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# Do Liquidity Proxies Measure Liquidity in Canadian Bond Markets?



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## Abstract

This analytical note evaluates the reliability of proxies for measuring liquidity in Canadian bond markets. We find that price-impact and bid-ask proxies paint a similar picture of evolving liquidity conditions to that obtained from richer measures of liquidity for benchmark Government of Canada bonds. In addition, we find that these proxies may be used with confidence to measure liquidity for bonds that transact much less frequently than benchmark bonds when the maturity of the bond is around five years or less. These results are important because the majority of Canadian bonds trade infrequently and over the counter, where there may be insufficient transactions or information to compute richer measures of liquidity. We can only use proxies to measure liquidity for these bonds.

*Bank topic(s): Financial markets, Debt management*

*JEL code(s): G12; G14; G23; G32*

## Résumé

Dans cette note analytique, nous déterminons la fiabilité de certaines mesures approximatives de la liquidité sur les marchés obligataires canadiens. Nous constatons que, dans le cas des obligations de référence du gouvernement du Canada, les mesures approximatives de l'incidence sur les prix et de l'écart entre les cours acheteur et vendeur dressent un tableau de l'évolution des conditions de liquidité qui est semblable à celui obtenu à partir de mesures de liquidité plus complètes. En outre, nous observons que ces mesures approximatives peuvent être utilisées avec confiance pour établir la liquidité des obligations qui sont échangées beaucoup moins souvent que les obligations de référence lorsque l'échéance de l'obligation est d'environ cinq ans ou moins. Ces résultats sont importants, car la majorité des obligations canadiennes sont peu fréquemment négociées et s'échangent sur les marchés de gré à gré, où les transactions ou l'information peuvent être insuffisantes pour calculer des mesures de liquidité plus complètes. Nous ne pouvons qu'utiliser des mesures approximatives pour évaluer la liquidité de ces obligations.

*Sujets : Marchés financiers; Gestion de la dette*

*Codes JEL : G12; G14; G23; G32*

## Introduction

Staff at the Bank of Canada combine a variety of liquidity measures with insights collected from market participants to monitor and understand conditions in financial markets.<sup>1</sup> For many over-the-counter (OTC) markets, including bond markets, staff rely on proxies for specific dimensions of market liquidity because there may be insufficient transactions or information to calculate liquidity measures. A natural question that arises is whether these proxies are reliable.

Our analysis produces two main conclusions. First, we find that the price-impact and bid-ask proxies used by the Bank of Canada do measure liquidity reliably. For benchmark Government of Canada (GoC) bonds, we show that using these proxies paints a similar picture of evolving liquidity conditions as that obtained from using measures of liquidity that are based on richer information. Second, we find that price-impact and bid-ask proxies may be used with confidence to measure liquidity for bonds that are traded much less frequently than benchmark bonds when the maturity of the bond is around five years or less. These results are important because most corporate and provincial bonds, as well as some GoC bonds, trade infrequently and OTC, where we can only use proxies.

## Liquidity Measures and Proxies on the CanDeal Trading Platform

We distinguish liquidity measures, which rely on a rich information set, and liquidity proxies, which have simpler information requirements. Both are valuable and widely used to assess market conditions (Goyenko, Holden and Trzcinka 2009), but none of these can perfectly represent market conditions. Our purpose is to evaluate whether the simpler proxies are reliable for their purpose.

For some bonds, we can compute and compare liquidity proxies and liquidity measures. This is the case for benchmark bonds (see, for example, Bulusu and Gungor 2017 for a definition). Benchmark bonds trade actively on CanDeal, Canada's largest fixed-income trading platform. **Table 1** describes our sample of benchmark bonds with maturities of 2, 5, 10, and 30 years in CanDeal, reporting the average number of transactions, transaction size and daily volatility in our sample. On CanDeal, benchmark bonds with shorter maturities have a larger number of transactions, a larger transaction size and a lower volatility of price changes, relative to bonds with longer maturities.

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<sup>1</sup> See, for example, Vulnerability 3, "Fragile Fixed-Income Market Liquidity," in the Bank of Canada *Financial System Review* (June 2016)

**Table 1: Averages of number of transactions, size of transactions and volatility in data from CanDeal**

Maturity (in years)	# Transactions	Transaction size (millions of Can\$)	Volatility	# Obs
2	62	21.1	0.00619	103,831
5	58	14.9	0.02488	80,730
10	45	10.2	0.05312	76,286
30	48	4.6	0.08436	99,126

Notes: # *Transactions* is the average number of transactions per day. *Transaction size* is the average transaction size in the sample. *Volatility* is the average daily standard deviation of price changes (expressed in per cent). # *Obs* is the number of transactions. Data are from CanDeal from January 2010 to December 2016. For each maturity, we remove 5 per cent of transactions with smallest size and 1 per cent of days with the least number of transactions. To exclude outliers, we also winsorize observations with prices that are below the 1 per cent or above the 99 per cent level in the sample.

CanDeal captures 30 to 40 per cent of the volume of benchmark bond transactions and provides a rich set of information: the market depth, the bid and ask quotes, the price and size of transactions and whether transactions were initiated as buy or sell orders (Gungor and Yang 2017). Based on this information, we compute the following liquidity proxies and measures.

The bid-ask proxy requires only transaction prices. This proxy is derived from the covariance between successive transaction price changes (Roll 1984). A larger negative covariance indicates that the transaction price bounces between a wider bid and ask spread. The richer information in CanDeal is used to calculate the effective spread. The effective spread directly measures the distance between the price of a trade and the midpoint between bid and ask quotes.

The price-impact proxy requires only transaction prices and sizes. This proxy measures the impact that the dollar value of transactions—its size—has on prices (Amihud 2002).<sup>2</sup> A higher value indicates that the size of transactions has a greater impact on prices. The richer information in CanDeal is used to calculate a richer measure of price impact: Kyle's lambda, which is the slope coefficient in a regression of price changes on the size of the transaction times the direction of the trade (i.e., +1 or -1 for a buy or sell order, respectively) (Kyle 1985). Kyle's lambda is computed every day that there are at least 25 transactions.

We compute monthly measures of the price-impact proxy, Kyle's lambda, the bid-ask proxy and the effective spread. Following Goyenko, Holden and Trzcinka (2009), we use the correlation as a simple but intuitive metric for the reliability of proxies. The correlations neglect the level of liquidity proxies but can tell us whether proxies paint a similar picture of evolving liquidity conditions.

**Chart 1** shows that the correlations between the effective spread and bid-ask proxies range between 0.54 and 0.63 for benchmark bonds with different maturities. **Chart 1** also shows that the correlations

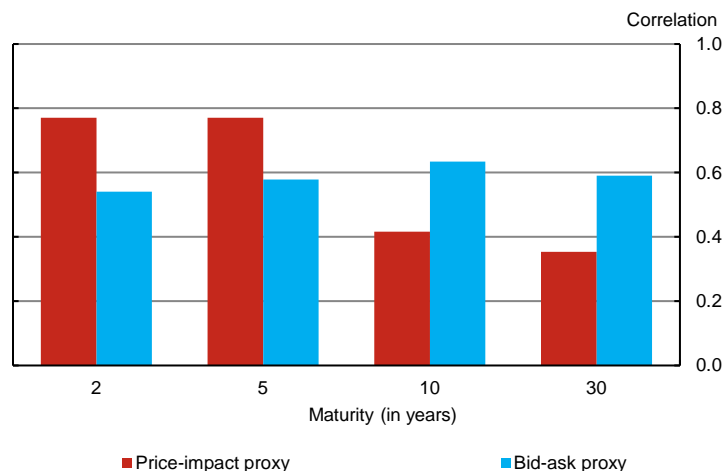
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<sup>2</sup>The computations of liquidity proxies and liquidity measures, except for the effective spread, are detailed in Gungor and Yang (2017). The computation for the effective spread can be found in Goyenko, Holden and Trzcinka (2009). All daily proxies and measures are aggregated to the monthly frequency by taking the median within each month.

between Kyle’s lambda and the price-impact proxy range between 0.35 and 0.77. Overall, the levels of the correlations in **Chart 1** suggest that proxies paint a reliable picture of evolving liquidity conditions.

**Chart 1: Reliability of Proxies**

Correlation of proxies with liquidity measures for benchmark bonds.



Sources: CanDeal and Bank of Canada calculations

## Over-the-counter markets

Apart from benchmark bonds, most transactions for other Canadian bonds occur in OTC markets, not on the CanDeal platform. One common alternative source of information about market activity for all these other bonds is the Canadian Depository for Securities (CDS) (Gungor and Yang 2017). However, the CDS data only include transaction prices and sizes, which means that we can calculate only liquidity proxies using this data.

We first ask whether the liquidity proxies for benchmark bonds paint similar pictures when computed with either CanDeal or CDS data. This comparison is important because most Canadian bonds are traded OTC, for which we must rely on liquidity proxies derived from the CDS data.

We expect the correlations to be high, but not perfect, because of some key differences between the data sets. CDS data include transactions that involve all market participants, whereas CanDeal only includes data for transactions between dealers and institutional clients. CDS data also include much larger transactions. **Table 2** describes our sample of benchmark bonds in CDS and shows that there are between two and three times more transactions in CDS than in CanDeal (depending on the maturity), but the average transaction sizes are much larger. Finally, the correlation could be weak if the timing of transactions is less accurate on CDS than on CanDeal.

**Table 2: Average number of transactions, size of transactions and volatility in data from the Canadian Depository for Securities**

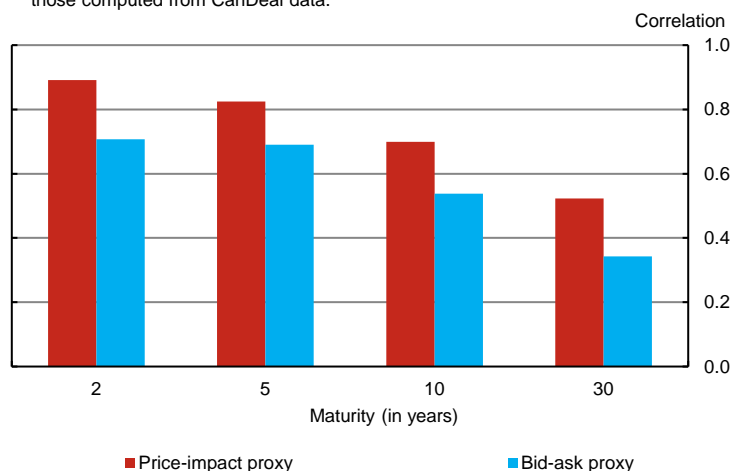
Maturity (in years)	# Transactions	Transaction size (millions of Can\$)	Volatility	# Obs
2	103	35.8	0.01934	177,375
5	146	20.2	0.05324	251,603
10	148	12.6	0.10383	256,103
30	136	10.7	0.19227	234,031

Notes: # Transactions is the average number of transactions per day. Transaction size is the average transaction size in the sample. Volatility is the average daily standard deviation of price changes (expressed in per cent). # Obs is the number of transactions. Data are from Canadian Depository for Securities from January 2010 to December 2016. For each maturity, we remove 5 per cent of transactions with smallest size and 1 per cent of days with the least number of transactions. To exclude outliers, we also winsorize observations with prices that are below the 1 per cent or above the 99 per cent level in the sample.

Chart 2 shows the correlations when the proxies are computed excluding transactions with volume greater than the 90th percentile (based on CanDeal data). This is a way to compare transactions that are similar in size and liquidity. The correlations are high for the price-impact proxy and the bid-ask proxy for maturities of 2, 5 and 10 years. The correlations for 2- and 5-year bonds for both proxies are greater than 0.6. This suggests that price-impact and bid-ask proxies are robust for all maturities except the 30-year maturity and are especially robust for the shorter maturities. The fact that bonds with longer maturities have greater price volatility is likely an important reason that exacerbates differences between the data sets.

**Chart 2: Canadian Depository for Securities and CanDeal Proxy Correlations**

Correlation of proxies computed from data from the Canadian Depository for Securities with those computed from CanDeal data.



Sources: Canadian Depository for Securities, CanDeal and Bank of Canada calculations

## Infrequently Traded Bonds

Most fixed-income securities in Canada trade infrequently. In many cases, only a handful of transactions are available in CDS to compute liquidity proxies. How reliable are these proxies? One indirect way to

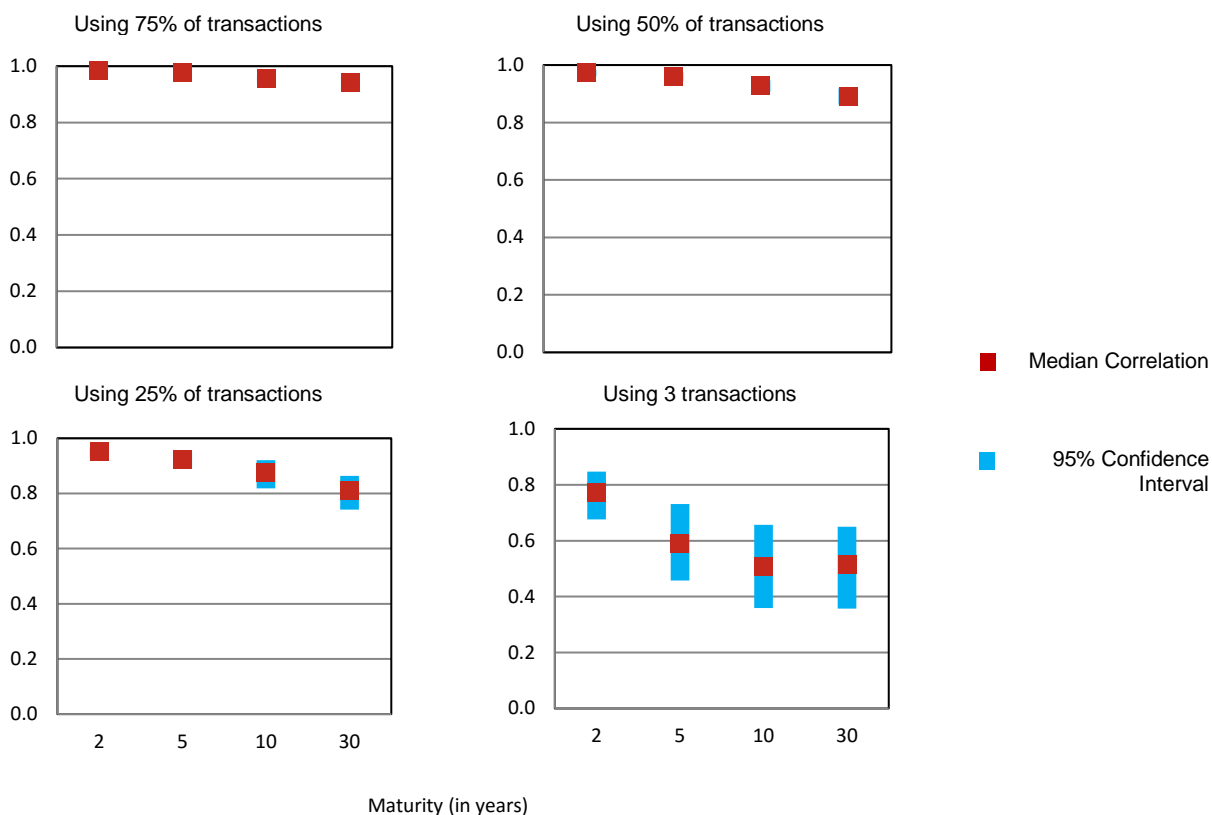
answer this question is to consider benchmark bonds, for which a large number of transactions are available, but compute the liquidity proxies using only a small number of these transactions.

For each benchmark bond maturity, we simulate cases with fewer transactions by randomly selecting 75, 50 or 25 per cent of all transactions every day. We then compute the proxies and the correlations with the proxy that uses all the data. We repeat each simulation 200 times. We also consider an extreme case where we only select three transactions per day. This daily number of available transactions is common in Canada. There are 392 Canadian corporate bonds, 132 provincial bonds and 70 non-benchmark GoC bonds that have at least three transactions per day on average in our sample.

**Chart 3** and **Chart 4** report the ranges of correlations between the 2.5 and 97.5 percentiles of 200 simulations (i.e., the 95 per cent confidence intervals). **Chart 3** reports results for the price-impact proxy. **Chart 4** reports results for the bid-ask proxy. The median correlations are greater than 0.8 in all cases when sampling 25, 50 and 75 per cent of the data. The confidence intervals are also very tight. With only three transactions every day, the median correlations for both proxies are around 0.8 and 0.6 for 2-year and 5-year bonds, respectively. In our sample, 191 corporate bonds, 61 provincial bonds and 59 non-benchmark GoC bonds have maturities of 2 or 5 years.

**Chart 3: Price-impact proxy**

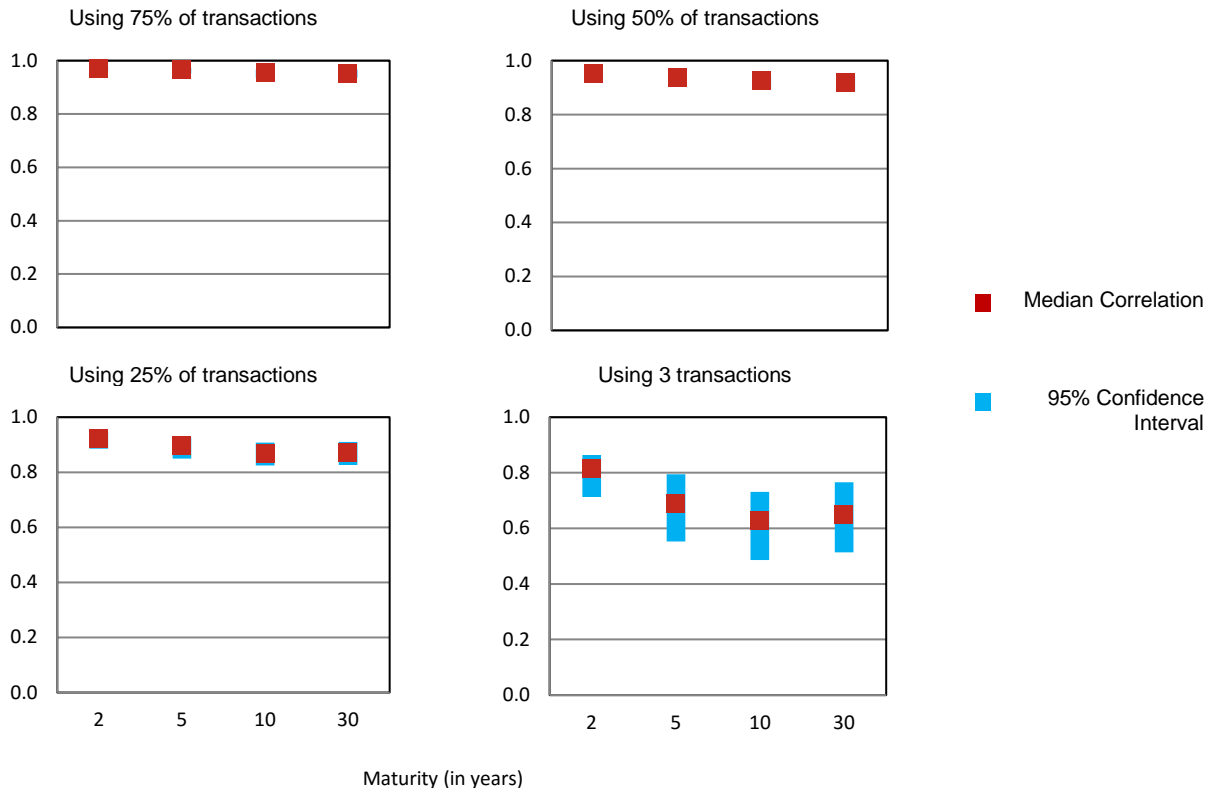
Correlation of proxies calculated from sampled data with proxies calculated from all data for benchmark bonds.





### Chart 4: Bid-ask proxy

Correlation of proxies calculated from sampled data with proxies calculated from all data for benchmark bonds.



## Conclusion

Overall, our results suggest that price-impact and bid-ask proxies can paint a reliable picture of evolving liquidity conditions for benchmark bonds. This is especially true for bonds with maturities of around five years or less because liquidity proxies for these maturities exhibit high correlations with liquidity measures based on a richer set of data. In addition, we show that for benchmark bonds, proxies calculated from only three transactions per day are highly correlated with proxies calculated from all available transactions. These results suggest that liquidity proxies can be used with confidence to measure liquidity of bonds that trade infrequently, like many corporate, provincial and non-benchmark GoC bonds. Of course, there remains room to improve liquidity proxies for bonds with longer maturities or higher volatility.

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