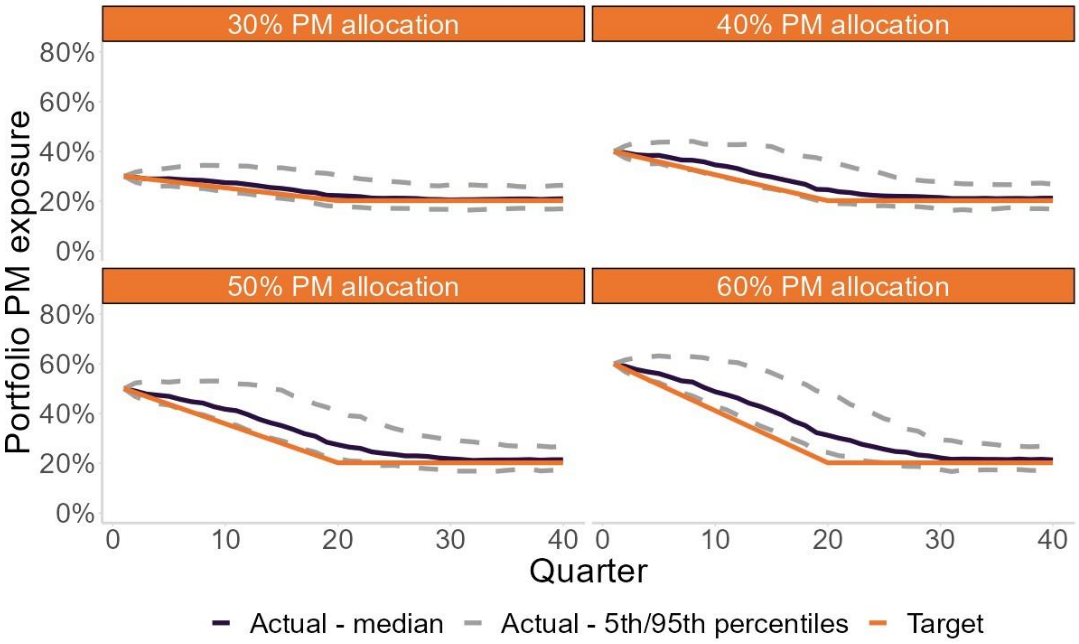
Steady state PM allocation	Portfolio turnover	PM relative weight – 95th percentile	Probability of adjusted commitment pacing
30% allocation	11.6%	+7.7%	38%
40% allocation	15.3%	+9.6%	57%
50% allocation	19.1%	+11.0%	67%
60% allocation	22.8%	+12.3%	76%

"Portfolio turnover" is defined as (Calls + Distributions) / Total NAV. "Probability of adjusted commitment pacing" shows the percentage of time commitment pacing had to be adjusted from its baseline level to manage exposure closer to target.

While the steady-state portfolio is important, the ability to steer the portfolio to adjust to a new strategic allocation is also highly relevant for an open scheme. Therefore, we now switch to a hypothetical scheme closure scenario that requires the scheme to transition to a new 20% private market allocation over five years in preparation for run-off. Figure 13 shows that in normal conditions managing down to the new target in expectation can be achieved with a starting allocation of up to 40% as the median path for this portfolio falls quite close to a new target allocation.

However, in stressed conditions (e.g., the 95th percentile outcome in terms of illiquid asset overallocation) the residual private market exposure can remain significantly above the new target. We think that planning for the stressed scenarios (e.g., considering relative risk tolerances and keeping options to create extra liquidity via different means) should be an integral part of the illiquid investment strategy and will ultimately influence what the most suitable illiquid asset allocation is for a given investor. Our research shows that stability of mandate is very important for maintaining high exposure to illiquid assets, which might have implications for Boards, sponsors, and even regulators.

Figure 13. Transition to new asset allocation for illustrative Railpen open scheme



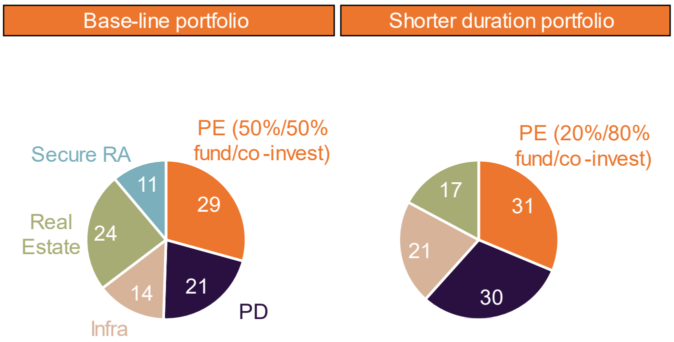
While the overall size of illiquid asset allocation is the most important variable to set, the illiquid asset mix for a given level of illiquidity is another lever that can be utilised to manage against a client's capacity for illiquidity. We highlight this by continuing with the previous scenario where an Open scheme aims to transition to a new 20% private market allocation.

We compare two portfolios that both start out with the 60% overall illiquid asset exposure in the total portfolio but have different illiquid asset mixes. We introduce a shorter duration illiquid asset mix by reallocating away from Secure RA and PE fund investments to Infrastructure and PE co-investments as outlined in Figure 14(a).

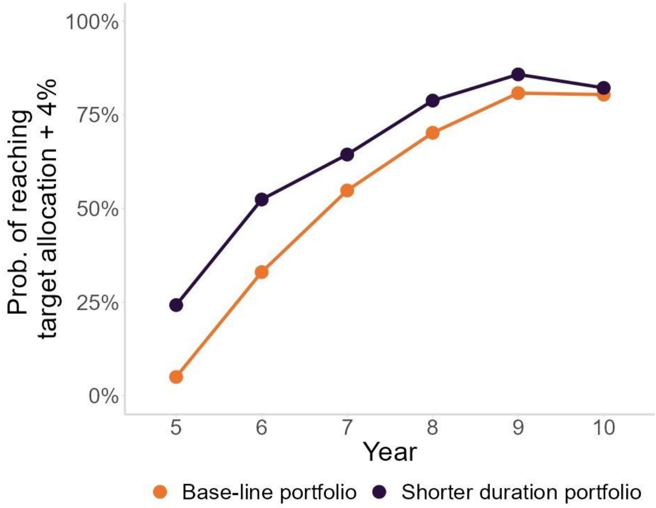
The impact of the alternative illiquid asset composition can be seen in Figure 14(b). The shorter duration portfolio exhibits a considerably higher probability of reaching the new private market allocation target compared to the base-line portfolio. This shows that thinking about a fitting asset mix alongside the overall level of illiquidity level can play a role in designing the appropriate illiquid asset strategy.

Figure 14. Illiquid asset mix impact on reaching new PM allocation target for illustrative Railpen open scheme

(a) Private asset mix alternatives (assuming a 60% PM allocation in the total portfolio)



(b) Probability of transitioning private market exposure to minimum acceptable level



The appropriate illiquid asset allocation for a pension scheme, both in terms of size and asset mix, should correspond to the governance model that a given investor operates under so that the chosen strategy is robustly executed and managed. Working with our Board, at this time we have concluded that the open DB schemes we manage at Railpen with strong sponsors and visibility of mandate could allocate up to 40% in a well-diversified illiquid asset portfolio in steady-state conditions. This level of allocation would be consistent with acceptable levels of portfolio drift and capital deployment variation over time while on average also allowing for a transition to a new lower strategic illiquidity target under a hypothetical strategy change scenario.

"Canadian pension fund"

We finally look at a hypothetical "Canadian pension fund" which we assume has a long investment horizon with little risk of significant strategy change. As a result, it aims to maintain a large steady-state illiquid allocation while also keeping adequate liquidity to ensure smooth overall portfolio functioning. This reflects the fact that there is a range of portfolio liquidity events that exhibit varying degrees of uncertainty on the size and timing that a prudent investor must plan for. We capture this consideration via a "required liquidity buffer" measure:

$$\begin{aligned} \textit{Liquidity buffer}_t &= \textit{Expected benefit payouts}(n\ \textit{periods})_t + \textit{Coverage ratio}_{UC} \times \textit{Uncalled capital}_t \\ &+ \textit{Coverage ratio}_{\textit{Growth Rebal}} \times \textit{Portfolio NAV}_t \\ &+ \textit{Coverage ratio}_{\textit{Derivative Pos}} \times \textit{Matching NAV}_t \end{aligned} \quad (6)$$

The measure specified in Equation 6) includes some of the main liquidity events that this type of investor might be exposed to such as expected pension benefit payments, private market capital calls, asset class rebalancing and margin calls on derivative positions (e.g., currency hedging). The Matching NAV is used for derivative liquidity events as it is the primary source of liquidity in this illustrative setup. This can be thought of as a general liquidity pot not invested to deliver excess returns. Depending on a particular portfolio it could incorporate other relevant liquidity uses such as LDI collateral management or allowance for pension scheme member switching.

The liquidity buffer assigns coverage ratios to each liquidity event so that the portfolio has enough liquidity to cope with a wide range of scenarios. For instance, while an investor may receive capital calls equalling 10% of uncalled capital each period on average, they might budget 1.5x of this amount in the liquidity buffer. This would enable the investor to cover unexpected cash outflows without causing undue stress on the overall investment processes. It is common to stack the liquidity events and assume no diversification benefit but in practice this is another source of prudence in the approach.

Table 4 shows how often required liquidity buffers are breached across a few illustrative portfolios running high illiquid asset allocations. To better gauge the underlying liquidity risk of a portfolio, we apply different stringency levels to liquidity buffer measures.

Across all liquidity buffer measures an investor allocating up to 60% in illiquid assets has not exhibited liquidity buffer failures and a 70% illiquid portfolio has experienced a low liquidity buffer failure rate for the most conservative measure. In contrast to these portfolios, moving to an 80% allocation starts posing significant challenges to maintaining required liquidity reserves in this example. A highly illiquid portfolio with significant liquidity needs such as extensive currency hedging programmes (rightmost column) would be almost constantly below the required liquidity buffer[7].

Table 4. Required liquidity buffer failure rates for different illiquid allocations

Steady state PM allocation	Items covered under liquidity buffer:			
	Uncalled Capital (Low coverage ratio_{UC})	Uncalled Capital (High coverage ratio_{UC})	Uncalled Capital + Growth Rebal	Uncalled capital + Growth Rebal + Derivative Position
50% allocation	0%	0%	0%	0%
60% allocation	0%	0%	0%	0%
70% allocation	0%	0%	0%	1%
80% allocation	4%	31%	50%	79%

Low coverageUC / High coverageUC ratio assumes a 1.5x / 2.5x coverage relative to average capital call. Growth Rebal assumes a buffer for Growth/Matching rebalancing event with a 2pp rebalancing band. Derivative Position assumes that 30% of Matching allocation is designated for collateral management and is unavailable for other uses. All measures also include expected pension benefit payments. Green/orange/red cells indicate values equal to 0%/falling between 0% and 20%/greater than 20%.

Once a liquidity buffer is drawn-down it needs to be recapitalised. This can put a further strain on the portfolio and can result in a skewed asset allocation, particularly if the liquidity event persists. A more sophisticated approach to liquidity buffer modelling would capture the recapitalisation rules an investor typically pursues to ensure the scheme remains solvent and that the asset allocation is within tolerances, even as the liquidity event persists.

[7] These findings are broadly consistent with the observed typical Canadian pension fund illiquid asset allocations that generally go up to 70% in illiquid assets.

Liquidity risk management trade-offs

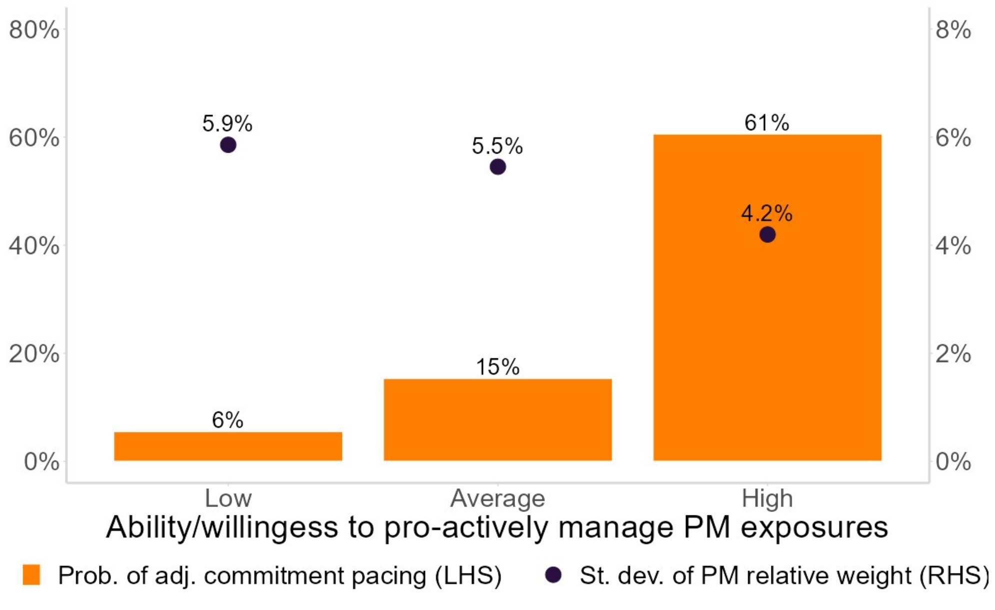
While the overall illiquid asset allocation is a foundational portfolio decision, we also note that there are multiple ways a given allocation can be implemented and managed. We use the "Canadian pension fund" to illustrate this point. We assume the fund runs a 60% illiquid allocation but implements it in different ways. We contrast how a portfolio can trade-off between relative allocation drift and willingness to change capital deployment pacing by varying the portfolio rebalancing band and commitment pacing parameters.

As Figure 15 shows, an investor preferring to rebalance less and have a more stable capital deployment programme (the leftmost bar), is set to run relatively larger deviations from the strategic target. The standard deviation around the 60% target is +/- 5.9%. This might be appropriate for an investor with lower governance or a strong desire to maintain market relationships through regular, consistent commitments to private markets strategies.

On the other hand, a very pro-active investor having a tighter rebalancing band and frequently varying capital deployment over time (the rightmost bar), can lower the relative exposure drift by approx. 30% relative to the more passive approach: the standard deviation around the 60% target is +/- 4.2%.

This illustrates the importance of considering the overall strategic portfolio illiquidity level in tandem with the implementation that is compatible with investor-specific preferences and ability to manage illiquid allocations.

Figure 15. Portfolio metrics for different rebalancing implementations



We assume that an investor with a high/average/low ability to pro-actively rebalance applies a 1pp/2pp/4pp rebalancing band for PE portfolio, a 2pp/4pp/6pp rebalancing band for PD portfolio and varies base-line commitment pacing by up to 60%/30%/10%. Assumed illiquid asset allocation split is 50% in PE/PD and 50% in direct RE/Infra/Secure RA.

Practical framework considerations

In the previous section we outlined some case studies that zoom in on elements that we think are most relevant for Railpen when thinking about client capacity for illiquidity. Naturally, these elements are likely to vary across different investment organisations. We therefore summarise some of the most important general considerations for operationalising the framework when designing, assessing, and managing different illiquid asset investment strategies:

- **Incorporating uncertainty of illiquid asset cash flows** is critical to appropriately assess capacity for illiquidity**.** Combining this with an incremental multi-period illiquid asset pacing process allows more robustly model expected distribution of illiquid asset drift over time. Managing this uncertainty requires thoughtfully considering a reaction function to being over- or under-exposed to illiquid assets in terms of commitment pacing or usage of secondary markets.

- **Assessing different sizes of illiquid assets and asset mixes** requires relevant portfolio management measures that reflect organisational risk tolerance and investment beliefs. In the framework we outlined willingness/ability to vary commitment pacing or acceptable probability of not transitioning to target illiquidity level as a few examples. These, or other more relevant metrics for a given client, could be incorporated in the overall SAA process. A comprehensive illiquid assets framework should incorporate metrics for both funding liquidity and market liquidity (portfolio steerability) risks.

- **Any illiquid asset investment strategy should be closely linked** to portfolio implementation. Key aspects to consider include pro-active commitment pacing, working closely with illiquid asset investment teams to regularly review assumptions and pipeline, and ensuring there is an aligned set of assumptions across the organisation on value creation period, including the discipline to sell. There is a vital cultural element to this that this research process has helped Railpen develop.

KEY TAKEAWAYS

Allocation to illiquid assets is an important strategic consideration that depends on a unique set of circumstances that a given investor faces. To address this strategy choice, in this note we have outlined a framework to help guide strategic thinking about the amount of illiquidity that would be commensurate with long-term client objectives. A better understanding of illiquidity capacity for a given investor should serve as an additional lens to portfolio construction – complementing the more standard risk and return considerations.

It is critical to recognise that a single ‘private asset’ label is not sufficient in describing the unique aspects of different private investments. Private assets have a number of unique properties (in terms of e.g., investment horizon, cash flow profile, discretion over investment decisions, and ability to transact on the secondary market), a combination of which has direct implications on how to manage portfolio liquidity. We therefore pay particular attention to modelling various types of private asset investment profiles and cash flow uncertainty emanating from them to better capture the underlying liquidity profile of a portfolio.

We apply the framework to three illustrative clients:

- Railpen closed DB scheme
- Railpen open DB scheme
- “Canadian DB pension fund”

These three illustrative clients have different long-term objectives, asset mixes, implementation models and risk tolerances, which in turn drive their underlying capacity for illiquidity. While the exact measures defining the appropriate illiquidity level may differ across clients, an overarching principle is ensuring that a private asset portfolio exhibits an acceptable and well understood medium-to-long-term risk of being forced to make unattractive and costly portfolio decisions to create needed liquidity.

For a typical closed scheme with a goal to fully liquidate the portfolio, it is critical to have a sufficiently long runway to smoothly manage the exposure down, coupled with the ability/willingness to tap into the secondary market if needed. When designing a portfolio for an open scheme, it is important to maintain high-quality private market investment implementation while also being in a position to steer the allocation to a new target in the case of a significant strategy change. Finally, while the hypothetical “Canadian pension fund” is potentially a less constrained investor due to the stability of mandate, illiquidity capacity should also be considered for portfolios with high illiquid asset allocations. We illustrate how liquidity buffers designed to withstand various portfolio liquidity events can help determine the appropriate level of illiquid asset exposure.

There are common threads running across all these client case studies. Taking into account client-unique objectives, constraints, opportunity sets and implementation approaches should play a crucial role when evaluating capacity for illiquidity. Any potential illiquid asset allocation should link up with these specific client requirements to deliver a portfolio that has the needed level of portfolio steerability and remains solvent in even extreme circumstances. Ultimately, capturing all these considerations requires having the appropriate governance model through which client investment strategy is effectively linked to illiquid asset investment implementation. We believe that the outlined framework can be a useful tool in addressing some of these issues when designing illiquid asset investment strategies.

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APPENDIX

Long-term capital market assumptions

Table 5. Capital market assumptions used in modelling

	EQ	FI	PE	PD	RE	Infra	Secure RA
E(r)	8.1%	3.9%	10.3%	8.7%	6.5%	6.5%	5.5%
EQ	18.4%						
FI	0.1	7.2%					
PE	0.7	0.0	21.8%				
PD	0.6	0.1	0.7	14.7%			
RE	0.6	0.0	0.4	0.3	14.1%		
Infra	0.5	0.1	0.3	0.3	0.4	14.2%	
Secure RA	0.6	0.3	0.4	0.4	0.6	0.9	7.9%

Key assumptions for private asset modelling

Table 6 summarises the key assumptions for each private asset class. Return volatility assumptions are presented on a de-smoothed basis to capture the underlying economic risk. These are the same as shown in Table 5 but are included below for completeness. In the framework, to reflect the lagged and appraisal-based valuation effects that occur in practice, we smooth returns for private market assets over 4 quarters to estimate how the investment exposures might develop relative to public markets.

Table 6. Key private asset modelling assumptions

Asset class	Investment horizon	Return / Volatility	Bow parameter	Cash flow distribution profile
Private Equity (fund)	11-15 years	10.3% / 21.8%	2.8	No regular income; back-loaded distributions driven by age, inv. horizon and bow parameters
Private Equity (co-investment)	4-8 years		100	
Private Debt (fund)	6-10 years	8.7% / 14.7%	2.6	Interest income in the intermediate; back-loaded principal distributions
Infrastructure (direct)	5-11 years	6.5% / 14.2%	100	Regular income yield; residual NAV liquidated at end of inv. horizon
Real Estate (direct)	7-13 years	6.5% / 14.1%	100	Regular income yield; residual NAV liquidated at end of inv. horizon
Secure Real Asset (direct)	20-30 years	5.5% / 7.9%	100	Annuity payment liquidating NAV by end of inv. horizon

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