Using Serial AUD 90-day Bank Bill futures in pricing and revaluation of interest rate derivatives

John Feeney, Martialis Consulting

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Executive summary

The Australian Dollar 90-day bank bill futures (IR) have been listed on ASX for many years and form the backbone for transparent pricing of short-dated interest rates based on BBSW.

These contacts have had quarterly expiry (March, June, September and December each) for many years and extend for 16 quarter months. In November 2024, ASX introduced 2 additional 'serial' contracts which, together with the existing quarterly contracts, cover each month of the next 3 months.

This paper looks at the pricing and uses of the serial IR contracts with the existing quarterly contracts. The paper includes:

- The effects on pricing of interest rate swaps by different interpolation methodologies commonly used by pricing systems.
- The effects of pricing with and without serial contracts for an example 2-year amortising interest rate swap.
- Forward pricing of IR contract expiry dates.
- The effects of double interpolation and how serial contracts can help resolve this problem.
- The impacts on revaluation and P&L attribution for reconciling derivative portfolio P&L movements.
- Using serial contracts to more accurately hedge short-dated risk exposures.

I conclude that using the serial contracts can improve the pricing and revaluation accuracy of interest rate derivatives. This is independent of the widely used linear or cubic spline interpolation methodologies. Including the serial contracts forces most interpolation methodologies to pass through more pillar points and therefore increases the accuracy of the pricing.

Double interpolation can be problematic. This happens when there are sudden changes to curvature and the interpolation methodology simply ignores the data point between the standard pillar points, for example quarterly rollover dates. While this problem can never be completely removed unless daily pillar points are used (which is not efficient) including the serial contracts and pricing methodology can significantly improve pricing accuracy.

Using serial contracts for pricing can improve the accuracy of interest rate swap pricing and revaluation. I also recommend trading the serial contracts to hedge the derivatives

and reduce risks in very short-dated exposures where appropriate for your trading strategy.

As a call to action for finance and risk professionals, including consideration of the serial IR contracts in pricing and revaluation systems may improve the accuracy of mark to market calculations and the pricing new transactions.

Introduction

Australian Dollar interest rate markets have relied heavily on 90-day Bank Bill (IR) futures over many years for pricing and hedging of interest rate risk. The contracts are very well established and have traded continuously since their introduction in 1979.

The IR contracts have historically listed quarterly expiries in March, June, September and December each year. The serial contracts were first listed in November 2024 for an additional 2 contracts to cover expiries in each of the first 3 months.

While the value of IR serial contracts in providing more granularity for very short maturities of the AUD yield curve is clear and obvious, my recent observations support a view that the serial contracts are not being routinely used by market participants.

Recent engagements with buy-side clients have shown some significant discrepancies in yield curve construction that could be readily addressed if market participants used serial IR contracts to construct their curves. In particular, forward rates for the next 3 months can be more accurately calculated from the serial contracts leading to more consistent pricing of certain interest rate derivatives.

The serial IR contracts also allow for more precise hedging of short interest rate exposures. Very steep yield curves and/or discontinuities at yield curve node points create challenges for hedging exposures at those points. The serial IR contracts allow for more exact hedging and can remove many interpolation and tracking errors for traders and revaluation systems.

Interpolation Methodologies

A number of interpolation methodologies are commonly used by market participants. For example, many firms use the cubic spline (or similar) method to make certain there are no discontinuities in the curves. In other cases, such as some vendor systems, other methodologies such as linear and stepwise are options, used as well.

The different methodologies will make a significant difference to the pricing and valuation of interest rate derivatives. The shape of the yield curve, any potential discontinuities in the curves and the steepness of the curve will all be potential issues for accurately pricing and valuing derivatives.

Cubic Spline

A cubic spline is a series of piecewise cubic polynomials between each pair of points, designed so the entire function is:

- smooth
- has continuous first and second derivatives
- interpolates all the points exactly

Cubic spline is often used to eliminate discontinuities in curves and reduce sudden changes to rates. The disadvantage is that the interpolation between points can change significantly for steep curves or sudden changes in adjacent points on the curve.

Linear

Linear interpolation is often used to provide a very clear method of interpolation which is very predictable between points. If the adjacent points change independently, the interpolation is predictable.

Linear is not often used as it can create very sudden discontinuities but it has the advantage of making P&L attribution very accurate due to the predictability of the interpolation.

Step Forward

Step forward is another methodology used when you assume the value holds steady until a known change — like prices that don't update every day, or interest rates that stay steady until a known point of change (e.g., RBA cash rate changes).

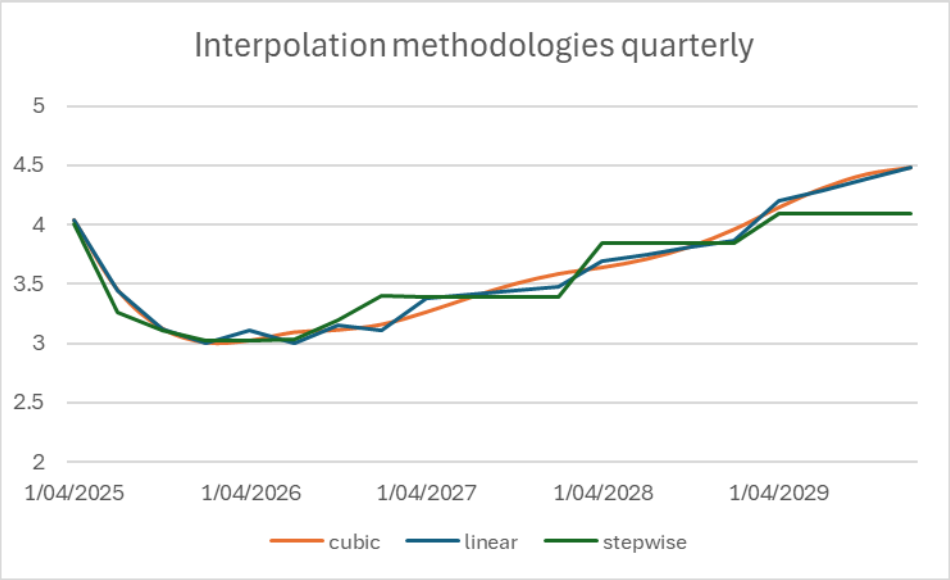
Some vendor systems use this in time series and it can be a default in the pricing settings.

Examples of interpolations

I have used the market close data on 15 April 2025 to generate the quarterly AUD swaps curves for 3-month BBSW. I have selected 15 April because the market had rallied significantly over the previous days, the yield curves were inverted from 0 to 2-years and then normal from 2 – 30 years. The changes in curve shape makes the differences in interpolations more pronounced.

The forward rates for 5 years were calculated and Charts 1 and 2 show the outcomes.

Chart 1 – Interpolation methodologies for quarterly interest rate swaps



The choice of interpolation methodology does impact the pricing and revaluation of certain interest rate derivatives. While the differences will 'average' over the 5 years, any derivative with exposure between the pillar points will calculate forward rates that differ between interpolation methodologies.

In the case of amortising structures, the forward rate differences will lead to pricing and revaluation differences as different rollover dates will have different weighting and the averaging process ceases to be effective.

Example of an amortising 2-year swap

The example used is a 2-year linearly amortising quarterly swap. The swap reduces in principal equally each roll so the final principal at maturity is zero.

The amortising 2-year swap was chosen to show the pricing differences due to interpolation methodology and the impact of including serial contracts in short-dated swap pricing. The serial contracts are within the first 3 months and therefore affect the shorter-dated swap prices more than longer-dated swaps. The amortising structure further emphasises the serial contract effects as more principal (and risk) is in the first few months.

The example swap prices were based on rates at close on 15th April 2025. I have used a spot start (16 April 2025) and a 1-month forward start (16 May 2025) swap. This helps show any differences in including or excluding the serial contracts because the curvature around the May serial contract expiry date (8 May 2025) changes and impacts the forward rates.

The following table shows the results in differences (basis points) between the interpolation methodologies and the impact of the 1-month forward start based on the 15 April rates.

I have included the step forward interpolation because this is used in some vendor systems. In these systems, the serial contracts are not included in the curve construction.

Table 1 – 2-year amortising swap

2-year amortising swap rates %						
Interpolation	No Serial			Serial		
	Spot	1-month fwd start	Difference	Spot	1-month fwd start	Difference
Linear	3.3656	3.3028	6.28	3.3600	3.2660	9.40
Cubic Spline	3.3619	3.2980	6.39	3.3595	3.2660	9.35
Step Forward	3.3277	3.2653	6.78			

The results show some interesting features:

- Spot start swaps:
    - Have small differences between the Linear and Cubic Spline interpolations when including or excluding serial contracts.
    - There is a significant difference between Linear/Cubic spline and Step Forward interpolations.
    - I also calculated the bullet swaps for all interpolations which all price 3.26 +/- 0.002%

- 1-month forward start swaps:
    - Have small differences between the Linear and Cubic Spline interpolations when excluding serial contracts.
    - There is a significant difference between Linear/Cubic Spline and Step Forward interpolations when excluding serial contracts.
    - There is a significant difference between Linear/Cubic Spline interpolations based on including or excluding serial contracts.
    - The Step Forward and Linear/Cubic Spline with serial contracts give similar prices.

In summary:

- The interpolation methodology does impact the pricing.
- Including serial contracts using Linear and Cubic Spline methodologies also impacts pricing by reducing the price for 1-month forward-starting swaps compared with not using serial contracts.
- Including the serial contracts using Linear and Cubic Spline methodologies, particularly the May 2025 contract, provides prices more in line with the Step Forward interpolation.

Which is more accurate: including serial IR futures or not?

I calculated the forward rates for the first 10 IR contracts excluding and including serial contracts in the pricing curve.

I used the linear interpolation for simplicity, but I note a cubic spline interpolation has similar results.

Table 2 – Futures comparison

Comparison of including and excluding serial IR contracts			
IR Contract	IR futures Yield	No serials	Serial
May 25	3.83	3.89	3.83
Jun 25	3.59	3.67	3.59
Jul 25	3.48	3.48	3.48
Sep 25	3.15	3.24	3.15
Dec 25	3.04	3.05	3.04
Mar 26	3.02	3.06	3.02
Jun 26	3.03	3.04	3.03
Sep 26	3.06	3.08	3.06
Dec 26	3.12	3.13	3.12
Mar 27	3.21	3.27	3.21

The difference to the actual futures yields is zero when the serial contracts are included in the curve construction. This is expected as the forward prices are calculated directly from the IR contracts and expiry dates and when serial contracts are included, the prices are aligned.

However, when serial contracts are excluded in the pricing, the forward prices are interpolated and any curvature implied by serial contracts is ignored.

But which is closer to the market prices?

- May 25 and June 25 using serial IR futures has exact alignment but not using serials has significant differences
- Jul 25 has close alignment in both cases as the Jul 25 serial is priced close to the interpolation between the Jun 25 and Sep 25
- Sep 25 has significant differences in when not using serial contracts. This is due to the 'double interpolation[1]' effect and the expiry of the serial IR futures and consequent changeover to quarterly IR futures.
- Using the serial contracts has clear benefits in matching the forward rates for the first 2 contracts.

Using serial contracts is significantly more accurate in pricing and revaluing trades with exposure to forward rates in the first 3 or 4 (i.e., 2 serial and 2 quarterly) IR contracts.

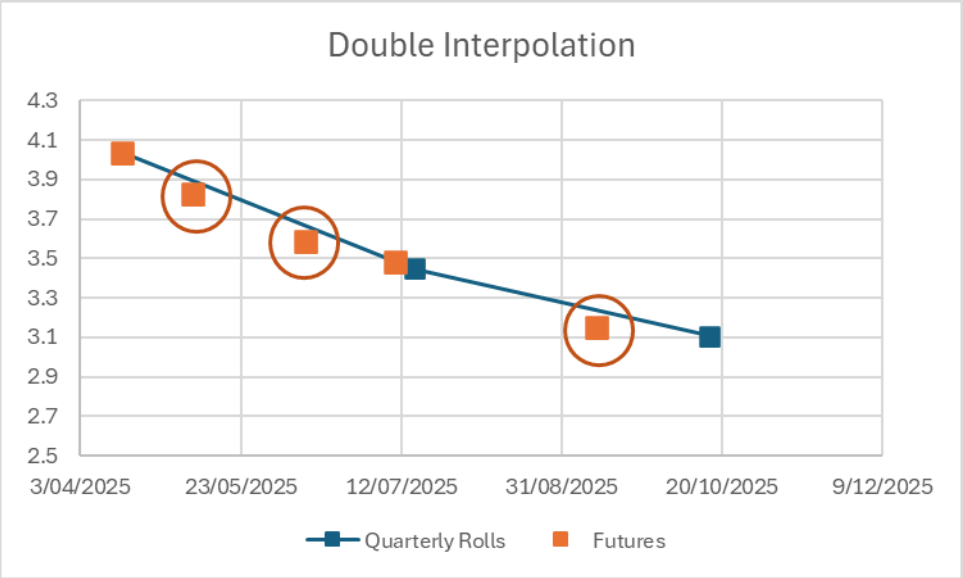
Double interpolation effects

Using serial contracts and removing the double interpolation impacts really changes the pricing and revaluation.

But what is double interpolation? The following chart shows how this can happen in yield curves with large changes in curvature.

[1] Double interpolation arises when forward rates are interpolated from IR futures to the roll dates of a spot start swap to construct the yield curve. If the IR futures show changes in curvature, then this will be effectively missed in curve construction for spot start swaps as the high or low point for the contracts is smoothed out.

Chart 2 – Double interpolation impacts



The circled futures dates are different yields to the linear interpolation of the quarterly roll dates of the spot-start swap. The yields on the roll dates will be equivalent to the futures yields if:

- the roll dates are on the futures dates; or
- the yield curve is very linear (as occurs in later dates).

This will not be an issue for spot-start swaps, there is a significant impact for forward-start swaps.

Including the serial months and pricing correctly from the futures shows large differences in the last column (Table 1) for a forward-start swap.

This is expected because the futures yield are below the interpolated yields in Chart 2 which would lower the yield on the forward start amortising swap.

Non-linear changes to revaluations- impact of P&L attribution

The P&L attribution can be challenging for Finance, Risk and front office staff. Most firms use at least 2 measures to estimate the P&L: delta (change based on exposure multiplied by rate move) and theta (time value).

The delta change is often larger than theta change. The individual pillar exposures (e.g., 5-year swap) are multiplied by the change in the rate and added across all pillars to calculate the delta move.

This will work perfectly well with linear interpolation as all exposures are multiplied by the interpolated rate which is proportional. However, for a cubic spline interpolation,

the movements between pillars are not always proportional so individual exposures may not be accurately predicted by the delta calculation.

With relatively flat and/or constant sloping curves, this is a minor issue. In a steep curve with variable slope, the linear/cubic spline differences start to become significant.

Serial contracts can help with this problem. By including more pillar points, the cubic spline is obliged to solve to those rates and minimise the curvature between the points.

Improving pricing and revaluation by including serial IR futures contracts

The analysis in this report shows that including serial IR futures contracts in curve construction can have considerable benefits.

- Shorter dated swaps can have improved pricing accuracy. This is the case from 0 to 2-years and particularly in the first 3 – 6 months.
- Certain derivative structures such as amortising swaps can have an increased exposure to the shorter dated rollovers and serial contracts do show closer fit to the actual curve and therefore tend to have better accuracy in pricing.
- The improvements in pricing are across the two curve interpolation methodologies I tested: linear and cubic spline.
- Including more pillar points (i.e., serial IR contracts) helps constrain the cubic spline curve interpolation and reduce the delta change errors for P&L attribution.

Once the quarterly curve is accurate, other curves can be readily calculated.

- Semi-annual curves are related to quarterly through published basis swaps. I do note that the AUD swaps curve is semi-annual from 4 years, so the quarterly curve is calculated using the basis swap from semi to quarterly.
- Monthly curves are also related to quarterly through basis swaps. However, I advise clients to take care with 0 to 6 months as this can be volatile and typically derived from de-compounding the quarterly forward rates.
- AONIA curves can be calculated from IB futures and the basis to 3-month curves.

Serial contracts may include some risks that you will need to independently assess in the context of your own trading strategies

Hedging and trading

Once the curves are calculated, alert traders will very likely find differences between the quoted prices and those calculated from basis markets and published rates.

- Trading opportunities can be created if markets are not aligned or curves used by some participants are inaccurate.
- Serial IR contracts can attract a very different view from traders and show large gaps from IB contracts, potentially providing arbitrage opportunities between Serials and IB futures.
- Trading and hedging can be impacted by these differences and present advantageous (cheaper) hedging options in certain markets.

end of paper

About the author

John Feeney has been in financial markets for over 35 years in trading and management roles across most asset classes. He has worked for National Australia Bank, Commonwealth Bank in Sydney, Citibank in Sydney and London and Macquarie Bank in Sydney. Over this time, he has traded and managed interest rate derivatives, foreign exchange, traded credit, commodities and funding businesses. Most recently, he has been focussing on LIBOR and other IBOR transition issues as well as the broader practice areas of Martialis Consulting.

Mr. Feeney has a PhD and BSc (Hons) from University of Sydney.

Contact details

martialis.com.au
john.feeney@martialis.com.au

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ASX contact details

Allan McGregor
Senior Manager, Rates
allan.mcgregor@asx.com.au

Neil Easton
Senior Business Development Manager
neil.easton@asx.com.au

Brent Glendinning
VP International
brent.glendinning@asx.com.au

Rates@asx.com.au
www.asx.com.au/markets

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