BBSW methodology enhancements

Consultation paper

27 July 2020

Invitation to comment

ASX is seeking submissions in response to this consultation by 27 August 2020. Submissions should be sent to:

E: ASXBPricing@asx.com.au

Office of General Counsel
ASX Limited
20 Bridge Street
Sydney NSW 2000

ASX prefers to receive submissions in electronic form.

If you would like your submission, or any part of it, to be treated as confidential, please indicate this clearly. All submissions will be provided to regulators on request. Submissions may also be published on the ASX website, unless they are clearly marked as confidential or ASX considers that there are reasons not to do so.

ASX is available to meet with interested parties for bilateral discussions on the BBSW methodology enhancements.

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1. Introduction

ASX Benchmarks is consulting on proposed enhancements to the existing Bank Bill Swap Rate (BBSW) waterfall calculation methodology. The objective of the changes is to increase the frequency with which BBSW rates are calculated using transaction data, while also ensuring that a high quality rate is produced.

The proposed enhancements relate solely to the transaction layer of the BBSW calculation waterfall. ASX proposes to implement the methodology changes in November 2020, subject to the feedback received from this consultation paper.

1.1. Invitation to respond

ASX Benchmarks invites feedback from market participants and BBSW subscribers on the proposed methodology enhancements set out in this consultation paper. The consultation will be open from 27 July 2020 to 27 August 2020.

Please submit your response to ASXBPricing@asx.com.au**.**

ASX Benchmarks will publish a market notice to advise market participants and BBSW subscribers of the outcome of the consultation in September 2020.

1.2. Structure of the consultation paper

Section 2 Provides background on BBSW and an overview of the current waterfall calculation methodology.

Section 3 Details the proposed enhancements to the BBSW transaction layer. This includes:

- Widening the maturity pool of eligible transactions for 2- to 6-month tenors and introducing a wider, asymmetric maturity pool for the 1-month tenor **(section 3.3).**
- Lowering the volume threshold for the 1-, 3- and 6-month tenors **(section 3.4).**
- Introducing a weighted least squares regression (LSR) model to complement the existing VWAP methodology **(section 3.5).**
- Progressing to the NBBO layer of the waterfall under specific circumstances **(section 3.6).**
- Summary of the results when all enhancements are implemented **(section 3.7)**.

Section 4 Details the consultation questions on the proposals from section 3.

Appendix A Provides the draft BBSW methodology document.

Appendix B Provides a timeline of the evolution of BBSW.

Appendix C Contains a glossary of key terms.

2. Background

2.1. About BBSW

BBSW is a forward-looking, unsecured, short-term money market rate that reflects a prime bank-facing exposure. As Australia's most widely used reference rate, BBSW is an important tool for pricing and valuing Australian dollar derivatives, loans and securities contracts, as well as being a key performance benchmark.

BBSW is one of five significant financial benchmarks in Australia, as declared by the Australian Securities and Investments Commission (ASIC), and is governed and licensed under the *ASIC Financial Benchmark (Administration and Compelled) Rules 2018*. Further, the Australian regulatory framework is recognised as equivalent by the European Union (EU) and BBSW is included on the European Securities and Markets Authority (ESMA) register for third country benchmarks. This enables BBSW to be used by EU entities.

BBSW rates are based on either transaction data or live executable prices using a robust calculation waterfall methodology. The primary layer in the calculation waterfall is currently the volume weighted average price (VWAP) methodology which uses transactions in prime bank paper[1].

2.2. Regulatory obligations of an administrator

As the administrator of a significant financial benchmark, ASX must use a methodology that is designed to ensure the quality, integrity, availability, and credibility of the benchmark. ASX, in consultation with the BBSW Advisory Committee and regulators, has assessed a number of different methodology options with the objective of maximising the use of transaction data, while ensuring the quality and integrity of the BBSW rate.

Section 2.2.2 and 2.2.3 of the *ASIC Benchmark (Administration) Rules 2018* require the benchmark administrator to design a methodology to generate – in the widest range of market conditions – a financial benchmark that is an accurate and reliable representation of the interest.

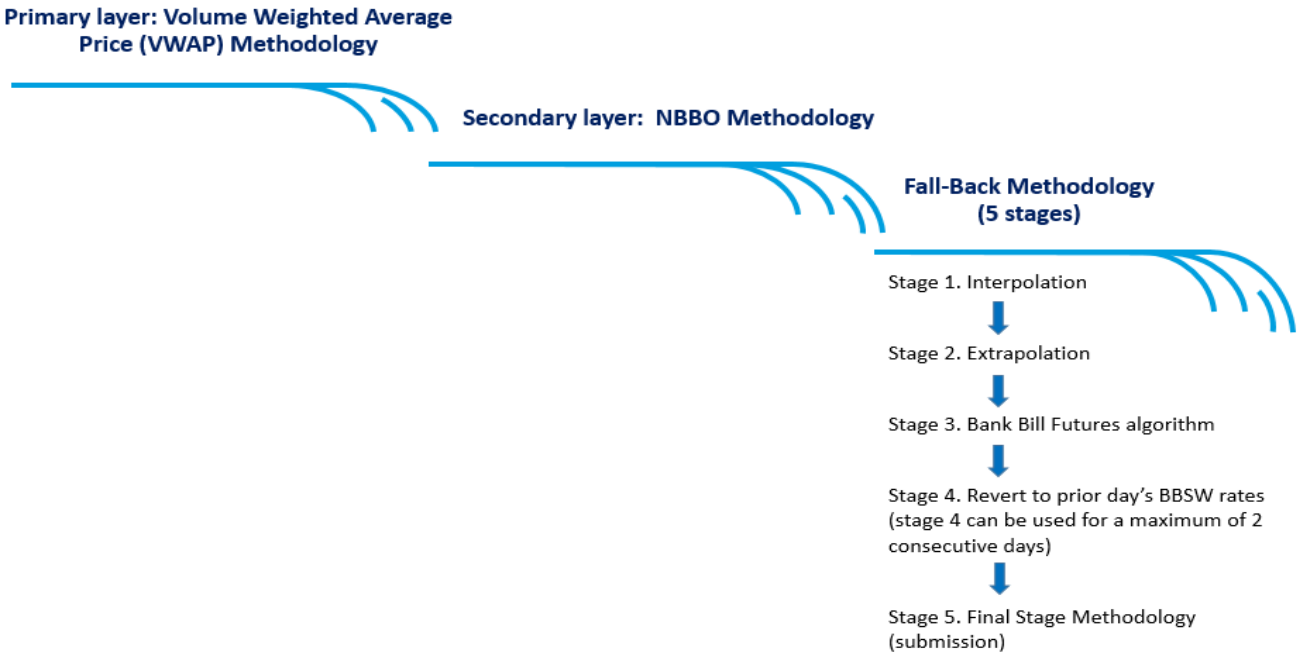
The *IOSCO Principles for Financial Benchmarks* require the benchmark administrator to design a methodology that uses financial data based on an active market, involving arm's length transactions that reflect the competitive forces of supply and demand, in priority to all other financial benchmark data.

The rules also state that while the method should prioritise the use of transaction data, other data (such as executable quotes) may be used if this data provides a more accurate representation of the interest, market or economic reality the benchmark is intended to measure. This is consistent with European Union Benchmark Regulation (EU BMR).

[1] Prime Bank Paper is defined as Bills of Exchange accepted or endorsed by Prime Banks or Negotiable Certificates of Deposit (NDCs) issued by Prime Banks, with a parcel size of A$10 million or more.

2.3. Current BBSW calculation waterfall

The following section outlines the current BBSW methodology:



BBSW is formed using a resilient and transparent waterfall methodology comprised of three main layers:

1. **Primary layer:** A VWAP calculation methodology ("the **VWAP methodology**"), based on eligible trades[2] during the rate set window, is used as the primary methodology for determining the BBSW rate for each tenor
2. **Secondary layer:** Where a BBSW rate cannot be formed under the VWAP methodology for one or more tenors, the national best bid and best offer ("**NBBO methodology**") is used to determine the BBSW rate for that tenor or tenors
3. **Fall-back methodology:** Where a BBSW rate cannot be formed under the NBBO methodology for one or more tenors, a fall-back **comprising five stages** is used to determine the BBSW rate for that tenor or tenors ("the **fall-back methodology**"). The fifth stage in the fall-back methodology is the final stage methodology that is based on the expert judgement of authorised submitters and approvers from each of the prime banks.

For further detail on the existing methodology, please refer to **section 4.1** of the *ASX bank bill swap (BBSW) conventions and BBSW methodology* located at: https://www.asx.com.au/documents/products/asx-bbsw-conventions.pdf

Since taking on administration of BBSW in January 2017, BBSW rates have been calculated using either the VWAP or NBBO methodology. To date, the fall-back methodology has not been used.

[2] 'Eligible trades' means all trades in Bank Paper that occur in the Rate Set Window for A$10 million or more and within the rolling maturity pool specified in the BBSW Conventions.

2.4. Current BBSW transaction layer

In May 2018, ASX introduced the VWAP methodology as the primary method of calculation for BBSW. The VWAP methodology is based on eligible trades executed during the rate set window. Eligible trades consist of trades that mature within a date range of +/-5 business days[3] either side of the straight-run maturity date for that tenor.

The VWAP methodology considers two variables (transaction yield and volume) in the calculation. However, this limits the transaction data which can be considered, as trades which take place on dates further away from the target maturity date cannot be used effectively in this calculation.

While the VWAP methodology works well, ASX Benchmarks would like to increase the frequency with which transactions are used to calculate BBSW, from the current 48% (since the introduction of VWAP methodology in May 2018). There is a significant amount of transaction data which cannot be used to form the benchmark rate because it falls outside of the current eligible maturity pool.

For the purposes of the current VWAP calculation, eligible transactions consist of trades that occur within a date range of +/-5 business days[4] either side of the straight-run maturity date for each tenor. A broad range of maturity dates can cause some variance in the VWAP rate, particularly when the yield curve is steep.

Trades with maturity dates greater than +/-5 business days[5] are therefore not used at present, due to the risk of introducing too much variance in the rate. To increase transaction-based tenor formation, the proposed BBSW methodology includes the ability to adjust for the maturity date, which is not part of the current VWAP methodology. This will allow the maturity pool to be widened and subsequently increase the use of transaction data in forming the rate.

ASX, in consultation with the BBSW Advisory Committee, analysed a number of transaction-based methodologies using historical data and scenario analysis to assess performance, relative to the existing methodology, using a wider set of inputs. ASX's analysis of historical data shows that solely widening the maturity pool to +/-10 business days under the current VWAP methodology would increase the frequency of setting the rate using transaction data, but would also increase the variability of the rate to an extent that could undermine the integrity and credibility of the benchmark.

In order to address the third variable (maturity date) and increase the use of transaction data without compromising the quality of the rate, ASX proposes to add a weighted least squares regression (LSR) methodology into the waterfall. The weighted LSR methodology supports a widening of the transaction maturity pool by adjusting the weighted average of the transactions by maturity date.

Based on ASX's analysis of historical data, including the maturity date of eligible trades as a calculation input in addition to using the proposed weighted LSR methodology would result in significantly less variability of BBSW rates for the wider eligible maturity pool when compared with the VWAP methodology. This is particularly evident in the 1-month tenor.

[3] +/- 3 business days for the 1-month tenor from 25 March 2019.
[4] +/- 3 business days for the 1-month tenor from 25 March 2019.
[5] +/- 3 business days for the 1-month tenor from 25 March 2019.

3. Proposed enhancements to BBSW transaction layer

3.1. Summary of proposed enhancements

ASX proposes to introduce the following changes to the existing transaction layer of the BBSW calculation methodology:

a) Widen the maturity pool for the 2- to 6-month tenors, and introduce a widened, asymmetric maturity pool for the 1-month tenor (see section 3.3)

ASX proposes extending the rolling maturity pool to +/-10 business days either side of the straight-run maturity date with the exception of the 1-month tenor which will use a -5/+10 business day maturity pool. This will apply to both the existing VWAP methodology and the proposed weighted LSR methodology (i.e. both stage 1.1 and stage 1.2).

b) Lower the volume threshold for the 1-, 3- and 6-month tenors (see section 3.4)

For stages 1.1 and 1.2, the minimum eligible volume for the 1-, 3-, and 6-month tenor will be reduced from $200 million to $100 million. There is no change to the minimum eligible volume for the 2-, 4-, and 5-month tenors.

c) Introduce a weighted least squares regression methodology (see section 3.5)

A weighted LSR methodology will be added to the transaction-based calculation. This will act as a supplementary methodology to the current VWAP methodology, and will be applied when the eligible trades for a tenor fall on multiple maturity dates.

d) Progress to NBBO methodology under specific circumstances (see section 3.6)

In developing stage 1.2 of the methodology, it was determined that there may be instances where ASX would need to progress to stage 2 (the NBBO methodology) to calculate BBSW. This would occur when:

- A weighted LSR rate is calculated that is 1.5 basis points away from that day's NBBO rate
- All trades are clustered solely toward one side of the maturity pool with no trade(s) on the straight-run date or either side of the straight-run date.

There are no changes proposed to stage 2 (NBBO methodology) or stage 3 (fall-back methodology) of the calculation waterfall.

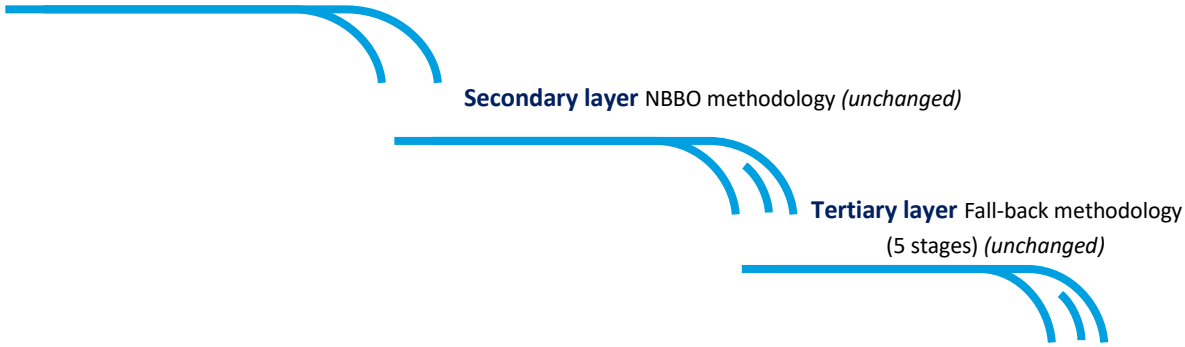
3.2. Proposed BBSW calculation waterfall

Primary layer

Stage 1.1 Simple VWAP methodology: Where all eligible trades for a tenor fall on the straight-run maturity date;

Or

Stage 1.2. Weighted least squares regression methodology: Where eligible trades fall on multiple maturity dates



3.3. Increase the pool of eligible trades by widening the maturity pool

ASX is proposing to widen the maturity pool criteria for eligible trades for the 2- to 6-month tenors to +/-10 business days. ASX is also proposing to introduce an asymmetric maturity pool of -5/+10 days for the 1-month tenor, where historical analysis indicates that this will generate a higher quality rate for the 1-month tenor.

Widening out the maturity pool will increase the:

- Number of transactions used to form the rate.
- Frequency with which the rate will be set using transaction.

Table 1 below shows the percentage of occasions on which the rate would be set under the current (VWAP) methodology and the enhanced (weighted LSR) methodology. This shows an improvement across all tenors under the enhanced methodology.

Table 1: Tenor formation under the current and proposed maturity pool.

Results are for the period 21 May 2018 to 20 April 2020

Transaction based tenor formation	1 month	2 month	3 month	4 month	5 month	6 month	Avg.
Current +/-5 days* (current volume threshold)	49%	48%	65%	19%	17%	89%	48%
Enhanced +/-10 days (current volume threshold)	61%	63%	72%	29%	27%	91%	63%

** +/-3 days for the 1-month tenor from 25 March 2019*

Analysis of historical data shows that widening the maturity pool to +/-10 business days under the current VWAP methodology would introduce greater variance in the rate that could undermine the integrity of, and confidence in, the benchmark. To address this, the widening of the maturity pool needs to be combined with a new methodology that adjusts for the different maturity dates. The introduction of a weighted LSR methodology is therefore proposed in section 3.4.

Asymmetric maturity pool of -5/+10 business days for the 1-month tenor

In March 2019, ASX implemented an interim change in the 1-month VWAP methodology to narrow the range of transactions eligible for inclusion in the calculation in order to reduce variability in the 1-month tenor. Slight inconsistency in the 1-month rate was predominantly caused by trades with less than 25 days to maturity.

By introducing an asymmetric maturity pool for the 1-month tenor of -5/+10 business days, variability will continue to be reduced by excluding trades with less than 25 days to maturity, while extending the range above the straight-run maturity date to maximise the use of transactions.

Historically, the 1-month curve tends to be steeper than the other tenors, which can result in a wider dispersion of rates. This is most prominent at the front of the maturity pool.

This steepness is in part because a transaction with 24 days to maturity has six days, but 20% less maturity than the target 30 day calculation point. However, a transaction with 84 days to maturity is still six days, but only 6.6% less maturity for the 90 day calculation point.

3.4. Lower the minimum volume threshold for the 1-, 3- and 6-month tenors

ASX proposes to lower the eligible volume threshold for the 1-, 3-, and 6-month tenors from $200 million to $100 million. The volume threshold determines whether there has been sufficient traded volume in a particular tenor to form a BBSW rate using the transaction layer of the calculation waterfall.

No change is proposed to the other criteria used to determine data sufficiency (i.e., a minimum of three transactions and minimum of four counterparties per tenor).

Table 2: Existing and proposed minimum volume threshold

	1m	2m	3m	4m	5m	6m
Current minimum volume threshold (millions)	200	100	200	100	100	200
Proposed minimum volume threshold (millions)	**100**	100	**100**	100	100	**100**

Lowering the minimum volume threshold for the 1-, 3-, and 6-month tenors will bring all tenors into alignment. Historical analysis indicates that lowering the volume threshold increases the use of transaction data, particularly for the 1-month and 3-month tenor points, without affecting the quality of the rate.

Table 3: Tenor formation increase when lowering the eligible volume threshold for the 1-, 3-, and 6-month tenors under the current VWAP methodology.

The below results are for the period 21 May 2018 to 20 April 2020.

Transaction-based tenor formation	1 month	2 month	3 month	4 month	5 month	6 month	Avg. (1, 3, and 6 month)
+/-5 days[1] (current volume threshold)	49%	48%	65%	19%	19%	89%	68%
+/- 5 days[1] (100 mln volume threshold)	63%	48%	82%	19%	19%	92%	79%

1. Maturity pool of *+/-3 days for the 1-month tenor from 25 March 2019.*

3.5. Introduction of a weighted LSR calculation methodology and analysis

It is proposed that a weighted LSR methodology is added to the primary layer of the calculation waterfall to enhance the existing VWAP methodology.

The objective of a weighted LSR methodology is to enable the use of a wider range of transactions, while maintaining the integrity of the rate. LSR is a regression model, which takes the price and volume data for multiple maturity dates to solve for the BBSW rate at each tenor's straight-run maturity date. The calculation methodology for the weighted LSR methodology, including worked examples, can be found in **Appendix A.**

The methodology was back-tested using 492 days of observations. As an indicator of the performance of the methodology, a comparison of the average change in BBSW rates from one day to the next under the enhanced methodology and current methodology is used.

The current methodology refers to results produced under both the VWAP and NBBO calculation methods (see 2.3 current BBSW calculation waterfall). The enhanced methodology refers to the results produced under the weighted LSR, VWAP and NBBO calculation methods (see 3.2 proposed BBSW calculation waterfall).

The results in **Table 4** for the enhanced methodology (row 2) incorporate widening out the maturity pool to +/-10 business days for the 2- to 6-month tenors (-5/+10 days for the 1-month tenor), implementing a weighted LSR methodology and reducing the minimum eligible volume to $100 million for the 1-, 3-, and 6-month tenors.

It should be noted that under the enhanced methodology, where a rate could not be formed using the weighted LSR methodology or VWAP methodology, the NBBO methodology was used to calculate that day's rate.

The results are for the period of 21 May 2018 to 20 April 2020.

Table 4: Average daily variation in BBSW rates from one day to the next under the enhanced and current methodology.

Average daily variation compared to prior day's rate (bps)	1 month	2 month	3 month	4 month	5 month	6 month	Total average
Current methodology[1]	0.9962	1.0110	1.0245	1.0897	1.1674	1.1842	1.0788
Enhanced methodology[2]	0.9945	1.0109	0.9941	1.0897	1.1676	1.1842	1.0735

1. Maturity pool of *+/- 5 days for all tenors except 1-month. 1-month tenor +/-3 days from 25 March 2019. Volume threshold for 1-, 3-, and 6-month 200 mln.*
2. Maturity pool of +/-10 days for all tenors except 1-month. 1-month -5/+10 days. Volume threshold for 1-, 3-, and 6-month 100 mln.

The overall performance of the enhanced methodology shows a slight reduction in daily variability when compared to the current methodology. By introducing the supplementary weighted LSR calculation into the methodology, it facilitates increased use of transaction data whilst minimising, and in some instances reducing, variance in the calculated rate.

As an aside, the performance of the enhanced methodology was analysed for the month of March 2020; a historically volatile period. The percentage of rates set using transaction data would have increased to 81% (under the enhanced methodology) from 65% (under the current methodology).

3.6. Progress to NBBO methodology under specific circumstances

ASX proposes to progress to the NBBO methodology under specific circumstances where it is deemed that the NBBO rate would be more reflective of the underlying physical bank bill market. This can occur when trades are solely clustered to one side of the maturity pool, skewing the line of best fit.

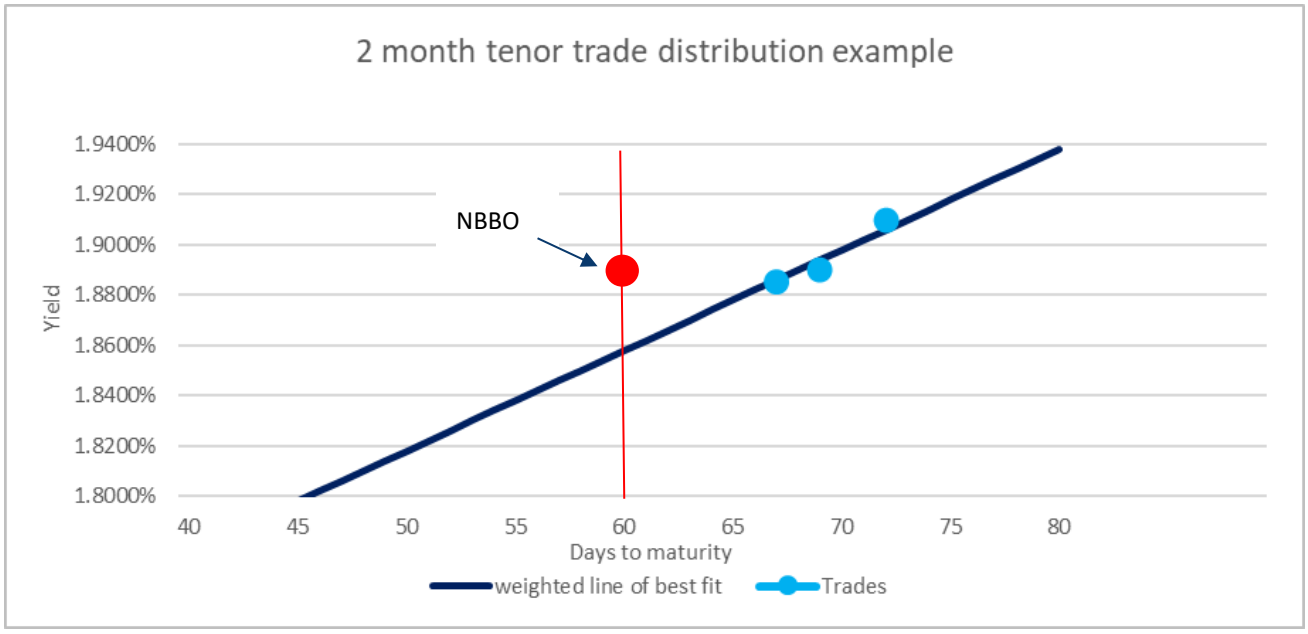
In these edge cases, the weighted LSR's mathematical formula can produce a rate that isn't considered to be the best representation of the BBSW rate for that day.

ASX proposes to progress to the NBBO methodology if:

1. The weighted LSR results in a rate that is greater than 1.5 basis points away from the NBBO rate.
2. Trades are clustered solely towards the front or the back of the maturity pool.
3. There are no trade(s) on the straight-run date or on the other side of the straight-run date to anchor the calculation.

An example of this distribution and the application of the rule proposed above is illustrated below, in this case for the 2-month tenor.

Scenario 1. Example where ASX would progress to NBBO



1. Weighted LSR set greater than 1.5 basis points away from NBBO (NBBO 1.885% & weighted LSR 1.860%).
2. All trades are clustered solely to right or far side of the maturity pool. There are no trades on the straight-run date.

In this hypothetical scenario, the weighted line of best fit becomes steeper due to the distribution of transactions and intersects the straight-run date (60 days) at a lower yield than if the trades were more evenly distributed across the maturity pool. As a result, the weighted LSR rate is greater than 1.5 basis points away from where the NBBO rate was determined for that day.

Analysis of historical data suggests that the above scenario would occur approximately 0.8% of the time or twice per year.

3.7. Impact of all proposed enhancements on transaction-based tenor formation

The proposed changes, taken together, would result in an overall increase in transaction-based tenor formation from 48% to 63%, or from two to three tenors per day to three to four tenors per day. This is a material improvement and will support the ongoing quality, reliability and longevity of BBSW.

Table 5 shows the combined impact by tenor. Row 1 captures the results under the existing VWAP methodology. Row 2 highlights the increase when the weighted LSR methodology is applied, the maturity pool is widened to +/-10 days (and -5/+10 days for the 1-month) and the minimum eligible volume is decreased to $100 million for the 1-, 3-, and 6-month tenors. The results are for the period 21 May 2018 – 20 April 2020.

Table 5: Tenor formation increase when combining all proposed enhancements

Transaction-based tenor formation	1m	2m	3m	4m	5m	6m	Avg
+/-5 days[1] (current volume threshold)	49%	48%	65%	19%	19%	89%	48%
+/-10 days[1] (100m volume threshold)	77%	63%	88%	29%	27%	94%	63%

1. Maturity pool of *+/-3 days for the 1-month tenor from 25 March 2019.*

Table 6 shows the absolute average difference between the weighted LSR and VWAP rates across tenors 1- to 6-months. For the weighted LSR results, the maturity pool is widened out to the proposed levels set out above. This data represents the days where a VWAP rate was formed over the observed period and the subsequent difference to the weighted LSR result.

Table 6: Weighted LSR average absolute difference to VWAP rate observed over the 492-day period

	1m	2m	3m	4m	5m	6m
Weighted LSR average difference to VWAP rate	0.27bps	0.16bps	0.11bps	0.20bps	0.18bps	0.09bps

Based on the above, the weighted LSR methodology produces a rate that shows minimal variance when compared to the rate produced under the VWAP methodology.

4. Questions

ASX invites comments from participants in the bank bill and NCD market, as well as the broad range of users of the BBSW rate, on the proposed change outlined in this paper. Specifically:

1. Are you supportive of ASX's proposed enhancements to the existing transaction layer of the BBSW calculation methodology?

2. Are there any points you would like to raise for consideration regarding the proposals outlined in this consultation paper?

5. Appendices

Appendix A Proposed BBSW methodology and worked example

How is the straight line determined?

LSR uses a technique called 'least squares' to determine a line of best fit through a set of independent variables and the corresponding dependent variables or observations. The parameters m and b in equation 1 are determined by minimising the sum of the squared differences between the actual observations y_i and the corresponding model values, $mx_i + b$.

$$y = mx + b \tag{1}$$

$$R = \sum_{i=1}^{N} \left(y_i - (mx_i + b)\right)^2 \tag{2}$$

Minimising the residual R in equation 2 with respect to the two model parameters m and b (see Appendix A) yields the following equations for m and b.

$$m = \frac{\sum_{i=1}^{N}(x_i y_i) - N\bar{x}\bar{y}}{\sum_{i=1}^{N} x_i^2 - N\bar{x}^2} \tag{3}$$

$$b = \bar{y} - m\bar{x} \tag{4}$$

Where:

- x_i = the independent variable (e.g. maturity date of eligible trade)
- y_i = dependent variable or observation (e.g. traded yield of eligible trade)
- N = the number of variables (number of eligible trades for that tenor)
- $\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i$ is the arithmetic average of the independent variables
- $\bar{y} = \frac{1}{N}\sum_{i=1}^{N} y_i$ is the arithmetic average of the observations.

Weighting the observations

Equations 2 – 4 assume all data points should be given equal weighting. However, there exist situations in which some observations should be given more weight in the model than others. For example, when trying to fit a line through a set of quotes, it may be desirable to give more weight to the quotes with higher volume. In this case, the residual function (equation 2) becomes:

$$WR = \sum_{i=1}^{N} w_i \left(y_i - (mx_i + b)\right)^2 \tag{5}$$

Where w_i represents the relative weight (e.g. normalised trade volume) to give to the i^{th}observation $\{x_i, y_i\}$. Minimising the weighted residual WR in equation 5 with respect to the two model parameters m and b (see Appendix A) yields the slightly modified equations for m and b, viz:

$$m = \frac{\sum_{i=1}^{N} w_i x_i y_i - \bar{x}\bar{y}\sum_{i=1}^{N} w_i}{\sum_{i=1}^{N} w_i x_i^2 - \bar{x}^2 \sum_{i=1}^{N} w_i} \tag{6}$$

$$b = \bar{y} - m\bar{x} \tag{7}$$

Where now:

- $\bar{x} = \frac{\sum_{i=1}^{N} w_i x_i}{\sum_{i=1}^{N} w_i}$ is the *weighted* arithmetic average of the independent variables
- $\bar{y} = \frac{\sum_{i=1}^{N} w_i y_i}{\sum_{i=1}^{N} w_i}$ is the *weighted* arithmetic average of the observations.

Note, the unweighted LSR described by equations 2 – 4 is a special case of the weighted LSR.

Applying this to BBSW, the independent variable (x) is the maturity date and the dependent variable (y) is the yield.

By weighting the LSR model, the third variable (volume) is accounted for in the BBSW calculation. This considers the size of the trade (assuming it meets the minimum volume threshold criteria) and weights the line of best fit accordingly.

Weighting the line of best fit produces a rate that is more representative of the underlying transactions that contribute to a transaction based rate.

At present, the maturity date of trades in physical bank paper is used to determine the eligibility of a trade based on whether it falls within the rolling maturity pool. However, a weighted LSR methodology uses the maturity date as an input into the calculation.

The below example shows how a BBSW rate can be calculated using the weighted LSR method, with trade volume (in millions) providing the weights.

Table 1 below provides hypothetical data for 1-month BBSW in the **x (maturity date)**, **y (rate)** and **w (trade volume)** columns. The remaining columns represent the calculations required to determine the slope m and intercept b parameters from equations 6 and 7.

Table 1[6]: Valid 1m BBSW transactions and pre-calculated values

x	y	w	wx^2	wxy	∑wx/∑w	∑wy/∑w	∑(wxy)	$\sum(wx^2)$	∑w
20	1.5400%	10	4000	308.00%	32.73568	1.62152%	12087.14%	250173	227
23	1.5650%	12	6348	431.94%					
25	1.5850%	30	18750	1188.75%					
32	1.6250%	50	51200	2600.00%					
36	1.6300%	80	103680	4694.40%					
37	1.6550%	20	27380	1224.70%					
39	1.6570%	15	22815	969.35%					
40	1.6750%	10	16000	670.00%					

Using the values calculated above, the slope of the hypothetical 1-month BBSW data is determined from equation 6:

$$m = \frac{12087.14\% - 227 * 32.73568 * 1.62152\%}{250173 - 227 * 32.73568^{\ 2}} = 0.00544\%$$

We then use the slope m to determine the intercept b from equation 7:

$$b = 1.62152\% - 32.73568 * 0.00544\% = 1.44344\%$$

Finally, we use the slope m and intercept b to calculate the 1-month BBSW rate for a straight-run maturity of 30 days using equation 1:

$$y = 0.00544\% * 30 + 1.44344\% = 1.6066^{7}\%$$

[6] The data presented in the worked example is hypothetical data created for illustrative purposes.
[7] BBSW is rounded to four decimal places.

Appendix B BBSW evolution

Year	Action
January 2017	ASX becomes administrator of BBSW.
December 2017	New BBSW trade and trade reporting guidelines become effective.
May 2018	ASX introduces the VWAP layer methodology as the primary method of calculation for BBSW - the first transaction based methodology for BBSW.
March 2019	Narrowed maturity pool window for 1-month tenor.
July 2020	Consultation on proposed methodology enhancements.
November 2020	Implementation of methodology enhancements (subject to consultation).

Appendix C Glossary of terms

- **Eligible trades:** Means all trades in bank paper that occur in the rate set window for A$10 million or more and within the maturity pool specified in the BBSW conventions.
- **Maturity pool:** Refers to a date range defined as +/-X business days either side of the straight-run date in which eligible trades are considered in calculating the rate.
- **Prime bank paper:** Bills of exchange accepted or endorsed by prime banks of negotiable certificates of deposit (NCDs) issued by prime banks with a parcel size of $10 million or more.
- **Rate set window:** the defined period of between 8:30am – 10:00am in which all eligible trades, subject to the meeting the eligibility criteria, are considered for the calculation of BBSW.
- **Straight-run date**: Refers to the date that determines the maturity pool for each tenor. For example, for the 1-month tenor, the straight-run maturity date is 30 business days. For the 2-month tenor, the straight-run maturity date is 60 business days, etc.
- **Transaction layer**: Refers to the primary layer where BBSW is calculated using eligible transactions. This includes both the VWAP methodology and the proposed weighted LSR methodology.

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