Dynamic Risk Management

Education Session

IASB Meeting, September 2017
Agenda Paper 4

Ross Turner
Industry Fellow
September 2017

Disclaimer

This paper has been prepared for discussion at a public meeting of the International Accounting Standards Board (the Board) and does not represent the views of the Board or any individual member of the Board. Comments on the application of IFRS® Standards do not purport to set out acceptable or unacceptable application of IFRS Standards. Technical decisions are made in public and reported in IASB® Update.

Meeting Agenda

- Prepayment Risk and Mitigating Strategies;
- What is DRM – A Summary; and
- Hedge Accounting and Capacity.

Prepayment Risk

Prepayment Risk

All discussions up to this point have assumed that the asset profile will exist from origination until contractual maturity.

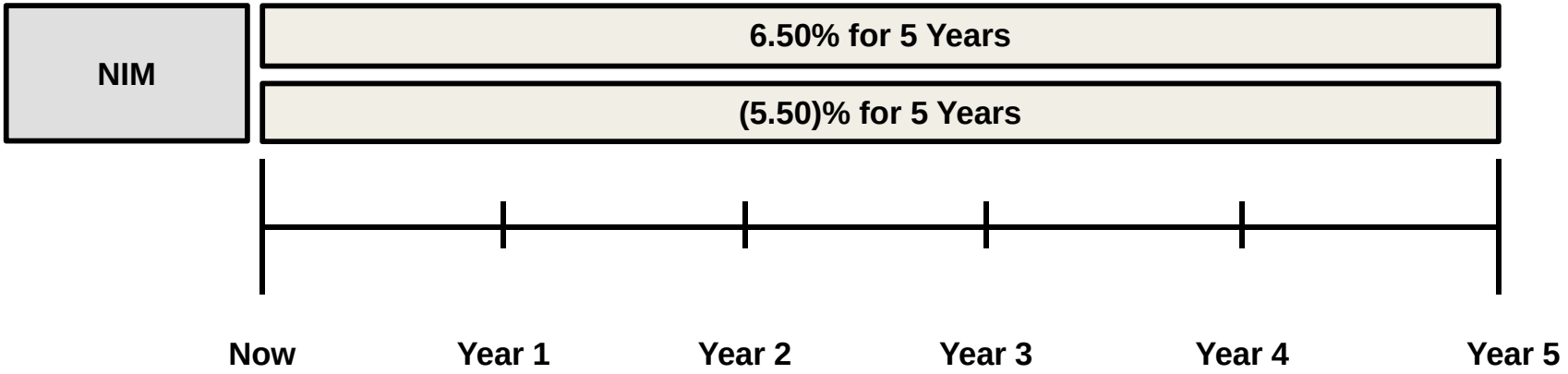
Unfortunately, this assumption does not hold true as borrowers can choose to prepay certain loans.

Through various case studies, the problems caused by prepayment risk and certain mitigating strategies will be demonstrated.

Case Study 1 – Prepayment Risk

The bank's balance sheet and NIM profile are as follows. All products are non-amortizing.

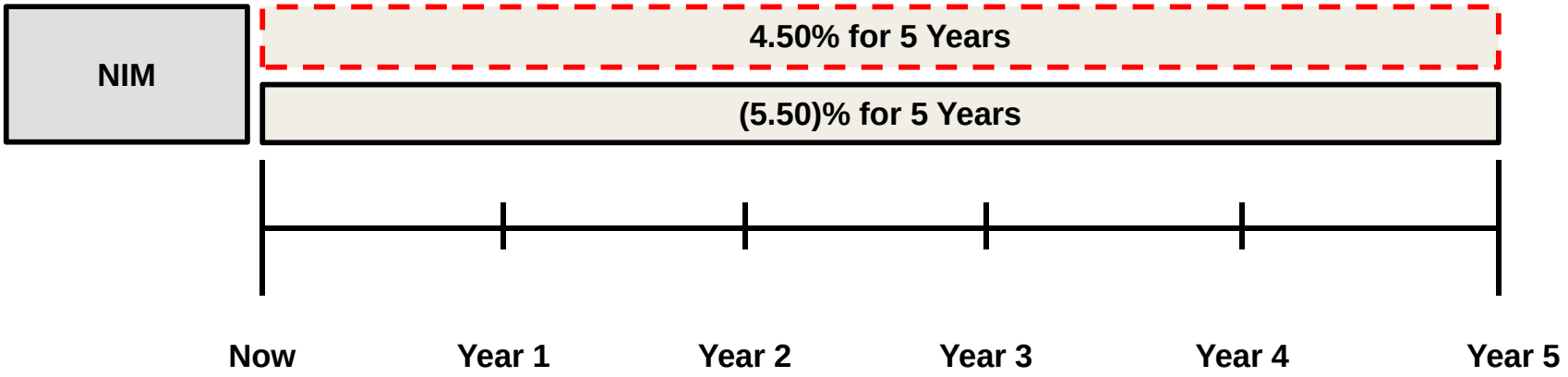
Product	Balance	Yield
Assets		
5YR Fixed Loans	1,000.0	6.50%
Liabilities		
5YR Senior Debt	1,000.0	5.50%



Overall, NIM is 1.00% and is fixed for 5 years. After year 5, both the loans and the debt will re-price. Therefore NIM is stabilised for 5 years.

Case Study 1 – Prepayment Risk

Shortly after origination, the borrower exercises the right to liquidate the loan when market rates are 4.50%. For simplicity, the borrower originates another loan with the same bank. This is called a “re-financing”.



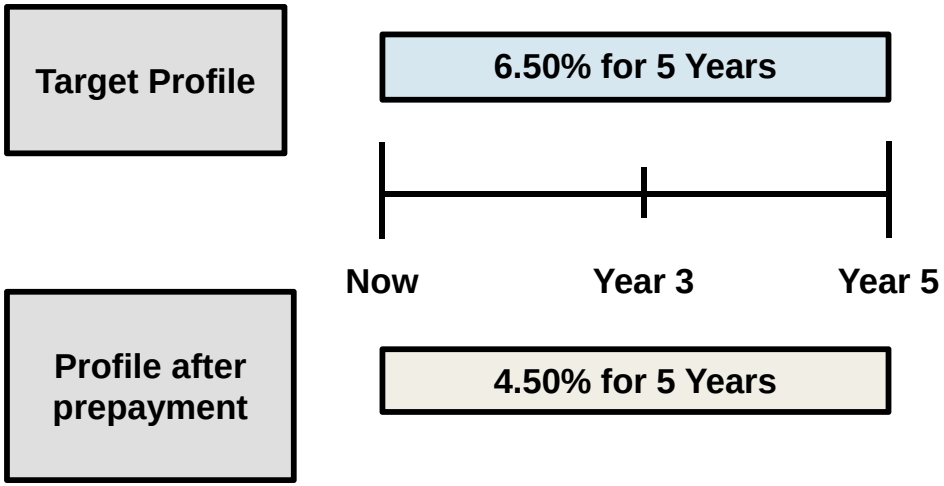
After the re-financing, NIM is expected to be (1.00)% for the next five years.

Prepayment has resulted in NIM re-pricing earlier than expected

IFRS

Case Study 1 – Prepayment Risk

If the prepayable loan is funded with core deposits, NIM is still subject to early and unexpected re-pricing.



While NIM remains positive at 4.50% given demand deposit funding, the bank has experienced an unexpected 2.00% change in NIM.

As the objective of DRM is to manage how NIM re-prices, DRM must consider prepayment risk

Case Study 1A – Callable Debt

The simplest method to manage prepayment risk does not involve derivatives nor does it require complicated projections of expected cash flows.

Prepayment risk arises when the customer has the ability to return the loan to the bank. If the bank could return funding to investors simultaneously, this would be a simple solution.

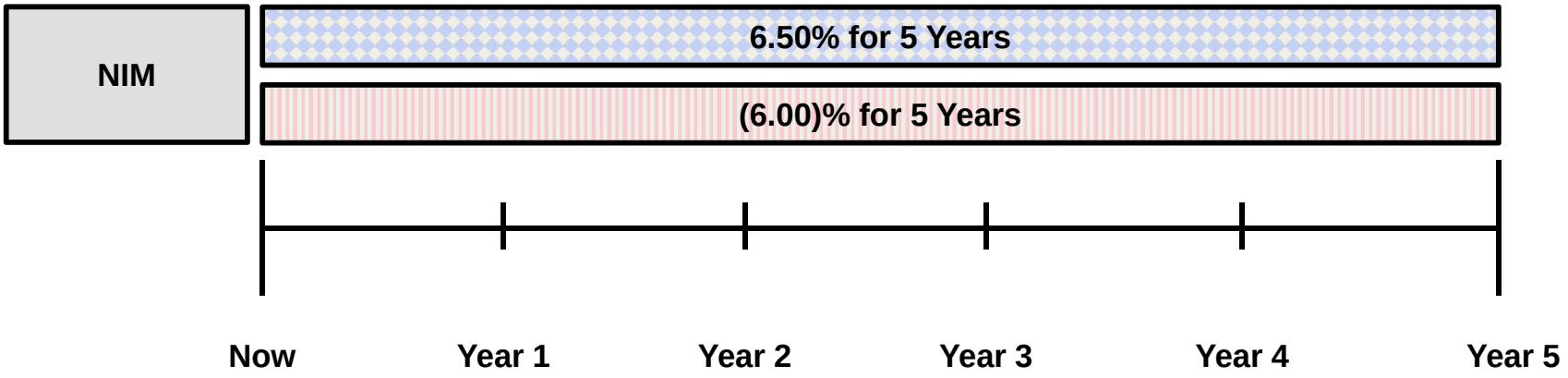
The following case study will demonstrate how issuing Callable Debt can manage prepayment risk.

Case Study 1A – Callable Debt

Step 1 – Issue callable debt and originate a prepayable loan

As the loan portfolio can re-price whenever the customer wants, issuing callable debt allows the bank to re-price the cost of funding whenever the bank wants.

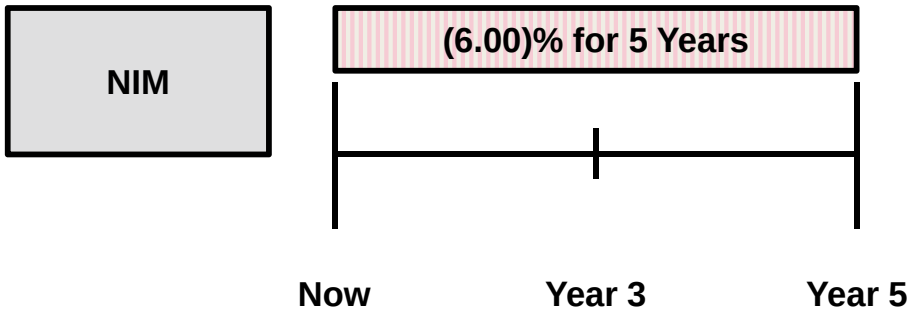
See profile below:



Initially, the bank is earning 0.50%. The cost of the debt is higher due to increased yield demanded by investors to compensate them for the risk that their yield could be called at anytime.

Case Study 1A – Callable Debt

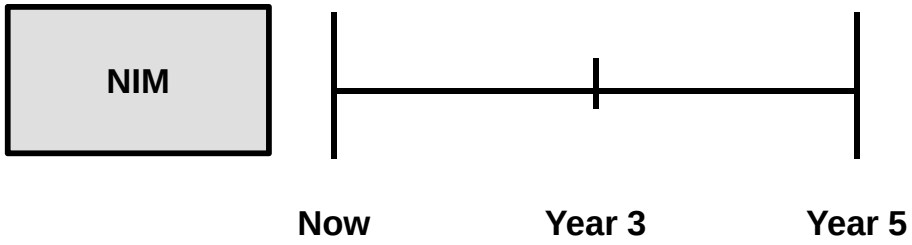
Step 2 – Rates decrease and customer liquidates



Shortly after origination the customer liquidates their loan.

The bank is now left with only callable debt.

Step 3 – Bank calls debt



In order to manage NIM and align the re-pricing of assets and liabilities, the bank will call the funding.

The bank would then issue new funding and new loans

Case Study 1A – Callable Debt

There are practical problems with the callable debt strategy:

1. Limited market depth;

2. Requirement for frequent issuance – as the bank will originate new loans frequently subject to prepayment risk, it would have to be a frequent issuer of callable debt; and

3. Notional mismatch – individual loans are small in comparison to a single debt issuance. As callable debt cannot be partially called – there would be a timing mismatch in customer versus bank behaviour.

Callable debt can be used as a blunt hedge, however for the above is not sufficient in isolation

Expected Cash Flows

Prepayment Risk

There are numerous approaches to manage NIM re-pricing from prepayable loan portfolios. However, every approach recognises that a pool of homogenous loans has three buckets:

A – Core prepayment: Even though it may not be in the borrower's best interest, they will liquidate a loan;

B – Bottom layer: There is a portion of the population that will never exercise their option, regardless of incentive; and

C – Rate sensitive: As the level of incentive increases, more customers will exercise their option to reduce their cost of borrowing.

Institutions will estimate expected cash flows of prepayable loans and incorporate them into the asset profile accordingly.

These estimates require the grouping of similar loans and predicting their behaviour as a portfolio.

Case Study 2 – Expected Cash Flows

Bank 2 has 1000 of fixed rate prepayable loans with a contractual maturity of 5 years. They are funded with core deposits evaluated to be zero cost perpetual funding. Management wishes NIM to re-price each year, thus a one year target profile is set.

Product	Balance	Yield
Assets		
5YR Prepayable Loans	1000	6.50%
Liabilities		
Core Deposits	1000	0.00%

The bank has created the maturity matrix below based on expected prepayment behaviour :

Bucket	Year 1	Year 2	Year 3	Year 4	Year 5
Core	5%				
Sensitive		40%	45%		
Bottom					10%

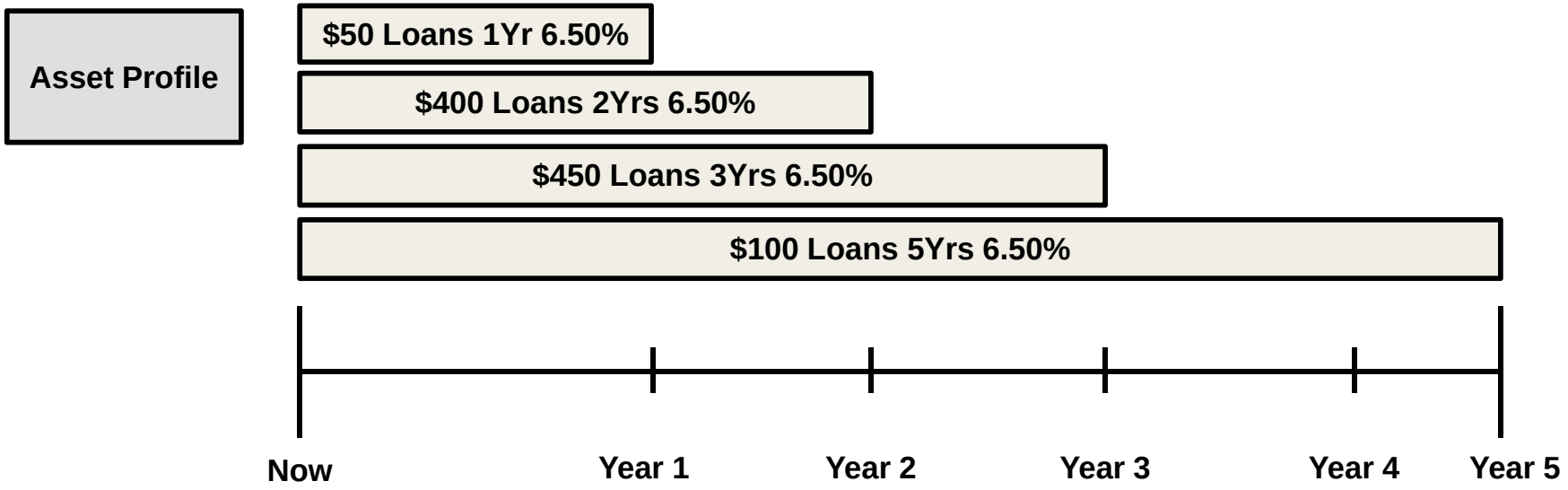
The risk profile will include the loans with the above maturity profile

IFRS

Case Study 2 – Expected Cash Flows

Risk Profile

The risk profile is modelled using the expected prepayment behaviour. Notionals are allocated to time buckets for estimating re-pricing risk.



In this case, the expected asset profile is measured against the target profile.

Core Prepayment

Case Study 2A – Core Prepayment

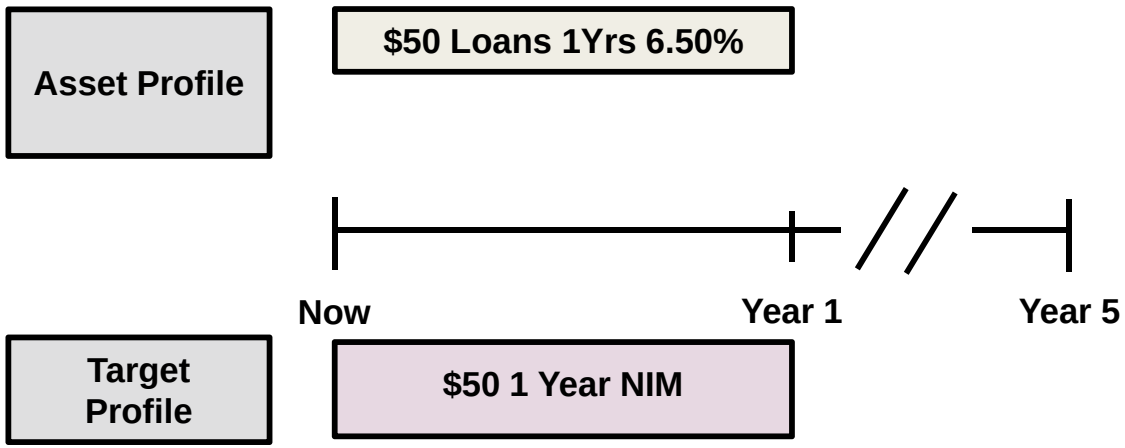
Customers prepay their loans for numerous reasons, even when that prepayment may appear ‘irrational’ applying a strict economic definition of ‘rationality’. For example, death or moving.

These prepayments will occur regardless of the interest rate environment and as such are referred to as core prepayments.

For the purpose of aligning the asset portfolio against the target profile, the assets are modelled considering core prepayments.

Case Study 2A – Core Prepayment

Even though a portfolio of loans has a contractual maturity of 5 years, a portion loans will be treated as shorter term. Then the shorter profile would be compared against the target profile to inform necessary mitigating actions.



As the bank estimated 5% of loans would prepay in the first year, $50 of loans are modelled as 1 year assets for the purpose of managing NIM re-pricing.

If a bank does not perfectly estimate core prepayment speeds, unexpected and undesired NIM re-pricing will result.

Bottom Layer

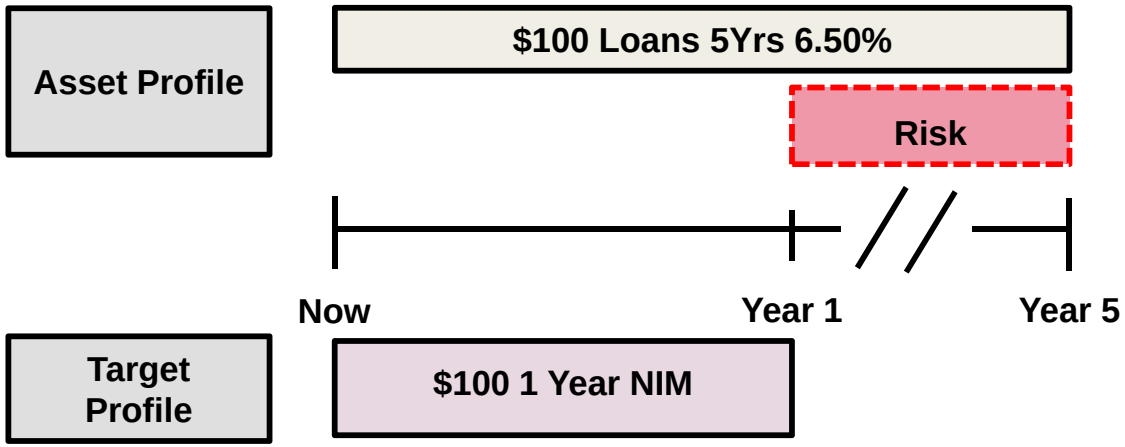
Case Study 2B – Bottom Layer

As an inverse to the “Core Bucket”, the bottom bucket (‘bottom layer’) represents a group of loans that will mature at their contractual maturity date – regardless of economic incentive.

While there are many reasons why this might be the case, two potential explanations are:

- Lack of interest; or
- Deterioration in credit.

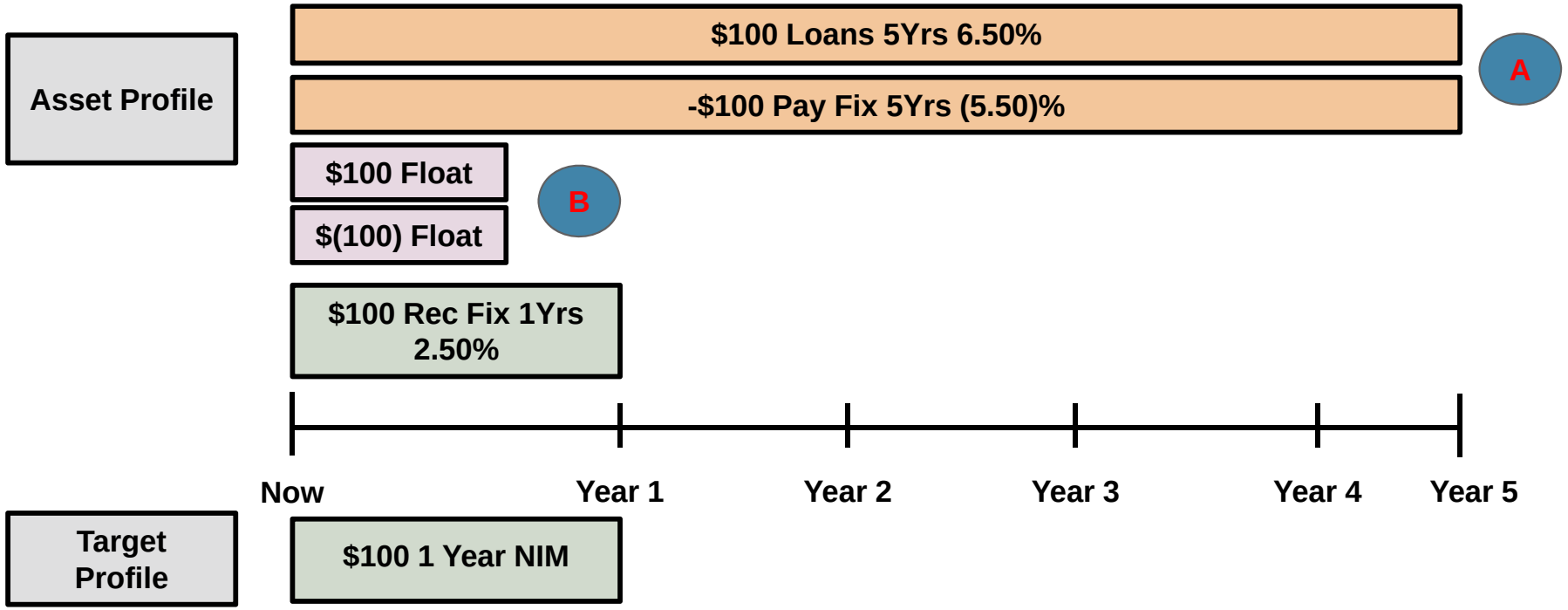
Below is the risk profile of the bottom layer, estimated at 10% of loans or $100.



Case Study 2B – Bottom Layer

To align the profiles, two swaps are required:

- 5 Year, pay fix, receive float interest rate swap, $100 notional; and
- 1 Year, receive fix, pay float, interest rate swap, $100 notional.



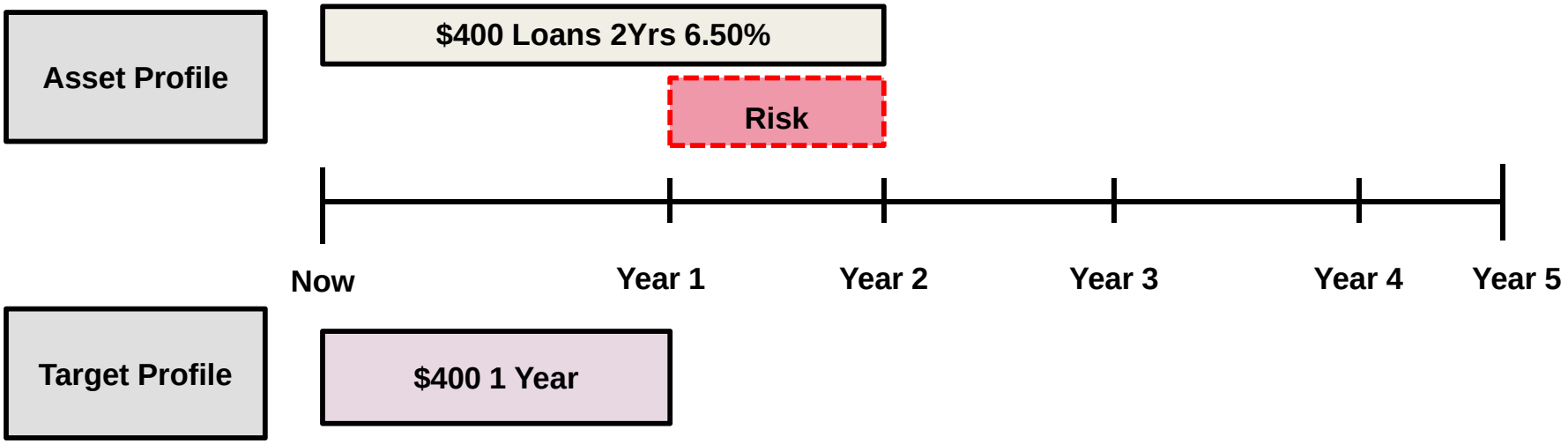
As **A** is an offsetting group and **B** is an offsetting group, the target profile has been achieved and will remain that way unless the bottom layer is smaller than $100 because of an estimation error.

Rate Sensitive Prepayments

Case Study 2C – Rate Sensitive

This bucket is comprised of rate sensitive customers. Their behaviour depends on the market level of interest rates and is difficult to accurately predict.

Focusing on the ‘time bucket 2’ profile below, we can examine how the rate sensitive bucket, estimated at 40% of total loans, is incorporated into the profile and managed over time.

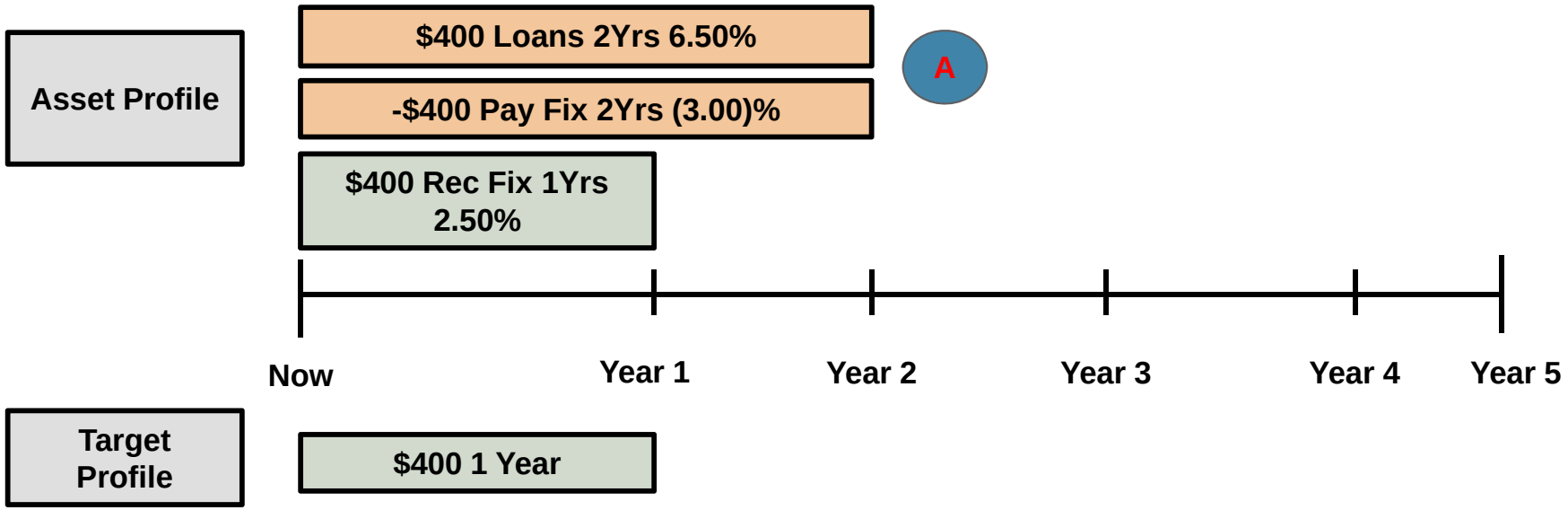


At the asset profile is not aligned with the target profile, mitigating actions are required.

Case Study 2C – Rate Sensitive

To align against the target profile, the following mitigating actions are required:

- 2 Year, pay fix, receive float interest rate swap, $400 notional.
- 1 Year, receive fix, pay float interest rate swap, $400 notional.

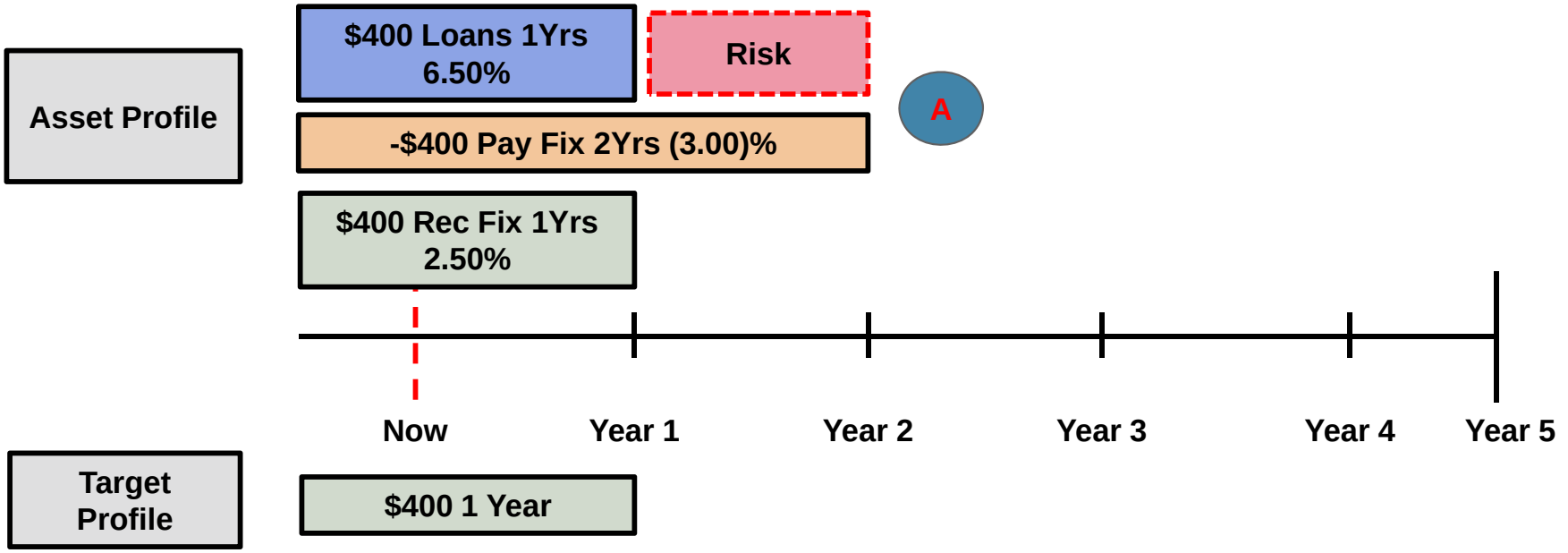


The target profile has been achieved as **A** is an offsetting group and based on the above profile, no further mitigating actions are required.

The offsetting float legs are not shown for simplicity.

Case Study 2C – Rate Sensitive

What would occur if the management assumptions were incorrect? To illustrate, assume management alters their cash flow projection three months after T^0 and the loan is expected to re-price sooner than expected.

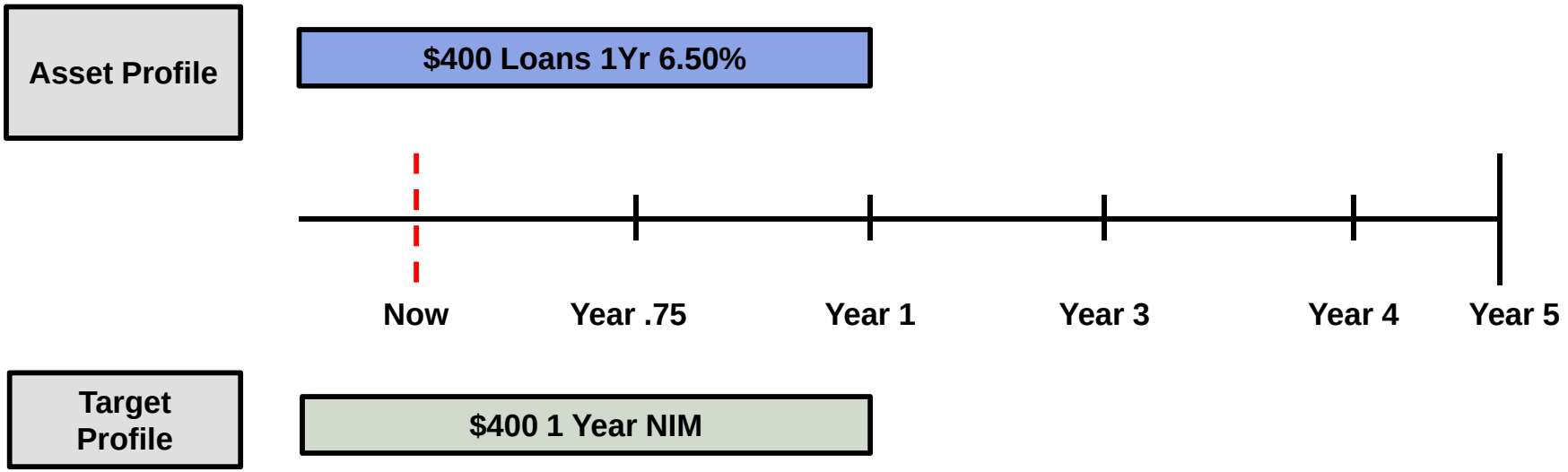


The loan re-pricing is now expected at T^1 and therefore, **A** is no longer an offsetting group.

Further mitigating actions are required after the input change.

Case Study 2C – Rate Sensitive

Comparing the asset profile updated for a change in input against the target profile shows the following if the derivatives are excluded:



As the asset profile is aligned with the target profile, no mitigating actions are required.

Case Study 2C – Rate Sensitive

While the input change has aligned the profiles without the need for mitigating actions, two observations should be highlighted:

1. The original NIM expectation on page 25 was 6.00% for one year. However, after updating the inputs on page 27, NIM is now expected to be 6.50% until the end of T^1.
2. The original interest rate swaps needed to align the profile are no longer required and must be cancelled or offset. Either approach will add additional NIM volatility.

Using this approach, management will update their assumptions periodically taking into account new information about the portfolio and market factors.

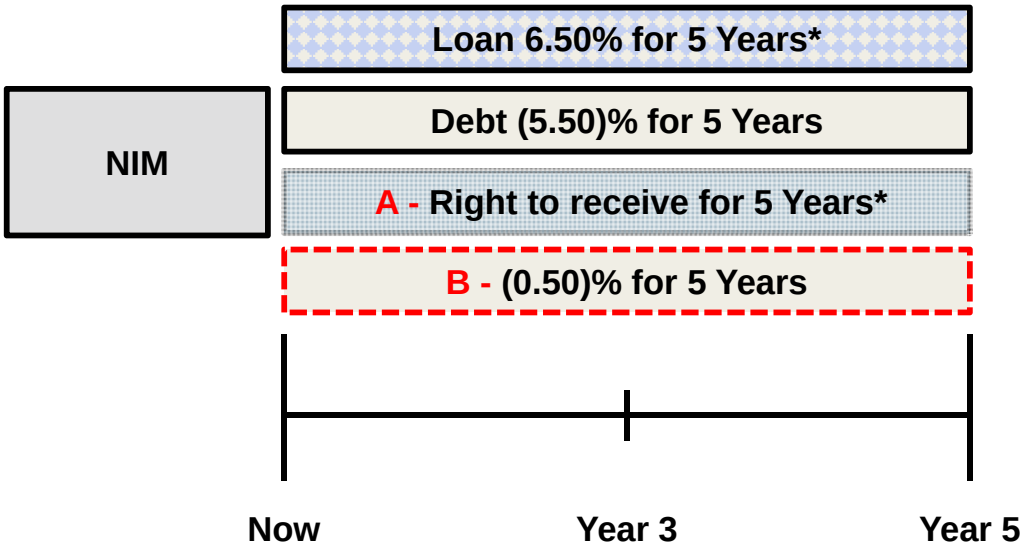
Management will execute numerous derivatives each time the assumptions are updated. Unless management's projections are perfectly accurate, NIM volatility will result versus the target profile.

Option Strategies

Case Study 3 – Buy Option

A more direct method to manage prepayment risk is to use options. Buying an option that allows the bank to receive fix at T^0 rates allows the bank to maintain NIM for a specific term regardless of prepayment risk.

See profile below:



While the loans are unchanged from the original fact pattern, the bank has purchased the right to receive fixed T^0 rates until the end of T^5 (**A**).

The cost of purchasing that right is $2.50 or 0.50% per year over 5 years (**B**).

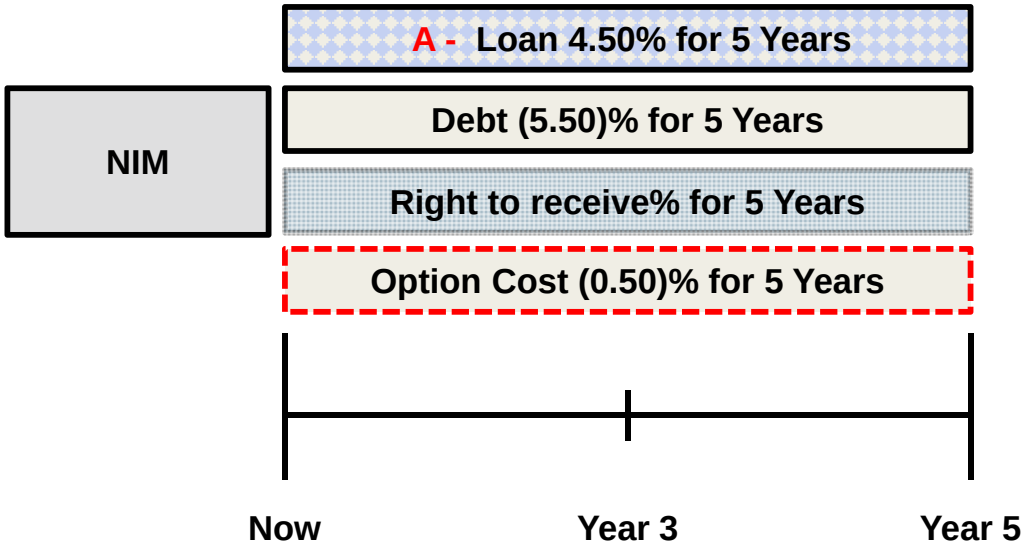
Initially, NIM is 0.50%. The cost of the purchased option ($2.50 or 50bps per annum) is paid to the hedge counterparty at T^0.

IFRS

Case Study 3 – Buy Option

Step 2 – Rates decrease and customer re-finances

After a drop in interest rates, the customer re-finances lowering their cost of funding.



NIM has changed as follows:

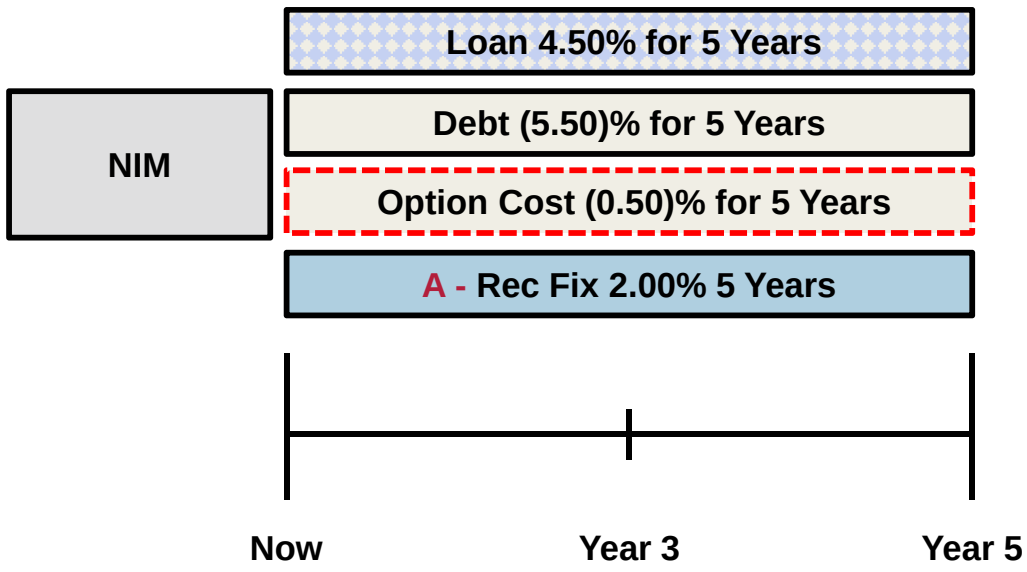
Original NIM	0.50%
Less old loan yield	(6.50)%
Add new loan yield (**A**)	4.50%
New NIM	(1.50)%

The bank has the ability to receive a fix stream of cash flows from the option it purchased at T^0.

Case Study 3 – Buy Option

Step 3 – Bank exercises option to receive fix

To address the re-pricing of NIM, the bank will exercise its option to receive fix at T^0 rates. The profile will change as follows:



The re-financing of the loan caused a 2.00% downward re-pricing of NIM from the original 0.50% target for 5 years.

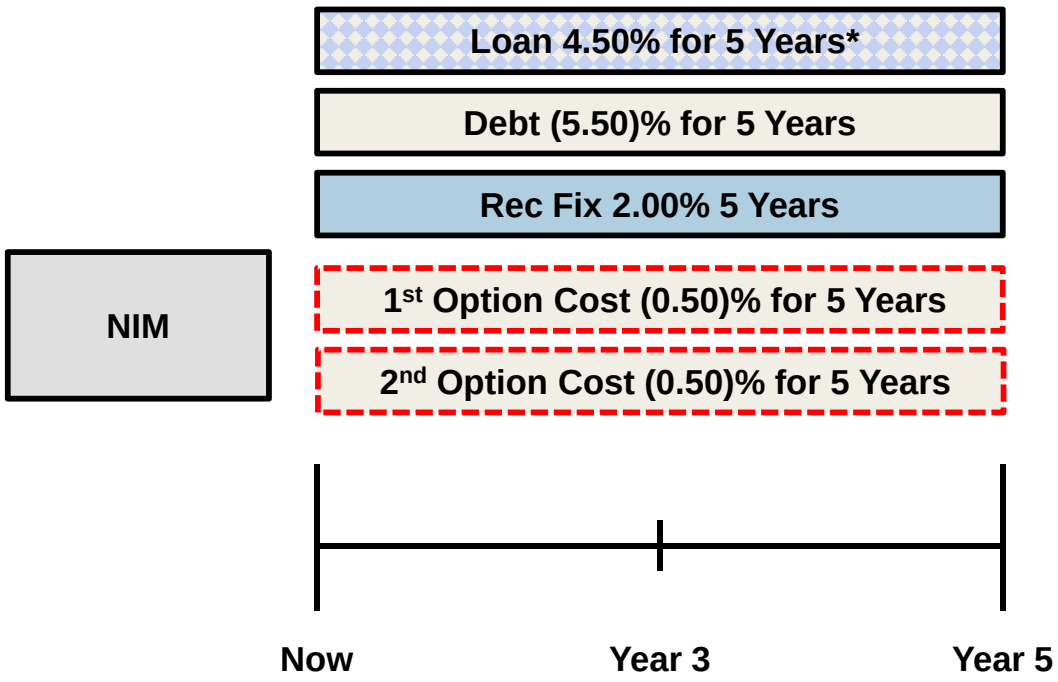
Once the option is exercised, it will provide 2.00% additional yield – offsetting the downward re-pricing of the loan. The yield from the option is derived from the difference in rates betweenT^0 and T^2.

The derivative actions offset the impact of prepayment on NIM

Case Study 3 – Buy Option(s)

Step 4 – Hedge the second option

The re-financed loan does have the ability to re-finance again if rates were to decrease further. As such the bank would likely purchase a second option to protect itself from future NIM re-pricing.



The bank will be required to pay another $2.50 or 0.50% per annum for 5 years to protect NIM from re-pricing.

As such, the cost of hedging NIM over 5 years has increased from 50bps per annum to 100bps per annum, reducing NIM.

NIM is now 0.00%

IFRS

Case Study 3 – Buy Option

As such, the practical problems with the option strategy are:

1. Option markets are less liquid than swap markets; and

2. Long run profitability – As the cost of hedging (i.e., option premium) is charged to the customer through the loan yield, the bank may not fully recover those costs by the time the loan prepays.

Prepayment Risk

Overall

Prepayment risk exists where the borrower has the right to prepay a loan. The decision is influenced by many factors.

When a borrower prepays the loan, the loan will re-price and thus NIM will re-price. This re-pricing of NIM may not be aligned with the target profile.

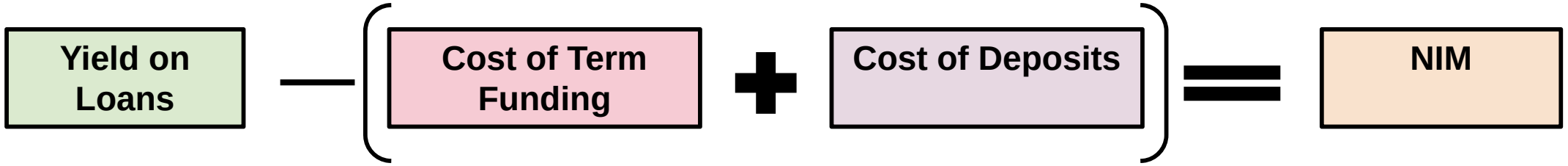
Common Strategies

Bucket	Approach
Core (First) & Bottom (Last)	Predict behaviour using estimates. Imperfect assumptions will result in NIM variability.
Rate Sensitive	**Primary:** Predict behaviour using estimates. Imperfect assumptions will result in NIM variability. **Secondary:** Use option products to “cancel” the NIM re-pricing

What is DRM – A Summary

What is DRM - Summary

Examining the NIM equation helps explain why the objective of DRM is difficult to define:



Ensuring loan yields and cost of funding re-price simultaneously is a common objective providing stable NIM.

However, if the cost of deposits is zero, and will always be zero, then the NIM equation is partially:

For deposit funded portfolios, NIM is dominated by the asset yield.

What is DRM - Summary

If NIM is dominated by the asset yield and assets must re-price, then NIM must re-price over time.

Furthermore, given significant amounts of deposits are effectively zero rate perpetual funding, management must decide what is the desired profile for NIM re-pricing.

This decision regarding NIM re-pricing defines the DRM target profile.

However, as banks cannot force customers to originate loans that are perfectly aligned with the target profile, mitigating actions are required to align the actual asset profile.

To inform the required mitigating actions, the target profile must be measured. The modelling of deposits is the quantification of the target profile.

Demand deposit modelling is a means to an end.

What is DRM - Summary

Ensuring perfect alignment at all times between the target profile and the combination of loans and derivatives is very difficult because:

Dynamic Nature of Portfolios:

DRM is a cycle whereby management reacts to changes in inputs (i.e., maturity, growth, and time) comprising the portfolio. While certain events should be expected (e.g., maturity), other events (e.g., growth) will alter the target and actual profile. These events will result in NIM variability period over period.

Prepayment Risk:

Loan portfolios exist where the borrower has the right to prepay their loan. Their behaviour is dependant upon a number of factors and will likely cause unexpected NIM re-pricing. The strategies to manage NIM re-pricing are focused on trying to either predict when the loan will re-price or enable the bank to cancel the NIM re-pricing.

A change in inputs is not a change in the target profile

DRM - Capacity

DRM – Capacity

- Compare how risk management activities are accommodated in banking versus a non-banking environment
- Introduce the concept of capacity
- Discuss how capacity impacts the information content of financial statements

Margin Management

Organisations try to manage the overall impact on cash inflows and outflows from market factors such as:

- Interest rates;
- Commodity prices; and
- Foreign exchange rates.

If market factors have an equal and offsetting impact on net cash inflows (margin), then no mitigating actions are required to manage margins.

If a change in market factors can negatively impact net cash inflows (margin), making it difficult for management to cover fixed operating costs, it is in management's best interest to act.

As mitigating actions often involve derivatives, if derivatives do not exist for the market factor in question (e.g., toothpaste forward) then there is no ability to manage margin.

Implications

Fundamentally, banks are trying to manage how margin changes over time by ensuring that assets and funding re-price simultaneously through the use of derivatives. In this way, they are trying to stabilise margin over time.

DRM is often described as a bank specific issue, however, banking is not the only industry which uses derivatives to stabilise margin over time.

For example, a coffee processor would face similar problems.

It would purchase coffee beans from those who farm the plants and sell finished coffee to end users.

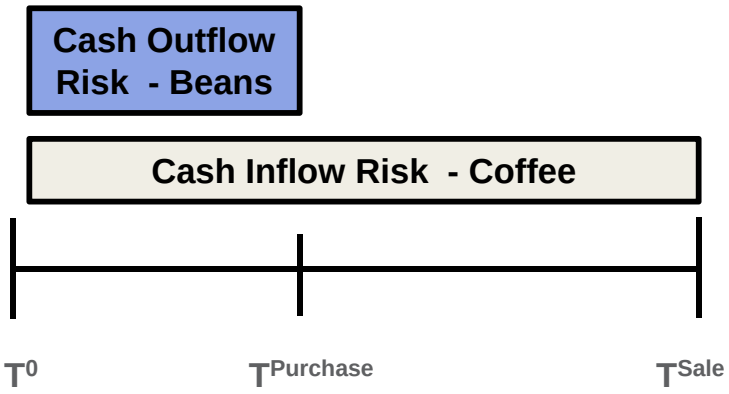
The cash outflows of the company are based upon the market price of coffee beans and the cash inflows are based upon the market price of coffee.

Margin is the difference between coffee bean prices and the price of finished coffee.

Coffee Production – No Hedging

As the raw ingredients require refining, there is a time lag between when the beans are purchased and when the coffee is sold. This means a company would have the following risks to margin (net cash inflows) at T^0:

1. Cost of beans – exposed to changes in market prices from T^0 to $T^{purchase}$; and
2. Price of coffee – exposed to changes in market prices from T^0 until T^{sale}.



Impact on Margin	Market Price Increase	Market Price Decrease
Coffee Beans	Negative	Positive
Refined Coffee	Positive	Negative

The margin of this business is not fixed at T^0.

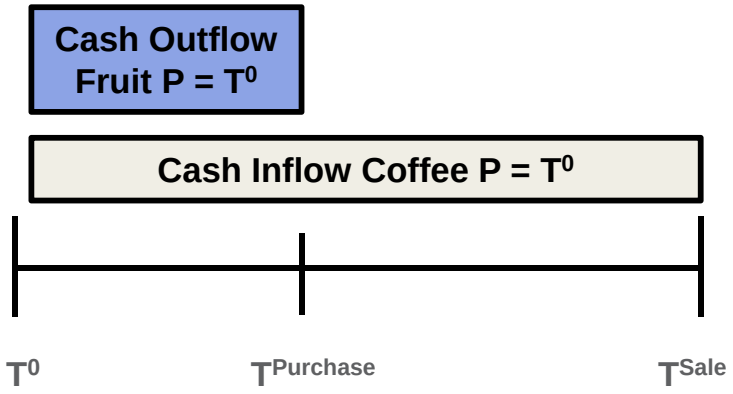
Management must decide if margin should be allowed to re-price with changes in market factors

IFRS

Coffee Production – Hedging

Assuming management has decided to manage 100% of re-pricing risk at T^0, mitigating actions (derivatives) can be used to reduce the impact of market factors. Specifically, two forward contracts could be used:

- A forward purchase of coffee beans, settling at $T^{purchase}$ providing cost certainty reflecting T^0 pricing; and
- A forward sale of coffee, settling at T^{sale} providing revenue certainty reflecting T^0 pricing.



Margin is now fixed at the price difference between bean and finished coffee at T^0

Coffee Example - Accounting

Assuming the definitions of highly probable future transaction are met, the company could designate the derivatives as follows:

Designation	Cash Inflow	Cash Outflow
Hedged Item	Expected purchase at $T^{purchase}$	Expected sale at T^{sale}
Hedging Instrument	Coffee bean forward buy @ $T^{purchase}$	Finished coffee forward sell @ T^{sale}

These two relationships would be highly effective given alignment between hedging instrument and hedged item.

The statement of profit or loss would record margin equal to the locked in hedged amount at the time of sale.

The effective designation of the purchase and sale aspects of margin have resulted in alignment between risk and accounting

Banking

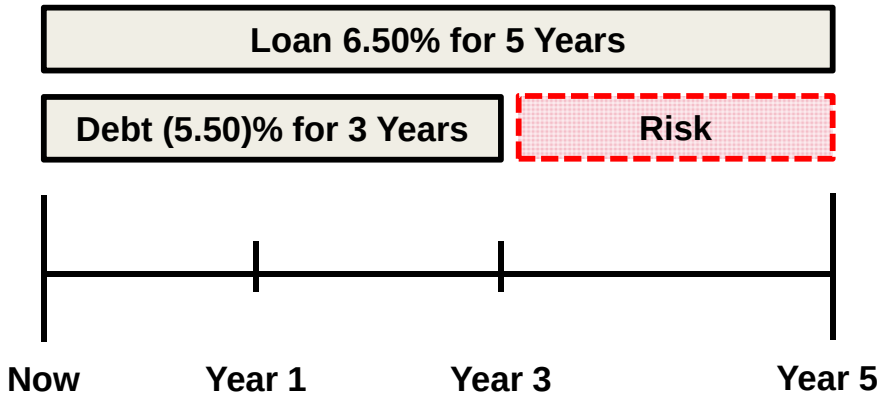
To demonstrate how the banking business activity is reflected in financial statements, we will examine the following series of scenarios:

- Bank A - 100% debt funded and 100% fixed rate assets; and
- Bank B - 100% core deposit funded with 100% fixed rate assets.

Bank A – 100% Debt Funded

Bank A wishes to minimize NIM re-pricing risk. Assets and liabilities are managed to re-price simultaneously. Their balance sheet and risk profile is as follows:

Product	Balance	Yield
Assets		
5YR Fixed Loans	1,000.0	6.50%
Liabilities		
External Debt	1,000.0	5.50%



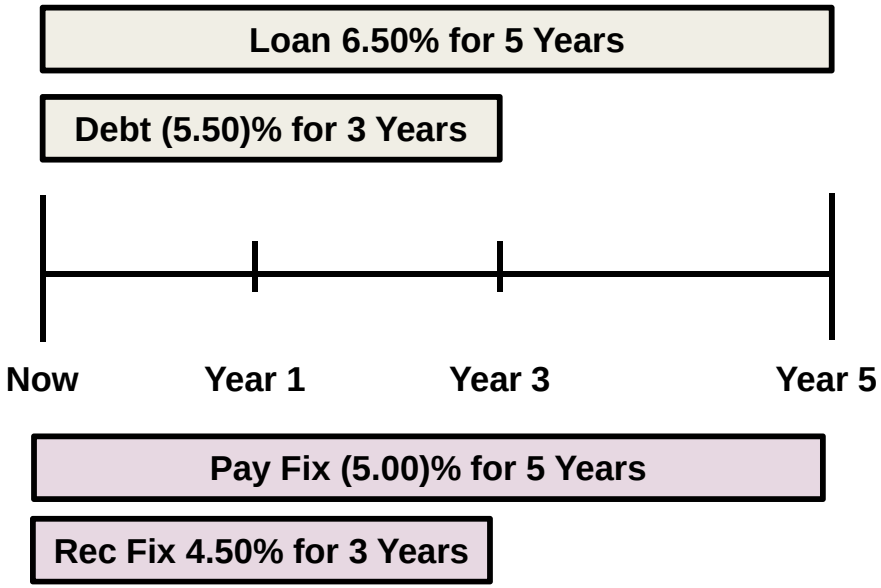
NIM will be 1.00% for the first three years, but at the end of year 3 when the debt re-prices, NIM is fully exposed. Mitigating actions are required to stabilise NIM.

Bank A – 100% Debt Funded

Management is able to stabilise NIM by executing two necessary swaps:

- 5 Year pay fix, receive float interest rate swap; and
- 3 Year receive fix, pay float interest rate swap.

The revised risk profile is as follows:



NIM is reduced from 1.00% to 0.50%, however, aligning the re-pricing of assets and funding has reduced NIM volatility going forward.

Bank A – Accounting

In this case fair value hedge accounting can be used to reflect the economics of the risk management activity in the financial statements.

The swaps could be designated as follows:

Designation	Cash Inflow	Cash Outflow
Hedged Item	Loan (Asset)	Debt (Liability)
Hedging Instrument	Pay Fix swap	Rec Fix Swap

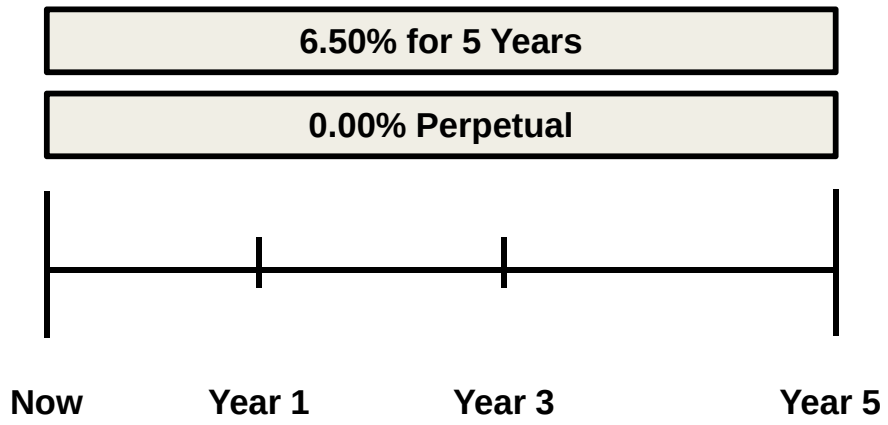
These two relationships would be highly effective given alignment between hedging instrument and hedged item. Margin is recorded equal to the locked in amount of 0.50% per annum providing information similar to amortised cost accounting.

An effective designation of the purchase (Debt) and sale (Loan) aspects of margin is possible

Bank B – 100% Core Deposit Funded

Bank B wishes to minimize NIM re-pricing risk. Assets and liabilities are managed to re-price simultaneously. The bank has 100% 5 year fixed rate loans funded by core deposits. The deposits have been assessed as zero rate perpetual funding. The risk profile is as follows:

Product	Balance	Yield
Assets		
5Year Fixed Loans	1,000.0	6.50%
Liabilities		
Core Deposits	1,000.0	0.00%

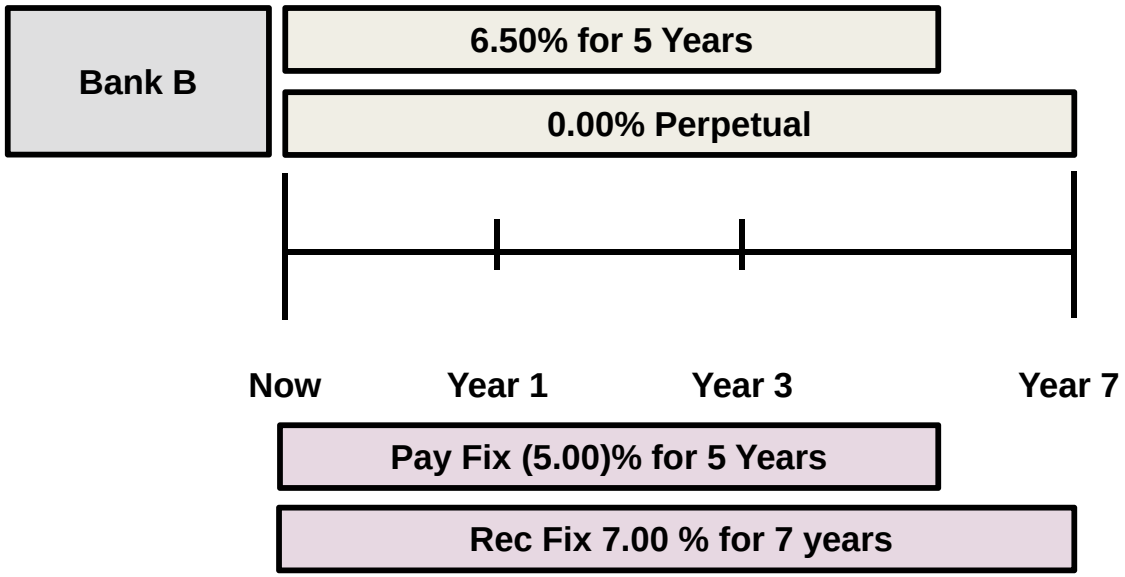


With NIM entirely a function of the asset yield, Bank C is uncomfortable with 100% of NIM re-pricing after 5 years and would prefer the re-pricing to occur after 7 years.

Bank B – 100% Core Deposit Funded

Management is able to transform the NIM profile by executing the necessary swaps. In this case:

- 7 Year, receive fix, pay float interest rate swap; and
- 5 Year, pay fix, receive float interest rate swap.



NIM will be 8.50% and is locked in until the end of year 7. After year 7, NIM will re-price consistent with the risk management objective.

Bank B – Accounting

The previous examples were able to reflect the result of their risk management activity because they could designate the purchase and sale leg of their margin equation.

In a traditional one to one hedge accounting model, Bank B is face with somewhat unique challenge when designating the necessary two hedges:

- The pay fix swap can be designated as a highly effective fair value hedge of the cash inflows (i.e., the loan); however
- The rec fix swap fix swap cannot be designated as a hedge of the cash outflow because the demand deposit does not have cash outflows. Nor does an individual deposit have fair value sensitivity.

Bank B cannot make a qualifying designation for the receive fix swap given the circumstances and the unique characteristics of core deposits.

The business model of fixed rate loans (mortgages) funded by core deposits is common.

Capacity

The coffee producer and Bank A were able to designate and reflect their activities because there is alignment between:

A. Necessary derivatives for margin management; and

B. Gross cash inflows + gross cash outflows.

Bank B will always struggle as they require twice as many derivatives as they have eligible cash inflows and outflows against which to designate.

This results from the economic uniqueness of core deposits.

In practice, deposits comprise at least 50% of banking book funding. As such, the purchase and sale leg capacity of the banking book is at most:

Sale Leg (Loans)	Purchase Leg (Funding)
100%	50%

Capacity and Accounting

The core reason why entities use alternative hedge designations is this capacity issue.

Entities faced with this capacity problem have three choices:

1. Use proxy hedging;
2. Use alternative performance metrics; or
3. Don’t hedge.

Thank you