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Has Liquidity in Canadian Government Bond Markets Deteriorated?

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Abstract

This note presents measures of liquidity used by the Bank of Canada to monitor market conditions and discusses recent trends in Government of Canada (GoC) fixed-income market liquidity. Our results indicate that the Bank's measures have improved since the financial crisis. Furthermore, GoC market liquidity deteriorated following several stressful events: the euro crisis in 2011, the taper tantrum in 2013 and the oil price shock in 2015. In all three cases, the deterioration remained within historical norms and liquidity returned to normal levels afterwards.

Bank topic: Financial markets
JEL codes: G12, G14

Résumé

Cette note vise à décrire les mesures de la liquidité qui servent à la Banque du Canada à évaluer les conditions de marché. Une analyse des récentes tendances qui se dégagent du comportement de la liquidité du marché des titres à revenu fixe du gouvernement du Canada est faite. D'après nos résultats, les mesures utilisées par la Banque se sont améliorées depuis la crise financière. Par ailleurs, la liquidité du marché des titres du gouvernement canadien s'est dégradée dans la foulée de plusieurs événements qui ont été porteurs de tensions : la crise de l'euro en 2011, l'épisode de forte volatilité qui a suivi les commentaires de Ben Bernanke en 2013 (*taper tandrum*) et le choc des prix du pétrole en 2015. Dans les trois cas, la détérioration observée est restée dans les normes, puis la liquidité a retrouvé son niveau habituel.

Sujet : Marchés financiers
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Introduction

Liquid financial markets promote the efficient allocation of resources in the economy and support economic growth. Nevertheless, market liquidity can suddenly evaporate, with adverse effects on financial stability and real activity. In the aftermath of the financial crisis, authorities introduced regulations to strengthen the resilience of the financial system and reduce the risk of a future financial crisis. These changes have raised concerns that market liquidity may worsen as dealers and market-makers adapt.

This note presents measures of liquidity used by the Bank of Canada to monitor market conditions and discusses recent trends in Government of Canada (GoC) fixed-income market liquidity.[1] Our results indicate that the Bank's measures have improved since the financial crisis. Furthermore, GoC market liquidity deteriorated following several stressful events: the euro crisis in 2011, the taper tantrum in 2013 and the oil price shock in 2015. In all three cases, the deterioration remained within historical norms and liquidity returned to normal levels afterwards.

What Is Liquidity?

An asset is considered to be liquid if it can be traded at low cost in large quantities in a short period of time without having a significant impact on its price. The seminal papers by Black (1971) and Kyle (1985) together identify four main dimensions of liquidity:

- *Depth* is the ability to trade an asset in large volumes without affecting its price.
- *Tightness* refers to the cost of turning around a position over a short period of time. Tightness is sometimes referred to as "width."
- *Resilience* is the speed of price recovery from a temporary imbalance caused by uninformed traders or by a large trade. An asset or a market is resilient if temporary price changes due to order imbalances quickly attract new orders that restore fair values.[2]
- *Immediacy* is the speed with which a trade of a given size and cost can be arranged.

[1] In addition, the Bank of Canada regularly monitors the liquidity of the corporate bond, provincial bond, equity, and foreign exchange markets. See Gungor and Yang (2017) for a detailed analysis of liquidity in Canadian corporate and provincial bond markets.

[2] Depth regards only the volume at the best bid and ask prices, while resilience takes the elasticity of supply and demand into account.

Data

We focus on GoC bonds with 2, 5, 10, and 30 years until maturity. We use intraday data from two different sources: CanDeal and the Canadian Depository for Securities (CDS). CanDeal is an online exchange that provides institutional investors with access to liquidity supplied by broker-dealers of Canadian fixed-income securities. The CanDeal data cover the period from January 2007 to December 2016 and capture intraday quotes of bid and ask prices as well as transaction information (such as price, quantity and trade direction) for trades conducted between institutional investors and dealers.

CDS provides depository, clearing and information services for market participants; nearly all Canadian fixed-income trades are settled through its systems. The transactions data from CDS include trade price and traded quantity over the period from October 2009 to January 2017.

Each database has its distinct advantage. Together, both databases are good complements to monitor market liquidity conditions. The CDS data cover client-to-dealer and dealer-to-dealer transactions, while CanDeal covers only a subset of transactions conducted between clients and dealers. Moreover, CanDeal data are heavily weighted toward benchmark bonds, capturing 30 to 40 per cent of the volume of benchmark bond trading, but only 1 to 2 per cent of the volume of non-benchmark bond trading. However, CanDeal provides more information, including bid and ask prices and trade direction.

Liquidity Measures

While relatively easy to define, liquidity is not easy to measure. Indeed, the academic literature has proposed a wide variety of proxies to measure liquidity. Using intraday data, we compute measures of bid-ask spreads to capture *tightness*, of price impact to capture *depth*, and of trading volume and trade size to capture market activity (see the appendix for the computational details of the liquidity measures).

We employ two measures for the bid-ask spread of GoC bonds. First, the quoted bid-ask spread for a security is calculated as the ratio of the spread between the bid and ask prices to the midpoint between bid and ask prices. This measure is obtained using the CanDeal quotes data and reflects the transaction cost for a typical small-size trade. Under normal conditions, when market-makers can easily execute a trade, the bid-ask spread remains tight, indicating a high level of market liquidity.

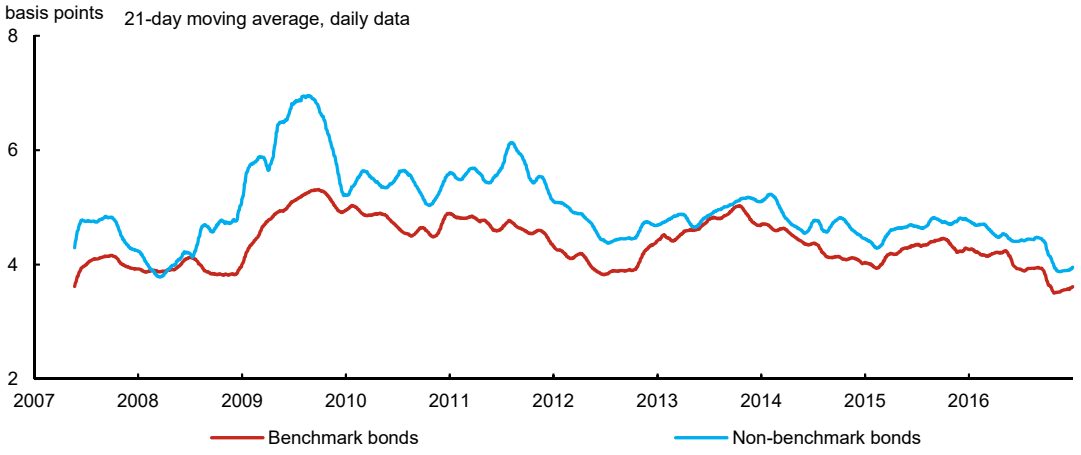
Second, we compute Roll's (1984) effective spread proxy using transactions data from CDS. The Roll measure reflects the average transaction cost across observed trades of all sizes. For each measure, the intraday spread is aggregated to a daily frequency by calculating the average every day. The quoted bid-ask spread, which uses CanDeal data, is available for a longer sample period, including the pre-crisis period, and it better captures the cost of trades for benchmark bonds. Roll's effective spread proxy, which uses CDS data, is available for a shorter sample period but has more comprehensive coverage of both benchmark and non-benchmark securities.

We also use two measures of price impact to capture market depth. Price impact is especially relevant to those executing large trades or a series of trades over a short period of time. First, using CanDeal transactions data, we compute Kyle's (1985) lambda, which employs regression analysis to measure how much a security's price falls (rises) in response to a seller-initiated (buyer-initiated) trade. Second, we compute Amihud's (2002) illiquidity ratio as a price-impact proxy using CDS transaction data. Intuitively, the illiquidity ratio is the average ratio of the price change to the trading volume over a day.

Has GoC Bond Market Liquidity Deteriorated?

The first two charts present the liquidity metrics from CanDeal data. **Chart 1** shows daily average quoted bid-ask spreads for benchmark and non-benchmark bonds.[3] As expected, we find that the average bid-ask spread widened markedly during the financial crisis, especially for non-benchmark bonds. At the peak of the crisis, spreads reached 6.9 and 5.3 basis points (bps) for non-benchmark and benchmark bonds, respectively. After the crisis, bid-ask spreads returned to their normal levels, averaging between 4 and 5 bps.

Chart 1: **The bid-ask spread has been stable for benchmark and non-benchmark bonds since the financial crisis**

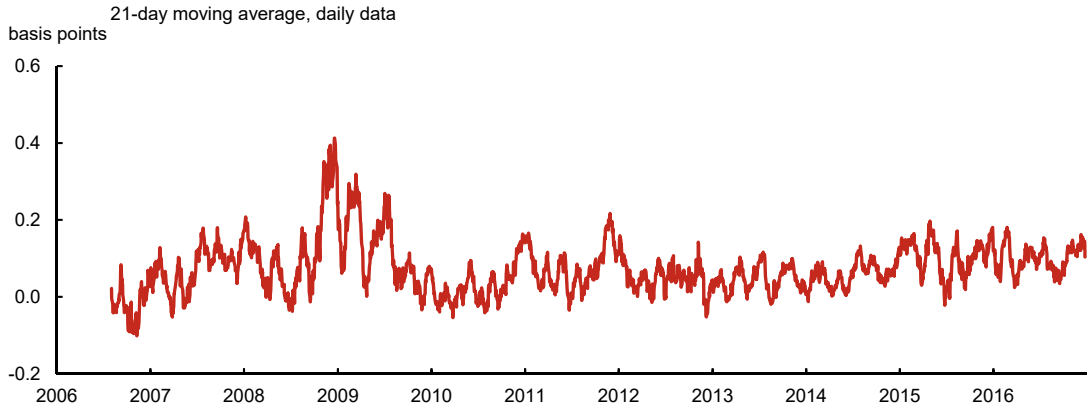


Sources: CanDeal and Bank of Canada calculations

Last observation: 31 December 2016

Chart 2 shows the average price impact (Kyle's lambda) of trades of $1 million. Similar to bid-ask spreads, the price impact rose sharply during the financial crisis but has since returned to historical levels.

Chart 2: **The price impact of trades has risen with stress episodes**



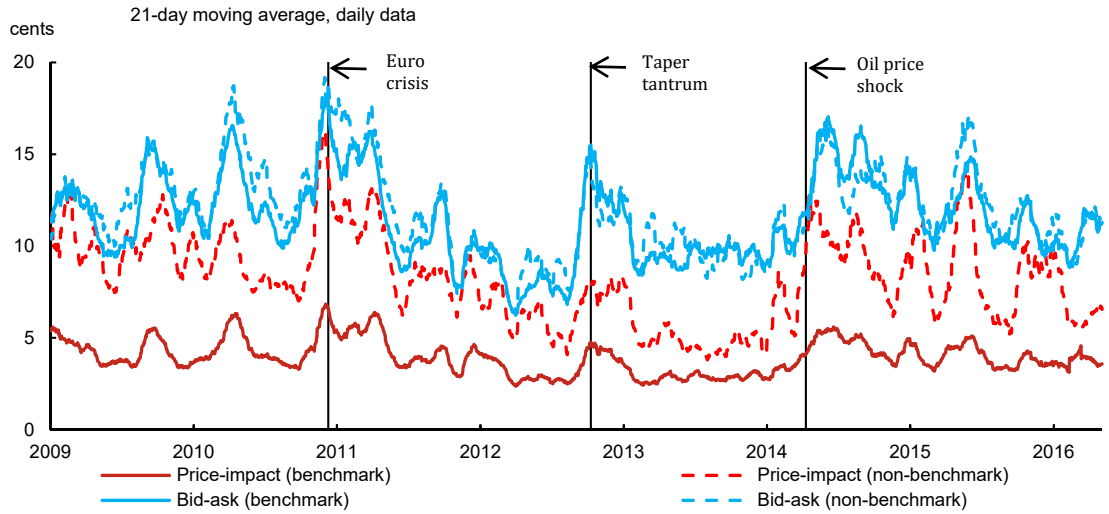
Sources: CanDeal and Bank of Canada calculations

Last observation: 31 December 2016

[3] The reported values for benchmark and non-benchmark bonds are the average of all bonds in each category with 2Y, 5Y, 10Y, and 30Y maturities.

Chart 3 reports the price-impact (Amihud's measure) and bid-ask (Roll's measure) proxies based on CDS data. These proxies are more volatile.[4] The price-impact and bid-ask proxies rose markedly during the euro crisis in 2011, the taper tantrum in 2013 and the oil price shock in 2015, but they exhibited gradual improvements following each event. Overall, the illiquidity proxies add to the evidence in **Chart 1** and **Chart 2** that the level of liquidity has not deteriorated, on average, for benchmark and non-benchmark bonds. In unreported results, we reach the same conclusion when looking separately at bonds with different maturities.

Chart 3: The price-impact and bid-ask proxies rose following stressful events for both benchmark and non-benchmark bonds



Sources: Canadian Depository for Securities and Bank of Canada calculations

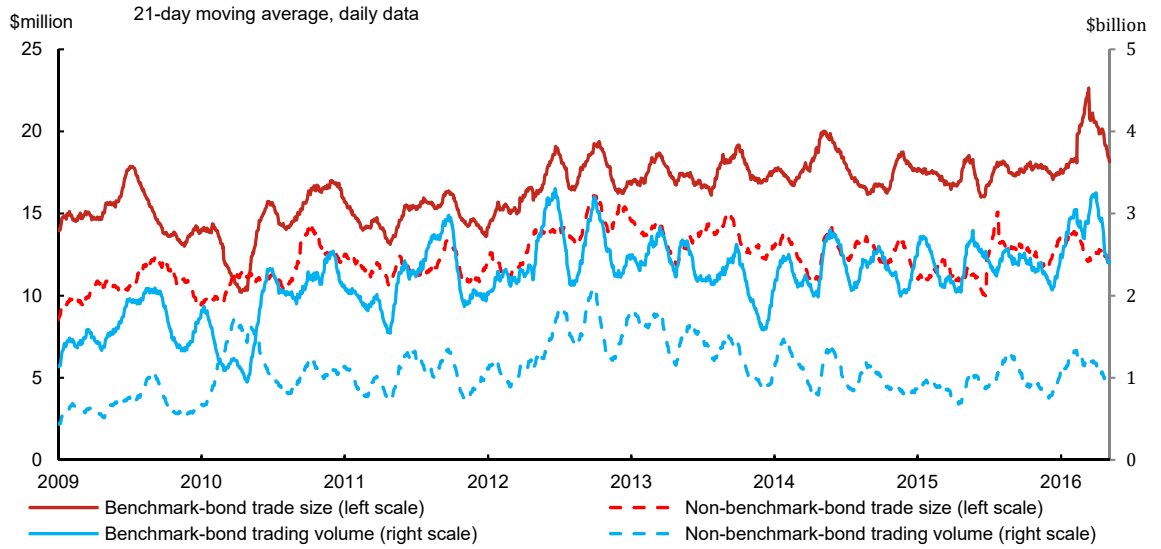
Last observation: 31 January 2017

Chart 4 shows average trading volume and trade size from CDS data. During our sample period, October 2009–January 2017, the average trade size for benchmark bonds increased from $15 million to $18 million, but it was mostly stable at around $11 to $12 million for non-benchmark bonds. The increase in the average trade size suggests that, on average, investors are not dividing large trades into smaller ones to control the price impact. Time-series patterns of trading volumes for benchmark and non-benchmark bonds are similar to those for trade sizes. This is consistent with surveys of market participants suggesting that trading activity is more concentrated in benchmark bonds.[5]

[4] The difference in volatility between Roll's effective spread in **Chart 3** and the quoted spread in **Chart 1** may be due to the following: (i) quoted spread measures the round-trip cost of a small trade, while Roll is computed using the transactions data for both small and large trades; (II) Roll is calculated using the CDS data, which capture almost all dealer-to-dealer and dealer-to-client trades, whereas the CanDeal data employed for the quoted spread capture only dealer-to-client trades; (III) Roll is an estimate of bid-ask spreads based on the covariance of consecutive returns on transactions; hence, it may be noisier than the quoted spread.

[5] The Canadian Fixed-Income Forum conducted a survey on Canadian fixed-income market liquidity from June to August 2016. Forty-two per cent of survey participants noted that they increased their allocation to benchmark or more liquid GoC bonds. Moreover, 54 per cent of participants reported a reduction in their total trading volume, while 52 per cent indicated that they reduced average trade size by slicing larger trades into multiple smaller ones.

Chart 4: **Trading volume and trade size have increased for benchmark bonds but remained stable for non-benchmark bonds**



Sources: Canadian Depository for Securities and Bank of Canada calculations

Last observation: 31 January 2017

Conclusion

Overall, the measures of tightness and market depth suggest that aggregate GoC market liquidity and trading activity have improved since the financial crisis and have been stable since then. We find some differences in trading activity between non-benchmark and benchmark bonds: average trade size and volume have been increasing since 2010 for benchmark bonds, but have remained stable for non-benchmark bonds. This is consistent with the recent survey conducted by the Canadian Fixed-Income Forum, where market participants noted that they increased their allocations to benchmark or more-liquid bonds.

Other dimensions of liquidity require further analysis. For example, market participants reported that more time is needed to execute a large trade. This time dimension of liquidity is not well captured by the measures employed in this note. Market participants may be more concerned about liquidity risk (i.e., the risk that liquidity will be lower than expected in the future). Indeed, our liquidity proxies indicate adverse liquidity movements around stress events such as the euro crisis in 2011, the taper tantrum in 2013 and the oil price shock in 2015. We leave these important questions to future work.

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Appendix

i. **Quoted spread**: The quoted bid-ask spread for bond *i* at time *t* is defined as

$$QS_{it} = (P_{it}^{A} - P_{it}^{B})/M_{it},$$

where P_{it}^{A} and P_{it}^{B} are the bid and ask prices, respectively. $M_{it} = (P_{it}^{A} + P_{it}^{B})/2$ is the quote midpoint. The intraday spread for each security is then aggregated to a daily frequency by calculating the average over each day.

ii. **Roll's effective spread**: Roll's (1984) measure is computed as twice the square root of the negative covariance between adjacent price changes (which tend to be negatively correlated)

$$Roll_{it} = 2\sqrt{-Cov(r_{i,t}, r_{i,t-1})}, \qquad if\ Cov(r_{i,t}, r_{i,t-1}) < 0,$$

where $r_{i,t}$ is the return of bond *i* at time *t* computed from consecutive trades.

iii. **Kyle's lambda**: Kyle's (1985) lambda (λ_i) is estimated as the slope coefficient of the regression

$$r_{it} = \alpha_i + \lambda_i I_{it} q_{it} + \varepsilon_{it},$$

where r_{it} is the return of bond *i* at time *t* computed from consecutive trades; I_{it} is a sign indicator, which is positive for a buy order and negative for a sell order; and q_{it} is the trading volume. This regression is estimated each day using intraday data for individual bonds with at least six transactions on a given day.

iv. **Amihud's illiquidity ratio**: This is the ratio of the absolute value of the asset return to the dollar value of trading volume:

$$Amihud_{id} = Average\left(\frac{|r_{it}|}{DVOL_{it}}\right),$$

where r_{it} and $DVOL_{it}$ are the return and dollar value of trading volume for bond *i* at time *t*, respectively. The transaction-level illiquidity ratio is averaged over a day *d* to find the daily illiquidity ratio. The higher the illiquidity ratio of a bond, the less liquid the asset is.