

The Life Cycle of Government of Canada Bonds in Core Funding Markets

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- Core funding markets are crucial to maintaining financial stability and supporting economic growth because they provide market participants with access to liquidity and the ability to acquire or sell short desired securities. In Canada, activity in core funding markets is mainly driven by trading in Government of Canada debt securities.
- This article analyzes the life cycle of Government of Canada (GoC) bonds by following them from issuance to maturity in the repurchase agreement (repo), securities lending and cash markets. Over their lifetime, longer-maturity bonds are more active in the securities lending market, while shorter-term bonds are used mainly in the repo and cash markets. This article argues that the observed variance in the use of securities of different maturity classes is consistent with investor types having different maturity preferences.
- The Bank of Canada plays a key role in supporting and monitoring core funding markets. It also provides policy advice to the government on the efficient management of its debt. Understanding the use of government debt securities in different markets could help the Government of Canada design more effective policies to lower the costs of GoC debt issuance and, more broadly, maintain well-functioning Canadian markets.

Well-functioning financial markets are critical to both financial stability and economic growth because both issuers of securities and investors rely on efficient, liquid markets to allocate capital effectively. Core funding markets, which include the repurchase agreement (repo), securities lending and cash markets, are key to achieving this objective. Market participants frequently face short-term liquidity needs and seek specific securities on short notice, either to fulfill client demand or to hedge. By helping financial institutions access liquidity and trade in specific securities at short notice, core funding markets ultimately support the creation of public and private credit and are therefore critical to the real economy (Carney 2008).

Relative to exchange-traded products (such as equities), data on core funding market transactions can be more difficult to obtain because such transactions are usually conducted over-the-counter.¹ As part of its agenda to study these markets in greater depth (see, for example, Garriott and Gray 2016; Fontaine, Garriott and Gray 2016; and Johal, Roberts and Sim forthcoming), the Bank of Canada has analyzed security-level activity in these markets using data from the Canadian Depository for Securities, the Canadian Derivatives Clearing Corporation² and Markit Securities Finance.³ This article presents the results of this analysis.

We construct the activity profile of securities of different maturities through the various stages of a bond's "life cycle" by measuring the daily use of each Government of Canada (GoC) bond from its issuance to maturity. This analysis of the life cycle of GoC bonds uncovers evidence supporting the preferred habitat hypothesis. According to this hypothesis, some investors in fixed-income securities have a strong preference for bonds of certain maturities (Modigliani and Sutch 1966). As a result, they have limited desire to substitute away from bonds of their preferred maturity. Further, the results suggest that the type of market participants, e.g., passive long-term investors or active short-term investors, affects the preferred choice of funding market. We highlight some of the implications of these findings for GoC debt securities, such as the cost-of-issuance and secondary market liquidity effects of policies that may affect the relative supply of bonds of different maturities.

The following section provides background relevant to the life-cycle analysis by discussing the motives and venues of trade of participants in the core funding markets. Readers familiar with this topic may choose to skip to the discussion of the GoC bond life cycle on page 34.

Trading Motives of Participants in Core Funding Markets

Repo and securities lending markets are the main venues where market participants satisfy their temporary needs for cash and specific securities (Baklanova, Copeland and McCaughrin 2015). The search for cash by financial intermediaries is typically motivated by their need to meet temporary mismatches between inflows and outflows or to finance a (leveraged) long position in a security. In other situations, an intermediary's motivation to trade is driven by the search for specific securities either to satisfy a client's request to trade or to take (or close out) a short position (Fontaine, Selody and Wilkins 2009; and Fontaine, Garriott and Gray 2016). The cash market, in which securities are bought and sold outright, is a substitute venue for such trades.

Repos involve the sale of a security for cash (the "first leg" of the contract), combined with a promise to buy the security back at a later date (the "second leg"). In other words, a repo is effectively a collateralized loan where the difference between the initial sale price and the repurchase price is the interest on the cash loaned out. Cash lenders who value the collateral only for the protection it offers in the event of counterparty default

◀ *Repo and securities lending markets are the main venues where market participants satisfy their temporary needs for cash and specific securities*

¹ Over-the-counter contracts are negotiated between two parties and do not use the trading infrastructure provided by securities exchanges. These transactions are characterized by a sequential search for counterparties and bargaining over the terms of trade (Duffie, Gârleanu and Pedersen 2005).

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³ See Bulusu and Gungor (forthcoming) for details about the different data sources used in this article.

are usually indifferent to the specific security being pledged, as long as it belongs to a basket of “equivalent” securities. The interest rate on such general collateral (GC) repos is independent of the specific security (from a pre-specified basket) being pledged. Other repo transactions are characterized by a desire to obtain specific collateral. If the desired security is scarce, the interest on the cash loan is lower, i.e., the repo rate for that bond is below the GC repo rate. These issues are referred to as being “on special” or a special repo. The spread between GC and special repo rates is the interest foregone by the cash lender in exchange for obtaining the desired security and can be interpreted as the borrowing fee for that security.

Securities lending contracts involve the loan of a security against cash or other acceptable securities. Against cash collateral, they are economically indistinguishable from repos. Unlike repos, however, these trades are conducted between the borrower of the security and the securities lending agent, who intermediates between the ultimate owners of these securities and the borrowers.⁴ Our calculations show that more than 85 per cent of securities lending in debt securities in Canada from 2010 to 2015 was against other securities. Since the vast majority of securities lending does not involve the exchange of cash, securities lending in Canada is motivated mainly by the desire to borrow specific securities.⁵ As such, it can be inferred that, in Canada, GC repos are driven by the search for cash, while the search for specific securities is satisfied using special repo and securities lending transactions.⁶

The cash market is an alternative venue for market participants to search for cash or specific securities. However, settlement delays affect cash trades, making them an imperfect substitute for repo and securities lending. Settlement conventions guide the time elapsed between the initiation of a trade and its settlement, i.e., the exchange of cash and securities. The first leg of both repo and securities lending trades are settled on the same day that they are initiated; however, most bonds are settled between two and three days later in the cash market.⁷ Thus, while cash or security needs that are fully anticipated can still be fulfilled by the cash market, unanticipated needs cannot. Another reason for the imperfect substitutability is that the absence of a “repurchase leg”—a feature of repo and securities lending contracts—exposes the holder of the security to undesirable price risk. In this article, the cash market is therefore treated as a separate category, even though it is a core funding market.

◀ *The cash market is an alternative venue—albeit an imperfect substitute—for market participants to search for cash or specific securities*

Participants' choice of core funding markets

Securities lending and repo contracts are close economic substitutes. For example, market participants wishing to borrow a particular bond could do so either in the securities lending market against cash (or other acceptable collateral) or through a repo. Similarly, lenders of a bond could access cash

⁴ The intermediation services offered by the lending agent include arranging trades, performing due diligence on prospective borrowers, reinvesting cash collateral, and managing the operational and administrative aspects of lending (Johal, Roberts and Sim forthcoming).

⁵ Aggarwal, Bai and Laeven (2016) suggest that securities lending is sometimes used to transform lower-quality collateral into higher-quality assets, which may in turn be used as collateral for repos, for example. In other words, securities lending may occasionally be motivated by the search for a class of securities, rather than for a particular security. For a more complete description of the securities lending market in Canada, see Johal, Roberts and Sim (forthcoming).

⁶ See Garriott and Gray (2016) for a more complete discussion of repo agreements and the repo market in Canada.

⁷ Government bonds with three years or less to maturity settle in two days, while those with longer maturities settle in three days. Only money market instruments (debt securities with less than one year to maturity) typically operate under the same-day settlement convention in Canada.

by posting their collateral in the repo or securities lending markets. Despite these similarities, the organizational structures of the two markets are significantly different. In particular, securities lending is typically intermediated, while repos are usually negotiated bilaterally in the over-the-counter market. These structural differences are an important factor in market participants' decisions on trading.

Typical lenders of securities in Canada include pension funds, mutual funds, university endowments and insurance companies (Johal, Roberts and Sim forthcoming). Such investors may choose not to participate directly in the repo market if their portfolio size or desired level of activity does not justify the investment in technology and expertise required to run their own repo desk. Therefore, they would typically use securities lending agents to enhance the returns on their portfolio of assets.⁸ Further, these investors may not wish to be exposed to the risk arising from the variable returns from reinvesting the cash collateral provided in repos, which increases the favourability of securities lending in Canada.⁹

Financial institutions using repo markets to search for cash typically include dealers and more active investors, such as hedge funds and some of the largest pension funds. Dealers depend on GC repos to fund their inventories, i.e., borrow the cash they have paid to acquire the bonds in their inventories. Other institutions, such as hedge funds, use repo markets either as a source of funds to meet operational cash requirements or to take leveraged positions.¹⁰ These same investors can use special repos to take temporary possession of a desired security. Dealers may choose to borrow a security in a special repo to make markets, i.e., to be able to fulfill client demand for the bond. Other shorter-term investors may use special repos to borrow bonds overnight to close out an existing short position.¹¹

The Life Cycle of Government of Canada Bonds

GoC securities play the most important role in core funding markets in Canada. From 2010 to 2015, they were used as collateral for more than 80 per cent of repo trade volume, constituted 60 per cent of all Canadian debt securities traded in the cash market and represented about 65 per cent of fixed-income securities on loan. The prevalence of the use of sovereign debt instruments in core funding markets is due to two main factors. First, they are widely accepted as safe collateral against which short-term loans can be obtained.¹² Second, since the closest approximation to the risk-free interest rate for a given maturity is the GoC bond yield at that maturity,

◀ *Differences in the organizational structure of the repo and securities lending markets are an important factor in market participants' trading venue decision*

◀ *Government of Canada securities play the most important role in core funding markets in Canada*

8 Bédard-Pagé et al. (2016) and Garriott and Gray (2016) provide evidence that size is correlated with participation in the repo market. In particular, they show that only the largest pension funds in Canada have a scale to justify being active repo traders.

9 To be able to earn positive returns from lending their securities in the repo market, lenders of the security need to reinvest the cash obtained as collateral in instruments that yield a higher return than the interest paid for borrowing cash. In contrast, in the securities lending market, the borrowers of securities simply pay an agreed-upon fee to compensate the lender of the security.

10 A leveraged position in a security can be taken by buying a security, using it as collateral for a repo and then buying back the security using the cash borrowed in the repo. See Fontaine, Garriott and Gray (2016) for details.

11 Of course, the same shorter-term investors may borrow bonds for longer periods in the securities lending market.

12 Dang, Gorton and Holmström (2012) argue that safe debt securities are widely used as collateral because their low credit risk reduces the overall costs of liquidity provision. The cost reduction is due to the safety of the securities offered, which reduces cash lenders' incentives to invest resources in producing information about collateral quality. In other words, safe assets are good collateral because of their information insensitivity.

contracts involving GoC securities are most appropriate for hedging interest rate risk in Canada. The focus below is therefore on activity in the repo, securities lending and cash markets involving GoC securities.¹³

The Canadian federal government issues a pre-announced amount of debt securities with maturities of 3, 6 and 12 months, and 2, 3, 5, 10, 30 and occasionally 50 years.¹⁴ In contrast to the issuance practice in the United States, large sizes in GoC bonds are achieved through consecutive re-openings after an initial auction. A reopening is a new primary auction of an additional amount of an existing security.¹⁵

A GoC bond of a particular maturity achieves benchmark status when its amount outstanding reaches a desired level.¹⁶ The benchmark bond is the bond against which other securities are priced and is the most liquid security in its maturity class. Given the government's stable issuance patterns, market participants adopt the bond as the new benchmark in its maturity class once its amount outstanding is close to that of the previous benchmark. Concurrently, the previous benchmark relinquishes this label; this usually takes place close to the last reopening of the new benchmark bond.¹⁷ Accordingly, the life cycle of a typical GoC bond can be split into three phases: (i) pre-benchmark—the period from the first issuance to the day before it attains the benchmark status; (ii) benchmark—the period between being designated as the benchmark and the day the next benchmark in the maturity class is announced; and (iii) post-benchmark—the period between the end of benchmark status and maturity. The pre-benchmark period is characterized by an increasing supply of the bond. Benchmark bonds are analogous to on-the-run Treasuries in the United States, and post-benchmarks are similar to off-the-run bonds.¹⁸

Use of Government of Canada Bonds over their Life Cycle

The life cycle analysis of GoC bonds presents indirect evidence of bond market clienteles in Canada. According to the preferred habitat hypothesis, some investors have preferences for specific maturities and have limited desire to substitute across bonds with different maturities; i.e., they are clientele of bonds of specific maturity classes.¹⁹ Previous studies (e.g., Longstaff 2004; Greenwood and Vayanos 2010; Krishnamurthy and

¹³ In Canada, Canada Mortgage Bonds and provincial government debt are the other debt instruments that constitute a significant fraction of the total trade volume. Trades involving other debt instruments such as corporate bonds, bankers' acceptances and asset-backed commercial paper are sporadic.

¹⁴ There have been a few changes to the maturity structure during the sample period, such as the issuance of ultra-long bonds of up to 50 years and a temporary pause in the issuance of new three-year bonds beginning in 2015. We do not include inflation-indexed bonds in our analysis because they form a very small portion of outstanding government debt. For a more detailed description of primary issuance practice in Canada, see Gravelle (1999).

¹⁵ Such staggered issuance is not unusual for markets with lower capacity to absorb large primary auction sizes without a price impact. The Spanish Treasury market, for example, followed a similar issuance strategy until 2001 (see Díaz, Merrick and Navarro 2006).

¹⁶ This desired amount is usually presented as a range that is pre-announced in the Government of Canada's annual debt-management strategy.

¹⁷ Select three-year bonds in our sample were reopened (re-designated) as two-year bonds and subsequently assigned benchmark status in the two-year maturity class. The anticipated potential rebirth of three-year bonds in their post-benchmark period makes their usage patterns quite different, and we therefore exclude these bonds from our analysis.

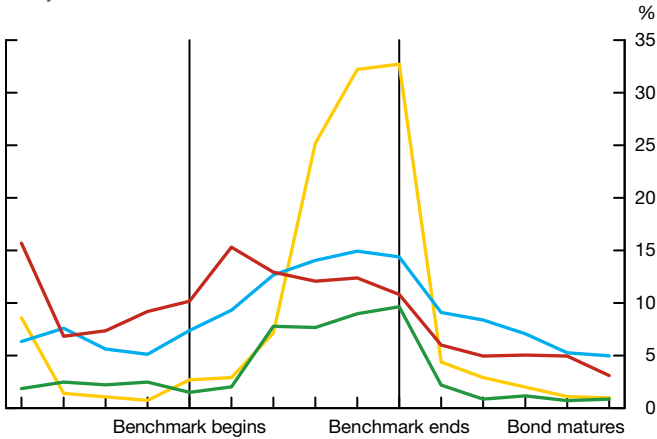
¹⁸ Short-term zero-coupon GoC debt (three-month, six-month and one-year maturity classes) is not used frequently in repo and securities lending markets. Furthermore, this debt does not experience any changes in status between issuance and maturity, which makes it relatively less interesting from a life-cycle perspective.

¹⁹ Which securities the different investor types ultimately hold depends not only on their preferences but also on other factors, such as the stock of available securities and the regulatory environment under which financial institutions operate.

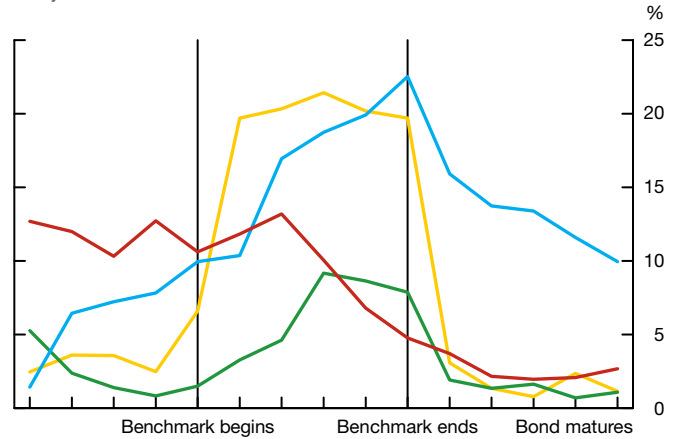
Chart 1: Use of Government of Canada bonds in core funding markets

Percentage of outstanding stock of bond

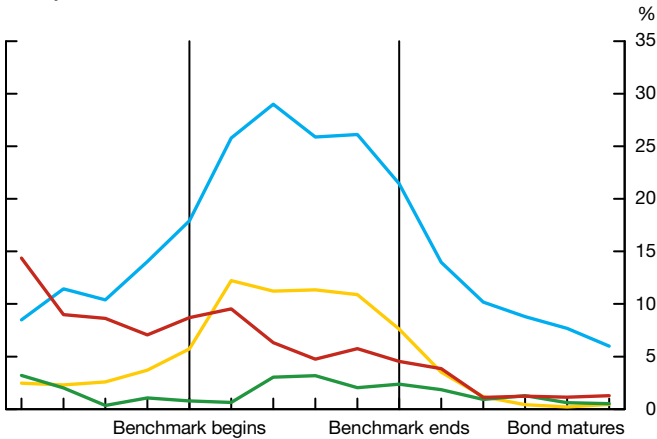
a. 2-year bond



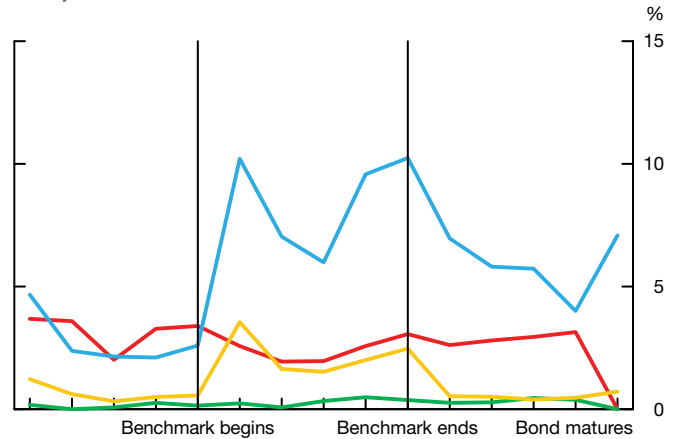
b. 5-year bond



c. 10-year bond



d. 30-year bond



— General collateral repo — Securities lending — Special repo — Cash

Sources: Canadian Depository for Securities, Canadian Derivatives Clearing Corporation, Markit Securities Finance and Bank of Canada calculations

Last observation: 31 December 2015

Vissing-Jorgensen 2012; D’Amico and King 2013) have noted that the price impact of regulatory or bond supply changes is consistent with this hypothesis. We add to this body of evidence by showing that GoC bonds across maturity classes are used differently in the core funding markets through their life cycle, which indicates the presence of bond market clienteles.

Under the preferred habitat hypothesis, longer-term investors prefer longer-maturity bonds to hedge their longer-term liabilities.²⁰ Since these investors are also more likely to employ the services of lending agents, we should observe higher use of longer-dated bonds in the securities lending market. Short-term bonds, in contrast, should have a greater use as collateral in GC and special repos throughout their lifetime. We now show that the life cycle of GoC bonds broadly conforms to these patterns. **Chart 1** shows the daily use of 2-, 5-, 10- and 30-year GoC bonds over their life

◀ Since longer-term investors are more likely to employ the services of lending agents, an implication of the preferred habitat hypothesis is that we should observe higher use of longer-dated bonds in the securities lending market

²⁰ The lack of data on portfolio holdings by investors makes it difficult to directly verify this hypothesis. However, many authors provide anecdotal evidence in its favour. For example, Vayanos and Vila (2009) suggest that, in the United States, pension funds are typical investors for bonds with longer than 15 years to maturity. Insurance companies prefer bonds around 15 years to maturity, while asset managers and banks’ treasury departments are the typical clientele for bonds of shorter maturities.

cycle as a percentage of their outstanding amount.^{21, 22} Each panel shows the use of bonds in the search for cash through GC repos, the search for the bond through securities lending and special repos, and trading in the cash market.

First, given the presence of bond-market clienteles, the use of a bond in the securities lending market increases with its maturity. Of the 2-year bond (panel a), 15 per cent is loaned out through securities lending in its lifetime, while the corresponding proportion for the 10-year bond (panel c) is close to 30 per cent. In contrast, 21 per cent of the 2-year bond and 17 per cent of the 10-year bond are used in the GC and special repo markets over their lifetimes.²³

Second, as the use of a bond in the GC repo market falls, its use in the securities lending market rises. This could be consistent with a shift in ownership of the security, either from dealers to investors or from more to less active trading investors. Furthermore, the strength of this pattern increases with the maturity of the bond, consistent with the preferred habitat hypothesis. Of the 10-year bond, 14 per cent was used as collateral for GC repos right after issuance, and this falls to 4 per cent in the final period of its benchmark phase. At the same time, the use of the bond in the securities lending market rises from 8 to 21 per cent. In contrast, the use of the 2-year bond in the repo market falls less sharply—from 16 per cent after issuance to 10 per cent at the end of its benchmark period. Its use in the securities lending market in the corresponding period rises from 6 to 20 per cent.

Third, in line with the preferred habitat hypothesis, lending of longer-term bonds occurs primarily in the securities lending market, while shorter-term bonds are borrowed using both securities lending contracts and special repos. More than 30 per cent of the 10-year bond is borrowed in the securities lending market over its lifetime, compared with 3 per cent using special repos. In contrast, 10 per cent of the lending in the lifetime of the 2-year bond is arranged through special repos, while 15 per cent is through securities lending contracts. This is consistent with owners of the longer-term security being less active in the repo market. Investors in the shorter-term security who are active repo traders prefer lending their bonds in the special repo market instead of sharing the lending fee with securities lending agents.

The cash market is an imperfect substitute for the repo and securities lending markets; accordingly, the use of GoC bonds of all maturities displays a strikingly different pattern in **Chart 1**. The cash market for all maturity classes is very active in the benchmark period and falls very sharply in the post-benchmark period. This is consistent with the behaviour of US Treasuries (Barclay, Hendershott and Kotz 2006). Nevertheless, the post-benchmark period is characterized by residual activity in the securities lending and GC repo markets. In its post-benchmark period, about 10 per cent of a bond is either used as collateral for cash or is sought after in the securities lending market.²⁴ These results reinforce the fact that the lack of trading in the cash market is not necessarily an indicator of an absence of activity in core funding markets.

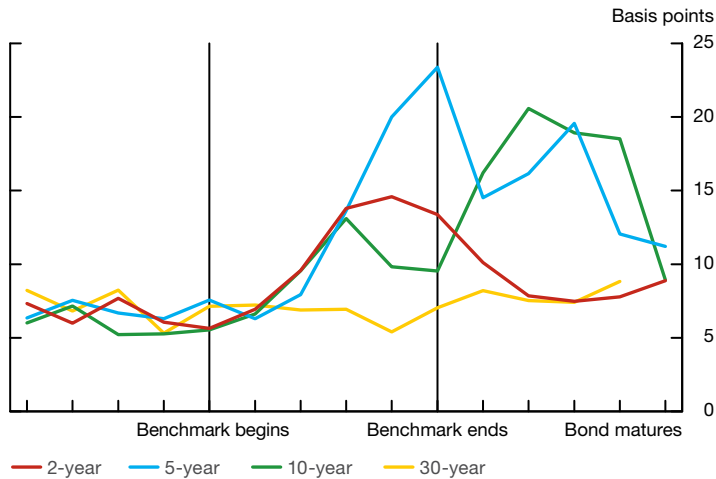
²¹ Since a typical GoC bond does not spend an equal amount of time in the three phases of its life cycle, we used a normalization scheme to standardize the time elapsed in each phase.

²² The amount outstanding of a bond is measured using par value, which is the amount paid to the holders of the bond at maturity. Unlike the market value, which is the price investors pay to purchase the bond, the par value of a bond is unchanged over time.

²³ This exposition focuses on the 2- and 10-year bonds. The life-cycle pattern of the 5-year bond lies in between that of the 2- and 10-year bonds. The seemingly anomalous behaviour of the 30-year GoC bond is discussed later.

²⁴ The search for the specific security in the securities lending market is perhaps necessitated by the difficulty of locating it in the thinly traded cash market.

Chart 2: Average special repo spread



Sources: Canadian Depository for Securities, Canadian Derivatives Clearing Corporation and Bank of Canada calculations Last observation: 31 December 2015

At first glance, the uniformly low activity in the 30-year bond in all the core funding markets could seem inconsistent with this analysis. While the low use of this very long bond in the repo market (both GC and special) is consistent with its purchase at issuance by long-term investors, the lack of activity in the securities lending market seems to present a challenge to the preferred habitat hypothesis.²⁵ Chart 2, which shows the average daily special repo spread over the life cycle for the different maturity classes, suggests that the demand to borrow a specific 30-year security is low throughout its lifetime. While the average special repo spreads for the 2-, 5- and 10-year bonds peak at 15 basis points (bps), 24 bps and 20 bps, respectively, that of the 30-year bond stays between 7 bps and 10 bps through its life cycle. Indeed, the data confirm that the amount of the average 30-year bond offered on loan in the securities lending market is higher than that of bonds in any other maturity class. Thus, the low uptake in the securities lending market and low borrowing rates in the repo market indicate the lack of demand to borrow the specific 30-year security by active trading investors.²⁶

To summarize, the evidence from the life-cycle analysis of GoC bonds points to the average longer-maturity investor being less active in the repo market. Owners of shorter-term bonds are typically active in the repo market and are therefore less likely to employ the services of securities lending agents. This heterogeneity of use of GoC bonds in the core funding markets lends credence to the presence of bond market clienteles; i.e., investors in Canadian fixed-income instruments have different maturity preferences.

◀ Evidence from the life-cycle analysis of Government of Canada bonds points to the average longer-maturity investor being less active in the repo market

Implications for Government Bond Markets

The importance of core funding markets for the well-functioning of both primary and secondary bond markets is well recognized. For example, Graveline and McBrady (2011) show that the ability of market participants to hedge interest rate risk through short sales (facilitated by repo trades) is

²⁵ The lack of activity in the cash market could suggest that the ultimate investors for these very long bonds bid for a larger fraction of their demand at the primary auction through primary dealers.

²⁶ The borrowing fees in the securities lending market and the spread in the special repo market closely track each other; any significant deviations in the two would drive borrowers to the cheaper source.

an important determinant of the price paid at primary auctions. Fontaine, Garriott and Gray (2016) point to the importance of GC repo and securities lending in supporting cash market liquidity.

This article highlights the activity of bond market clienteles in core funding markets. Knowledge of investor preferences and their trading venues could help inform policies on the maintenance of a well-functioning market in GoC securities. Given the results presented in this article, for example, dislocations affecting the repo market may have a greater impact on liquidity in shorter-term bonds, while those in the securities lending market may have a greater impact on the market for longer-term bonds.

The role of bond market clienteles in decisions on sovereign debt issuance has recently gained prominence in academic and policy circles (see, for example, Guibaud, Nosbusch and Vayanos 2013; and Cochrane 2015). Another strand of literature suggests that sovereign debt managers need to take into account the use of these securities in financial markets when determining the term structure of issuance (Greenwood, Hanson and Stein 2015).²⁷ This article highlights differences in the use of GoC bonds of different maturity classes by financial market participants and could be an additional input into the debt manager's issuance decision.

These results also provide support for the use of minimum issuance constraints by maturity class in the Canadian Debt-Strategy Model (Bolder and Deeley 2011). Minimum issuance in different maturity classes is usually suggested as a means of maintaining a "presence across the curve." The analysis in this article reinforces clientele demand as a reason for the Canadian government to issue securities of different maturities. The current practice of considering feedback from market participants to arrive at the minimum issuance constraints at each maturity could be supplemented by estimates of clientele demand using the activity in core funding markets.

Conclusion

This article uses new data on Canadian debt securities to analyze the use of GoC bonds in Canadian core funding markets. The findings on the life cycle of the use of GoC bonds are consistent with the preferred habitat hypothesis, which postulates that some fixed-income investors are characterized by a strong preference for securities of a particular maturity. Accordingly, the data show that shorter-term bonds are disproportionately held by participants that are more active in the repo market. Their greater use is driven by both the search for such securities and the use of these securities to obtain cash. Longer-term bonds are largely held in the portfolios of investors that are less active in the repo markets. Consequently, market participants seeking to borrow longer-term bonds are more likely to find them with securities lending agents contracted by the owners of such instruments to enhance the returns on their portfolio.

The presence of distinct investor clienteles could be an important factor governing the use, availability and trading venue of bonds of different maturity classes, which could in turn affect secondary-market properties of GoC bonds. Given the importance of maintaining well-functioning core funding markets, awareness of these determinants could contribute to better-designed policies to aid the Bank of Canada in maintaining a stable and efficient financial system. Furthermore, estimates of demand by clientele type could help infer the demand for individual securities at primary auctions and thus help achieve better outcomes in the debt-issuance process.

◀ *Knowledge of investor preferences and their trading venues could help inform policies on the maintenance of a well-functioning market in Government of Canada securities*

²⁷ Additionally, D'Amico and King (2013) argue that some of the effect of the US Federal Reserve's asset purchase program was achieved due to the presence of bond market clienteles.

Literature Cited

- Aggarwal, R., J. Bai and L. Laeven. 2016. "The Role of the Government Bond Lending Market in Collateral Transformation." Georgetown McDonough School of Business Research Paper No. 2692251.
- Baklanova, V., A. M. Copeland and R. McCaughrin. 2015. "Reference Guide to U.S. Repo and Securities Lending Markets." Federal Reserve Bank of New York Staff Report No. 740.
- Barclay, M. J., T. Hendershott and K. Kotz. 2006. "Automation Versus Intermediation: Evidence from Treasuries Going off the Run." *Journal of Finance* 61 (5): 2395–2414.
- Bédard-Pagé, G., A. Demers, E. Tuer and M. Tremblay. 2016. "Large Canadian Public Pension Funds: A Financial System Perspective." Bank of Canada *Financial System Review* (June): 33–38.
- Bolder, D. J. and S. Deeley. 2011. "The Canadian Debt-Strategy Model: An Overview of the Principal Elements." Bank of Canada Staff Discussion Paper No. 2011-3.
- Bulusu, N. and S. Gungor. Forthcoming. "Government of Canada Securities in the Cash, Repo and Securities Lending Markets." Bank of Canada Staff Discussion Paper.
- Carney, M. 2008. "Building Continuous Markets." Remarks to the Canada–United Kingdom Chamber of Commerce, London, England, 19 November.
- Cochrane, J. 2015. "A New Structure for U.S. Federal Debt." In David Wessel, Ed., *The \$13 Trillion Question: How America Manages its Debt*: 91–146. Washington DC: Brookings Institution Press.
- D'Amico, S. and T. B. King. 2013. "Flow and Stock Effects of Large-Scale Treasury Purchases: Evidence on the Importance of Local Supply." *Journal of Financial Economics* 108 (2): 425–448.
- Dang, T. V., G. Gorton and B. Holmström. 2012. "Ignorance, Debt and Financial Crises." Yale University and Massachusetts Institute of Technology Working Paper.
- Díaz, A., J. J. Merrick and E. Navarro. 2006. "Spanish Treasury Bond Market Liquidity and Volatility Pre- and Post-European Monetary Union." *Journal of Banking & Finance* 30 (4): 1309–1332.
- Duffie, D., N. Gârleanu and L. H. Pedersen. 2005. "Over-the-Counter Markets." *Econometrica* 73 (6): 1815–1847.
- Fontaine, J.-S., C. Garriott and K. Gray. 2016. "Securities Financing and Bond Market Liquidity." Bank of Canada *Financial System Review* (June): 39–45.
- Fontaine, J.-S., J. Selody and C. A. Wilkins. 2009. "Improving the Resilience of Core Funding Markets." Bank of Canada *Financial System Review* (December): 41–46.

- Garriott, C. and K. Gray. 2016. "Canadian Repo Market Ecology." Bank of Canada Staff Discussion Paper No. 2016-8.
- Graveline, J. J. and M. R. McBrady. 2011. "Who Makes On-the-Run Treasuries Special?" *Journal of Financial Intermediation* 20 (4): 620–632.
- Gravelle, T. 1999. "Liquidity of the Government of Canada Securities Market: Stylized Facts and Some Market Microstructure Comparisons to the United States Treasury Market." Bank of Canada Staff Working Paper No. 1999-11.
- Greenwood, R., S. G. Hanson and J. C. Stein. 2015. "A Comparative-Advantage Approach to Government Debt Maturity." *Journal of Finance* 70 (4): 1683–1722.
- Greenwood, R. and D. Vayanos. 2010. "Price Pressure in the Government Bond Market." *American Economic Review* 100 (2): 585–590.
- Guibaud, S., Y. Nosbusch and D. Vayanos. 2013. "Bond Market Clienteles, the Yield Curve, and the Optimal Maturity Structure of Government Debt." *Review of Financial Studies* 26 (8): 1914–1961.
- Johal, J., J. Roberts and J. Sim. Forthcoming. "Canadian Securities Lending Market Ecology." Bank of Canada Staff Discussion Paper.
- Krishnamurthy, A. and A. Vissing-Jorgensen. 2012. "The Aggregate Demand for Treasury Debt." *Journal of Political Economy* 120 (2): 233–267.
- Longstaff, F. A. 2004. "The Flight-to-Liquidity Premium in US Treasury Bond Prices." *Journal of Business* 77 (3): 511–526.
- Modigliani, F. and R. Sutch. 1966. "Innovations in Interest Rate Policy." *American Economic Review* 56 (1/2): 178–197.
- Vayanos, D. and J.-L. Vila. 2009. "A Preferred-Habitat Model of the Term Structure of Interest Rates." National Bureau of Economic Research Working Paper No. 15487.