TSX Calculated Closing Price Bid Ask for ETFs Research Paper

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Executive Summary

A prevailing issue in the Canadian marketplace is that the prices currently used for valuation of exchange-traded funds (ETFs), the majority of which are thinly traded, are often not reflective of their true market price. The two key prices currently in use - Last Sale Price, and Last Bid/Ask - have issues of "staleness" when used to represent the value of these infrequently traded instruments. In particular, the median age of an ETF's Last Sale Price at the end of the day, is over 2 hours old.

These issues may be resolved by using a calculated Closing price and Bid/Ask price, which integrate the most current quote in cases where the Last Sale Price is stale. These issues of staleness, and the efficacy of the calculated Closing and Bid/Ask prices, are demonstrated quantitatively in a study conducted by TMX Group Limited ("TMX"), and are discussed in depth in this paper.

Background

The prices currently used for valuation of ETFs on investors' statements and in various accounting contexts are often not reflective of their "true" market value based on observations late in the trading day. The Closing Price, or Close, is commonly used to reflect the most recent security price at the end of the day. While the "Closing Price" is a term referenced and relied on by many, there is no official definition. Typically, the value used for Closing Price is the Last Sale Price, which is defined in the Universal Market Integrity Rules ("UMIR") as the price of the last board lot trade of the day. There is no requirement, in UMIR or elsewhere, that the Last Sale Price be a trade that occurs near the end of the trading day. In fact, the most recent board lot trade may have occurred many hours prior to the 4:00pm established end of the trading day.

The Last Bid and Last Ask are another key pair of prices that are used for end of day valuations. The Canadian Securities Administrators ("CSA"), through National Instrument 31-103 "Registration Requirements, Exemptions and Ongoing Registrant Obligations", set out the basis upon which market value must be established for client reporting purposes. This regulation specifies that the market value should be determined using the last bid price in the case of a long security and the last ask price in the case of a short security, as shown on a consolidated pricing list or exchange quotation sheet as of close of business.

Both these prices have issues in reflecting an ETF's market value. The Last Sale Price can be a good representation when the last trade is close to the end of the day; however, when an ETF has not traded for hours or even days, the current value of the ETF can deviate dramatically from its Last Sale Price. The Last Bid is meant to reflect the highest price a buyer (bid) is willing to pay at the end of the day; similarly, the Last Ask is meant to reflect the best price a seller (ask) is willing to accept at the end of the day. However, while trading extends to 5:00pm ET, the close of the main trading day is at 4:00pm ET, after which many orders are cancelled, often leaving only a small subset of the orders that were available at 4:00pm. The result is that the Last Bid and Last Ask as of 5:00pm are no longer accurate representations of the security's bid and ask prices – the Last Bid is lower, and the Last Sale higher, than their more realistic values at 4:00pm. This can negatively affect dealer capital and client margin requirements, while also creating confusion among clients and their advisors as to the true value of their investments.

To address these issues, TMX implemented new values for Closing Price and Last Bid/Ask for ETFs listed on Toronto Stock Exchange ("TSX"). These values are officially called 'TSX Closing Price', 'TSX Bid' and 'TSX Ask'. The new methodology uses a time weighted average price ("TWAP") calculation over the last 10 minutes of trading to determine the TSX Last Bid, the TSX Last Ask, and, in the absence of a trade during those last 10 minutes of trading, the TSX Closing Price. This methodology is intended to provide an improved reference point for portfolio valuations over a possibly stale Last Sale Price. The TSX Bid and the TSX Ask provide a realistic tight spread by calculating the time weighted average of bid quotes and ask quotes, respectively. (Note that the TWAP calculation is utilized only for ETFs. For corporate securities, the TSX Closing Price is equivalent to the Last Sale Price, and the TSX Bid/Ask is the TSX Bid/Ask as of 4:00pm.)

These new values were approved and implemented after public consultation[1], and appear on the TSX top of book (level 1) and reference data feeds. Disseminating a single new message on the TSX data feeds with these three new data points allows interested parties to easily and conveniently identify a closing price and the associated closing bid and closing ask. In addition, the new values provide for more accurate valuation for thinly traded ETFs and improve the experience of investors, advisors, dealers, and asset managers when valuing the performance of ETFs.

1 The Notice of Proposed Amendments and Request for Comments is available on the TMX website at https://www.tsx.com/resource/en/2665/tsx-proposed-amendments-to-introduce-definitions-for-tsx-closing-price-tsx-last-ask-price-and-tsx-last-bid-price-2021-06-17-en.pdf

Research Study

To illustrate the issues with the current metrics of Last Sale Price, Last Bid and Last Ask, TMX conducted a study comparing the new calculated prices – TSX Calculated Closing Price, TSX Calculated Bid, and TSX Calculated Ask, to the prices currently in use - Last Sale Price, Last Bid, and Last Ask. This study focused on ETF securities listed on TSX during the 3-month period from September 1, 2021 to November 30, 2021 inclusive. The calculated prices were based on the same methodology as the one in use for TSX Closing Price, TSX Bid, and TSX Ask. For details on calculations, see Appendix A - Calculation of Prices.

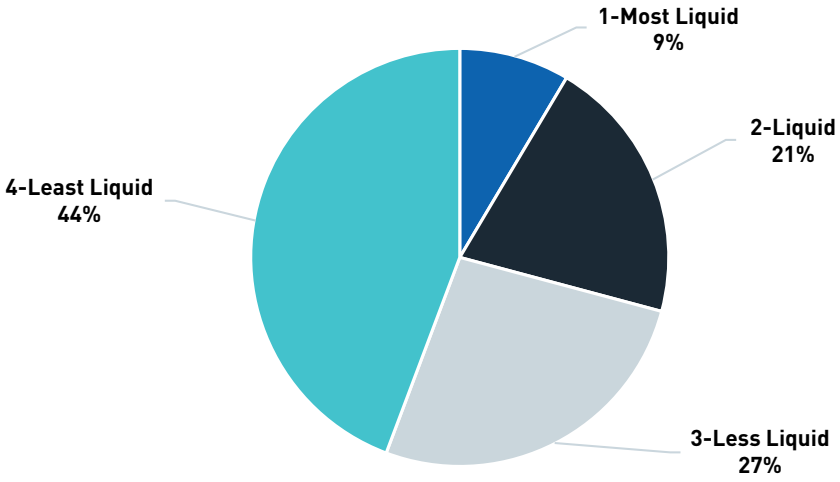
The results are segmented by relative trade frequency, or "observed" liquidity. Each security is ranked based on the average daily value ("ADV") traded on TSX in the previous 12-month period. The 1-Most Liquid category covers securities that trade an average daily value of $1 million or more. Securities that trade less than $1 million in average daily value are ranked in descending order of average daily traded value, and then divided into 10 deciles. The top 3 deciles (1-3) correspond to the 2-Liquid category, with the next 3 deciles (4-6) labelled 3-Less Liquid, and the bottom 4 deciles (6–10) classified as 4-Least Liquid, representing the most thinly traded securities. See Appendix B - Classification of Securities for details on the classification of securities.

Majority of Canadian ETF Securities Are Thinly Traded

The majority of ETF securities listed in Canada are thinly traded. Using the liquidity classification system, we find that most of the TSX-listed ETF securities are not traded frequently, as 92% trade less than $1 million average daily value (ADV). This means that the results for the categories for 2-Liquid, 3-Less Liquid, and 4-Least Liquid are the most relevant as they impact the majority of Canadian ETF securities.

FIGURE 1

Liquidity Levels for TSX-listed ETFs



Note the disproportionately small percentage of ETFs in the Most Liquid (> $1 million ADV) category.

TSX Calculated Closing Price vs Last Sale Price

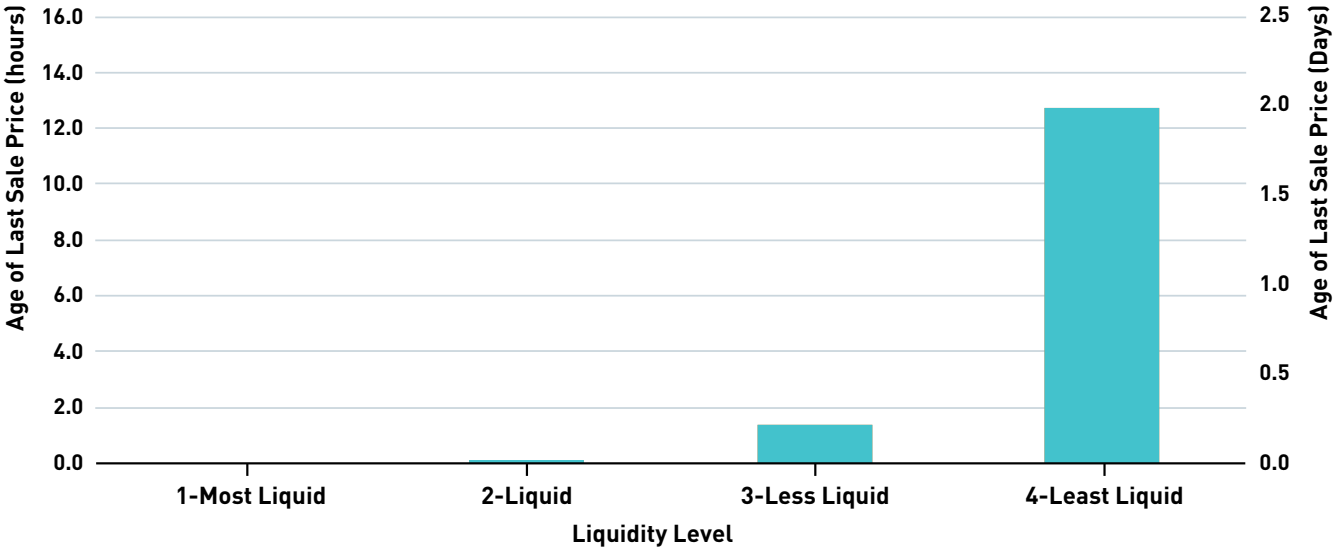
LAST SALE PRICE CAN BE "STALE" AND NOT REFLECT THE CURRENT VALUE OF THE SECURITY.

One of the main problems with utilizing the Last Sale Price for valuation is that, for thinly traded ETFs, the time of the last trade can be hours or even days prior to the close of trading on any given observation date. To measure this, TMX looked at the average age of the Last Sale Price on any given day in hours, as measured at the close at 4:00pm ET every day in the study period. The trading day is counted as 6.5 hours a day, from 9:30am to 4:00pm, which means that any age greater than 6.5 hours is over one day old. The higher the age is, the more "stale" the Last Sale Price is.

From our study, we find that the age of the Last Sale Price increases with lower levels of liquidity. Across all liquidity levels, the median age of the Last Sale Price is 2.2 hours for ETFs.

FIGURE 2

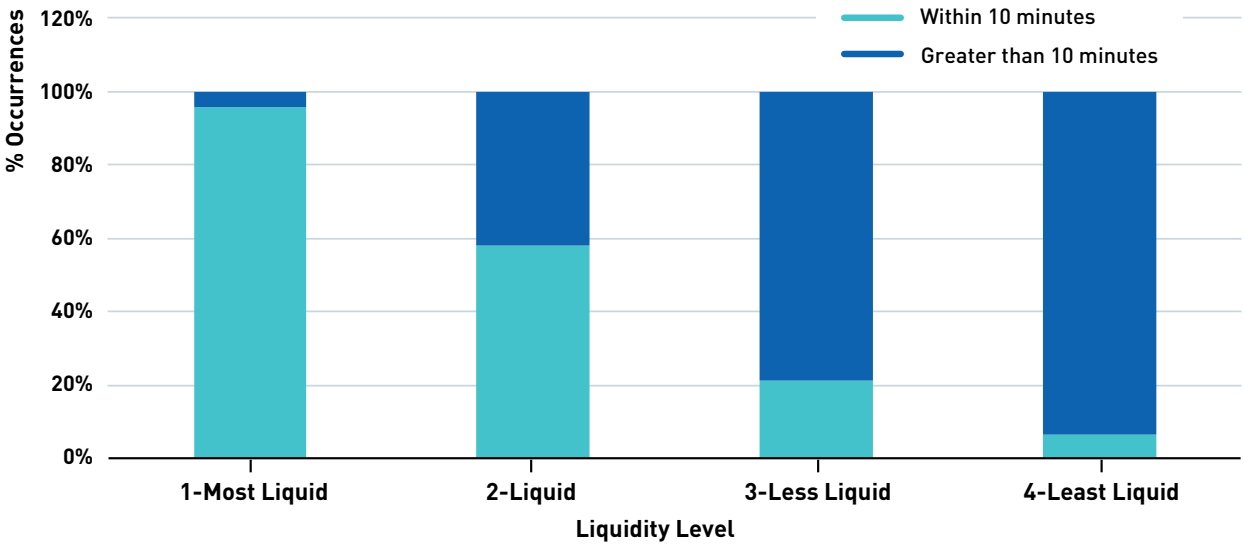
Age of Last Sale Price for ETFs By Liquidity Level



The TSX Calculated Closing Price addresses this issue by automatically switching to the midpoint of the quote if the Last Sale Price occurred more than 10 minutes (~0.17 hours) prior to the 4:00pm close of trading, discarding any "stale" last sale prices from its calculation. In our study, we found that the Last Sale Price occurred outside of this 10-minute window most of the time for ETFs, as seen in the chart below. This shows that the Last Sale Price for those securities are stale, and the TSX Calculated Closing Price does not use the Last Sale Price in its calculation for most ETFs.

FIGURE 3

Age of ETF Last Sale Price Within 10 minutes and Greater than 10 minutes



LAST SALE PRICE IS MORE LIKELY TO BE OUTSIDE OF THE CLOSING QUOTE COMPARED TO TSX CALCULATED CLOSING PRICE.

Another measure of "staleness" is how often the Last Sale Price is outside the quote at the close. In this study, the TSX Best Bid and Offer ("TBBO") at the closing time of 4:00pm is used as a measure of the most relevant price at that time. The TBBO is a good proxy for the National Best Bid and Offer ("NBBO"), which is the best bid and best offer across all Canadian protected marketplaces[2], and represents where a security can be traded right now on the Canadian marketplaces as a whole, as opposed to a historical view of the stock's price. The next trade in the security would automatically be within the TBBO, rather than outside of it. Therefore, a price that is outside the current TBBO is unlikely to represent the current value of the security.

2 The list of protected Canadian marketplaces used for the study, as enumerated by IIROC, are: NEO-L, CSE, Nasdaq CXC, Nasdaq CX2, Omega, and TSX.

To evaluate this, the TSX Calculated Closing Price and the Last Sale Price were compared to the TBBO over a period of days, across all TSX-listed ETFs. If a price is greater than or equal to the TSX Best Bid ("TBB") and less than or equal to the TSX Best Offer ("TBO"), then it is within the TBBO; otherwise, it is outside the TBBO and thus more likely to be stale. In this way, a statistical view was obtained on the probability of each stock's Calculated Closing Price and Last Sale Price being inside or outside the TBBO at closing time.

In the table below, it is evident that for the Most Liquid ETFs, the % of occurrences outside the TBBO is roughly the same for both the TSX Calculated Closing Price and the Last Sale Price. This is a natural consequence of the nature of the TSX Calculated Close, which for more highly-traded ETFs is essentially identical to the Last Sale Price. (See 'Appendix A – Calculation of Prices'.) However, for all other liquidity levels, the TSX Calculated Closing Price is outside of the TBBO at a much lower frequency than the Last Sale Price. This disparity in frequency between the Last Sale Price and the TSX Calculated Closing Price increases dramatically at lower liquidity levels.

FIGURE 4

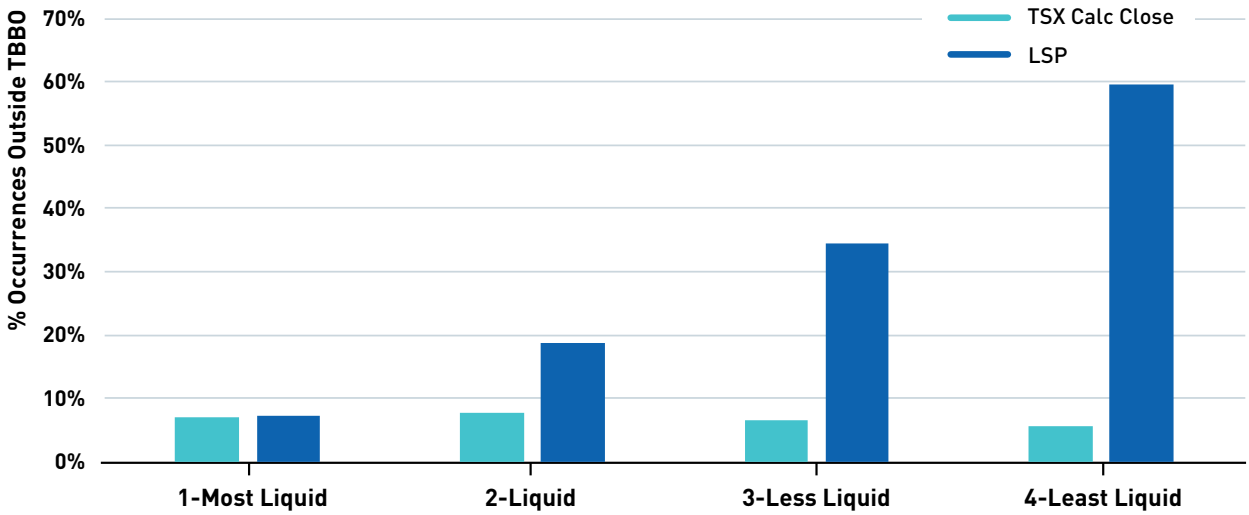
TSX-listed ETFs - % Occurrences Outside TBBO

			% OCCURRENCES OUTSIDE TBBO		
LISTING MARKET	**SECURITY TYPE**	**LIQUIDITY LEVEL**	**TSX CALCULATED CLOSE**	**LAST SALE PRICE**	**DIFFERENCE (%LSP - % CALC CLOSE)**
TSX	ETF	1-Most Liquid	7.1%	7.4%	0.3%
TSX	ETF	2-Liquid	7.8%	18.7%	10.9%
TSX	ETF	3-Less Liquid	6.5%	34.4%	27.9%
TSX	ETF	4-Least Liquid	5.6%	59.6%	54.0%

The chart below provides a visualization of these percentage differences for TSX-listed ETFs:

FIGURE 5

TSX-listed ETFs - % Occurrences Outside TBBO



The % time the ETF Last Sale Price is outside the TBBO is 18.7%, 34.4% and 59.6% for Liquid, Less Liquid and Least Liquid ETFs respectively. In contrast, the % time that the ETF TSX Calculated Closing Price is outside the TBBO is less than 8% for all liquidity levels.

Note that for more liquid ETFs, there is often a great deal of quoting activity near the end of the trading day, and as a result, it is not unusual for the TBBO to move away from the Last Sale Price before market close; as illustrated above, this phenomenon occurs roughly 7% of the time.

Based on the above analysis, we conclude that the TSX Calculated Closing Price is a significant improvement over the Last Sale Price as an indicator of the true ETF end-of-day price.

TSX Closing Bid/Ask vs Last Bid/Ask

From our study, we observe that ETF quotes widen at 4:00pm and again after 4:10pm, and finally widen further just prior to 5:00pm. This is an issue as current regulation stipulates that the Last Bid and Last Ask be used for official purposes including the valuation of clients' assets by dealers. We believe that most dealers interpret this to be the TSX Bid and TSX Ask at 5:00pm, the last quote of the day, and most systems operate with this interpretation. This means that the observed quote widening impacts the accuracy of client valuation of their ETF positions:

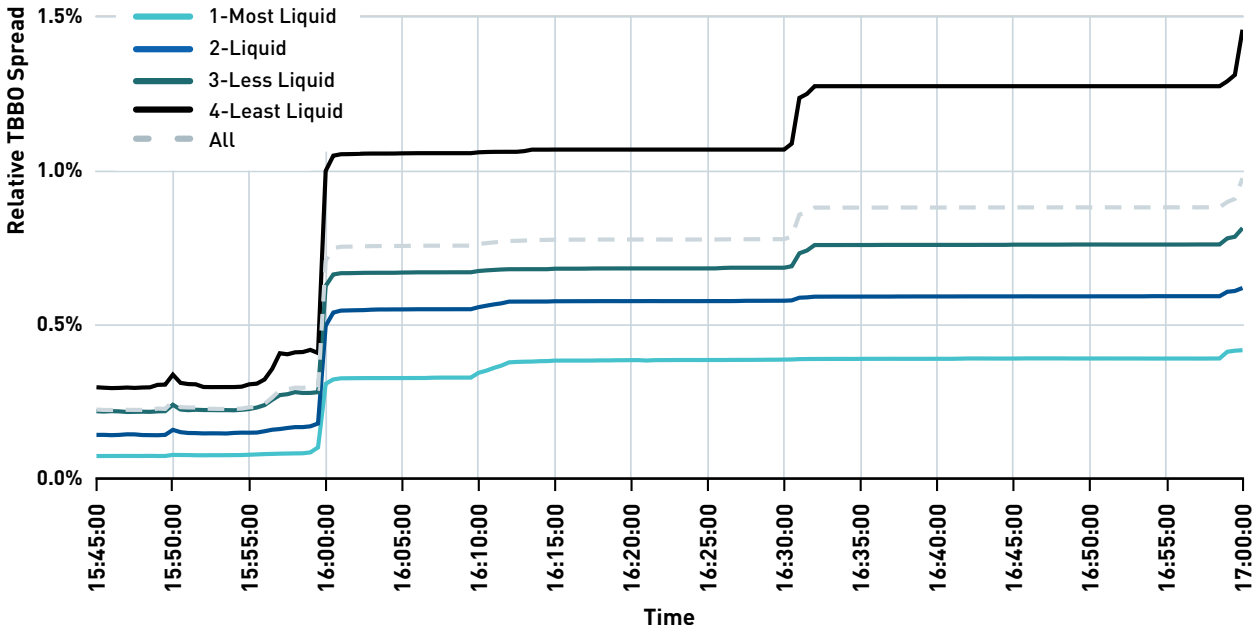
- Long positions, which utilize the bid price, tend to be undervalued.
- Short positions, which utilize the ask price, tend to be overvalued.

This practice can negatively affect dealer capital and client margin requirements, while also creating confusion among clients and their advisors as to the true value of their investments.

In the figure below, the average TBBO spread is graphed over the last hour and 15 minutes of the trading day for all ETF liquidity levels. The TBBO spread is normalized for each ETF by dividing by its midpoint price; i.e. it is (TBB – TBO)/((TBB + TBO)/2). The larger the TBBO spread, the bigger the difference between the bid and ask price being used to determine the market valuation on client statements.

FIGURE 6

End of day spreads for TSX-listed ETFs



All liquidity levels exhibit a similar spread profile:

- Relatively consistent spreads prior to 4:00pm
- A significant widening of spreads just before 4:00pm
- Further spread widening around 4:30pm, when some derivatives markets close, and then again just before 5:00pm

This spread widening leads to a dislocation between last quoted prices and true value at 5:00pm. Of particular note is that the effect is markedly larger for the Least Liquid ETFs.

These price dislocation issues are particularly pronounced in ETFs because of the nature of ETF liquidity provision, where the vast majority of quoted liquidity is provided by market makers. Market makers typically withdraw or widen their quotes shortly before 4:00pm, anticipating that they will have limited opportunities after 4:00pm to hedge any end-of-day trades. This behavior is clearly reflected in the above chart.

Conclusion

The study shows the TSX Calculated Closing Price to be a better reflection of an ETF's end-of-day value, because of the potential "staleness" of the currently-used Last Sale Price. This effect is greater for more thinly traded securities that trade less than $1 million ADV, which are the great majority of all TSX-listed ETFs.

The staleness of the Last Sale Price on ETFs is embodied by its median age of 2.2 hours; i.e. a significant fraction of the trading day. On the Least Liquid ETFs, the median age of the last trade is a full two trading days ago; and the likelihood of the Last Sale Price being outside the TBBO is greater than one half (59.6%). As the TBBO is a measure of where a stock can currently trade, this demonstrates that the Last Sale Price is unreliable. The TSX Calculated Closing Price addresses the issue of staleness by taking into account the quote if the Last Sale Price is more than 10 minutes old, resulting in a much smaller proportion (6.4%) outside the TBBO on ETFs as a whole.

We also believe the TSX Calculated Ask and TSX Calculated Bid to be a better reflection of ETF value compared to the Last Bid and Last Ask currently in use because of the widening of spreads just prior to and after 4:00pm. By 5:00pm, which is the time most dealers take the Last Bid and Last Ask to value securities on client statements, that quote is widened considerably and no longer reflects the trading prices at the end of the trading day. The Last Bid and Last Ask are taken from a time when there is no trading in the marketplace, and when most participants have cancelled their quotes. Furthermore, these quotes are inaccessible, as the TSX does not permit trading past 4:00pm except at Last Sale. As a result, we believe the Last Bid and Last Ask are frequently not an accurate reflection of the end-of-day value of the security. Instead, we believe the TSX Calculated Bid and TSX Calculated Ask better represent the end-of-day value of an ETF in these situations, by averaging the quotations at which the ETF would be available to trade near the end of the trading day.

In conclusion, we believe this study has illustrated the issues with the current reference prices used to valuate ETFs at the end of the day. The alternative TSX Calculated Closing Price, TSX Calculated Bid, and TSX Calculated Ask address these limitations and provide a better reflection of the security value as compared to the Last Sale Price, Last Bid and Last Ask respectively. We believe that the adoption of this approach in the Canadian industry, including via formal recognition as an accepted valuation basis, may help foster greater investor confidence in Canada's ETF market and capital markets more generally.

Appendix A - Calculation of Prices

TSX CALCULATED CLOSING PRICE

The calculation for the TSX Calculated Closing Price is as follows:

- If there is a last sale price on TSX ("TLSP") during the last 10 minutes of the regular trading session, the TSX Calculated Closing Price is the TLSP
- If there is no TLSP during the last 10 minutes of the regular trading session, the TSX Calculated Closing Price is the midpoint of the following two time-weighted average prices ("TWAP"):
  - TWAP of TSX Best Bid ("TBB") during the last 10 minutes of the regular trading session, and
  - TWAP of TSX Best Offer ("TBO") during the last 10 minutes of the regular trading session
- If there is no TSX Best Bid and Offer ("TBBO") during the last 10 minutes of the regular trading session, the timing of the TLSP and the last TBBO is evaluated as follows:
  - The TLSP occurs later than the last TBBO → TLSP
  - The last TBBO occurs later than the TLSP → Midpoint of the last TBBO
  - No TLSP during the current trading session → Midpoint of the last TBBO
- If there is no TLSP and no TBBO during the regular trading session for that day, the TSX Calculated Closing Price is the previous day's TSX Calculated Closing Price.
  - If the previous day's TSX Calculated Closing Price is not available, the TSX Calculated Closing Price is the previous day's TLSP.

Note that while TMX currently only publishes the calculated price for ETFs, for the purpose of this study, this same calculation was applied to equity securities as well to compare with the Last Sale Price.

LAST SALE PRICE

For this study, the "last sale price" of a security listed on TSX or TSX Venture Exchange ("TSXV") is the price of the last sale of at least one standard trading unit of the security, but does not include the price of a sale resulting from an order that is a:

1. Basis Order;
2. Call Market Order;
3. Closing Price Order;
4. Special Terms Order, unless the Special Terms Order has executed with an order or orders other than a Special Terms Order; or
5. Volume-Weighted Average Price Order.

TSX CALCULATED BID AND TSX CALCULATED ASK

The TSX Calculated Bid and TSX Calculated Ask are calculated as follows:

- If there is a TSX Best Bid and Offer ("TBBO") during the last 10 minutes of the regular trading session, then:
  - the TSX Calculated Bid is the TWAP of TSX Best Bid ("TBB") during that time period, and
  - the TSX Calculated Ask is the TWAP of TSX Best Offer ("TBO") during that time period.
- If there is no TBBO during the last 10 minutes of the regular trading session, then:
  - the TSX Calculated Bid is the last TBB of the current trading day, and
  - the TSX Calculated Ask is the last TBO of the current trading day.

LAST BID AND LAST ASK

Currently, the definition of 'market value' that is relevant for the valuation of securities reflected on client statements, and which specifies for listed securities is listed in paragraph 200.1(c)(i) of IIROC Dealer Member Rule 200 Minimum Records under subparagraph (A)[3]: " For listed securities, the last bid price of a long security and, correspondingly, the last ask price of a short security, as shown on a consolidated pricing list or exchange quotation sheet as of the close of business on the relevant date or last trading date prior to the relevant date, as the case may be;"

For the purpose of this study, we assume that most broker-dealers ingest quotes from the listing exchange and take the last bid and ask of the day. In the case of TSX-listed and TSXV-listed securities, this would be the last current quote as of the close of trading, which is 5:00pm, on TSX and TSXV.

Appendix B - Classification of Securities' Relative Trade Frequency Levels

For the study, TMX categorized listed securities according to tiers based on the level of trading activity in the securities. Securities that fall into the Tier A category are the most actively traded securities based on the security's average daily value ("ADV") traded on TSX or TSXV in the previous 12-month period. The Tier B category covers securities that, on average, trade less actively. The tiers are further divided into sub-tiers, which are also based on levels of trading activity. The Liquidity Level is mapped to each of these tiers.

FIGURE 7

Classification of Securities' Relative Trade Frequency Levels for Study

LIQUIDITY LEVEL	DECILE	AVERAGE DAILY VALUE TRADED ("ADV")		
		ADV – TSX EQUITIES	ADV – TSX ETFS	ADV – TSXV EQUITIES
1-Most Liquid	N/A	> $1 million		
2-Liquid	1	$206,963 - $999,999	$98,823 - $999,999	$98,823 - $999,999
	2			
	3			
3-Less Liquid	4	$75,578 - $206,987	$37,243 – $98,342	$38,703 – $98,342
	5			
	6			
4-Least Liquid	7	< $75,578	< $37,243	< $38,703
	8			
	9			
	10			

3 For current IIROC Dealer Member Rules, see the RulesCollated_EN.pdf document on the IIROC website.

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