

Staff Analytical Note/Note analytique du personnel 2015-2

# Estimating Canada's Effective Lower Bound



by Jonathan Witmer and Jing Yang

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## **Estimating Canada's Effective Lower Bound**

**by**

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## Abstract

In 2009, the Bank of Canada set its effective lower bound (ELB) at 25 basis points (bps). Given the recent experience of Sweden, Denmark, Switzerland and the euro area with negative interest rates, we examine the economics of negative interest rates and suggest that cash storage costs are the source of a negative lower bound on interest rates. European experience demonstrates that markets can adapt to challenges associated with negative interest rates. However, given uncertainty over the precise level of the lower bound, central banks should monitor both market functioning and the demand for cash in order to identify signals that policy rates are approaching their lower bound.

*JEL classification: D53, E41, E43, E58*

*Bank classification: Central bank research; Monetary policy framework; Monetary policy implementation*

## Résumé

En 2009, la Banque du Canada a fixé la valeur plancher du taux directeur à 25 points de base. À la lumière de l'expérience récente de la Suède, du Danemark, de la Suisse et de la zone euro eu égard aux taux d'intérêt négatifs, nous examinons les aspects économiques des taux d'intérêt négatifs et avançons que ce sont principalement les coûts d'entreposage des espèces qui sont à l'origine de la limite inférieure négative des taux d'intérêt. L'expérience européenne montre que les marchés peuvent s'adapter aux défis que posent des taux d'intérêt négatifs. Néanmoins, compte tenu de l'incertitude concernant le niveau exact de la limite inférieure, les banques centrales devraient surveiller le fonctionnement des marchés et la demande d'argent liquide afin de déceler des signaux montrant que le taux directeur se rapproche de sa valeur plancher.

*Classification JEL : D53, E41, E43, E58*

*Classification de la Banque : Recherches menées par les banques centrales; Cadre de la politique monétaire; Mise en œuvre de la politique monétaire*

## Costs of Holding Cash Dictate the Ultimate Lower Bound

The existence of cash—a zero-yielding asset—is the main source of a lower bound on the central bank policy rate. Since investors must pay to store large amounts of cash, the effective yield on cash is actually negative. When deposit rates fall to a negative level that is below this effective yield on cash, investors would prefer to hold cash over bank deposits that lose money. How low a policy rate can go without triggering a flight to cash depends on how much it costs to store and insure cash as well as other possible conveniences offered by deposit holdings (e.g., the ability to transfer funds to other accounts). These negative yields therefore set the lower bound for deposit rates.

Our best estimate for the effective lower bound is a target rate of around -50 basis points (bps). Cash storage costs, including direct costs of storage and insurance costs, are approximately equivalent to 25 to 50 bps per year. Wholesale storage pricing does not vary much with denomination; instead, it is largely driven by insurance costs. Our estimate of storage costs is determined using three different sources. First, our current third-party pricing for insured short-duration storage is in this range. Second, storage costs for precious metals (e.g., gold), including insurance costs, are of similar magnitude. Third, fees for exchange-traded funds that are physically backed by gold or silver are also in this range, reflecting in large part the storage and insurance costs.

We need to bear in mind that the insurance costs will likely increase with the demand for cash storage. Moreover, the current industry practice suggests that there is a finite amount of cash any insurance company is willing to insure. Aside from the insurance cost, the duration of negative interest rates is another important factor affecting the demand for cash. For individuals, the decision to hoard cash may depend not only on the level of interest rates but also on how long the rates are expected to remain negative. For firms, investing in additional storage capacity is likely to incur substantial fixed costs, which would be worth bearing only if negative interest rates are expected to persist.

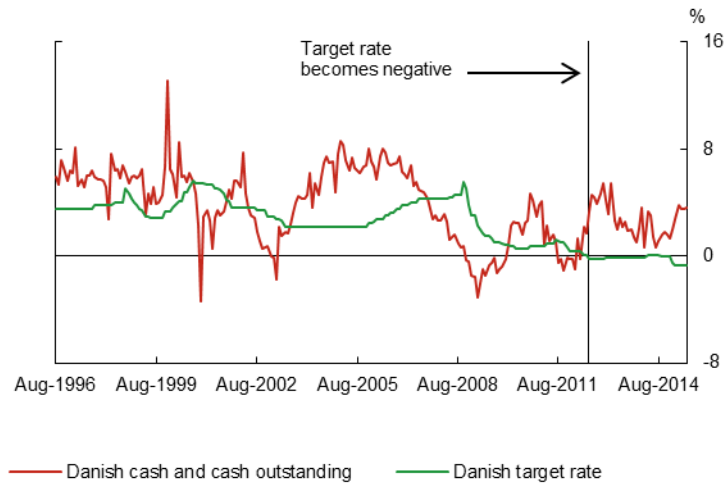
The lack of any abrupt surge in cash demand in European countries with negative rates within this range suggests that the cost of holding cash could in fact be larger than the storage and insurance costs (**Chart 1** and **Chart 2**).<sup>1</sup> The absence of abnormal cash demand in Switzerland, for example, with the target rate at -75 bps, supports this possibility. The policy rate could even go a bit below cash storage and insurance costs to account for the convenience benefit of electronic money as well as the spread between the target rate and prevailing short-term interest rates. Of course, measures of convenience yields and the wedge between the target rate and prevailing market interest rates when rates go negative are bound to be imprecise.

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<sup>1</sup> Jackson, H. 2015. "The International Experience with Negative Policy Rates." Bank of Canada Staff Discussion Paper 2015-13.

### Chart 1: No extraordinary cash withdrawals in Denmark

Year-over-year percentage change in Danish cash and cash outstanding

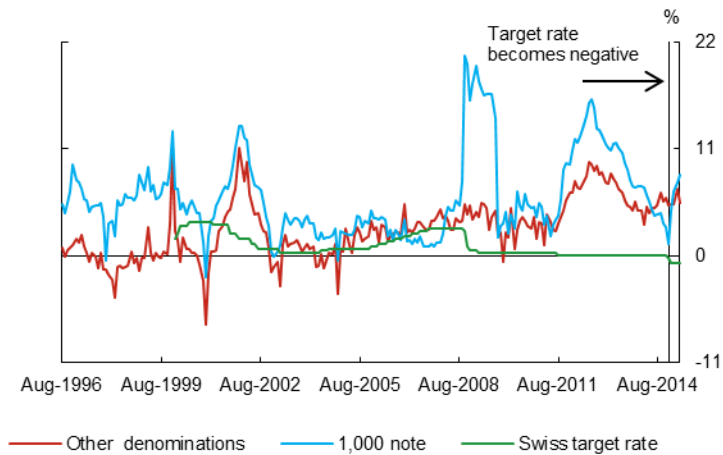


Sources: Danmarks Nationalbank and Bloomberg

Last observation: June 2015

### Chart 2: No extraordinary cash withdrawals in Switzerland

Year-over-year percentage change in Swiss bank notes



Sources: Swiss National Bank and Bloomberg

Last observation: April 2015

## The Financial System Can Adapt to an Environment of Small Negative Rates

If the cost of holding cash sets a hard constraint for the effective lower bound (ELB), market frictions can represent soft constraints. Financial contracts that have an explicit or implicit payout floor of zero when interest rates become negative can create such frictions. However, since financial contracts can evolve and adapt, these frictions do not set the real constraint on the lower bound for interest rates.

For example, in a repo transaction, one party may lend \$100 and receive some securities from the cash borrower as collateral. At the end of the contract, the lender returns the securities and receives

$\$100(1+r)$  with  $r$  as the return, or repo rate, on the money lent. When the repo rate is positive, the contract is rolled over at the repo rate of 0 per cent if the bonds are not returned. Therefore, there is an incentive to deliver the bonds because the opportunity cost of failing to do so is positive. When the repo rate becomes negative, the contract is rolled over at the *same* negative repo rate, implying the opportunity cost of failing is zero. The incentive to deliver securities therefore disappears when rates go negative; the securities borrower will be indifferent between failing to deliver (rolling the contract over at the negative repo rate) and borrowing the security at the same negative repo rate.

Such frictions exist in many financial contracts and products with an explicit or implicit floor at zero, including repos, banking deposits, money market funds (MMFs) and floating rate notes (FRNs). These could all be influenced by negative rates because of an explicit or implicit floor at zero:

- By convention, as noted in the example above, the securities borrower in a repo transaction has an opportunity cost of failing to deliver that is equal to the repo rate when rates are positive and zero when rates go negative.
- By convention, banks pay their depositors a non-negative nominal return on their deposits.
- MMFs have a fixed share price and pay their shareholders a non-negative dividend that equals the money market rate less management fees.
- Issuers of FRNs pay their bondholders a coupon that is effectively floored at zero.<sup>2</sup>

Given that these contracted payout rates have different spreads to their respective reference rates (which themselves may trade at a spread to overnight rates), they will each be affected by different thresholds of negative overnight interest rates. The larger the spread, the less the negative overnight rates will pose a problem.

Generally, the relevant participants in Europe have used three methods to adapt to negative interest rates. First, some participants have accepted a reduction in their profit margin and used other lines of business to cross-subsidize such loss. Second, some participants have changed their financial contracts by removing the implicit floor when interest rates go negative. Third, participants have also attempted to protect their profit margins when rates go negative (e.g., some European banks have not lowered their lending rates).<sup>3</sup>

**General collateral (GC) repo markets have continued to function in a low or negative overnight rate environment.** In the GC repo market, the purpose of trade is to borrow cash. This market can function when repo rates go negative since the opportunity cost for cash is also negative. In Canada, when the policy rate reached 25 bps in 2009–11, the overnight rate traded close to target and the repo market had normal trading volume without any sign of increases in settlement failures. In Europe, the GC repo market has continued to function normally despite repo rates very close to zero from 2012 to 2014 and

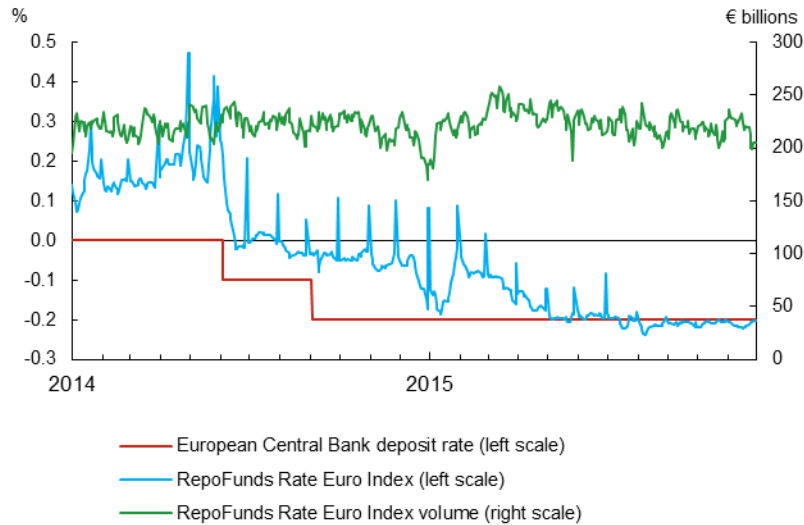
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<sup>2</sup> FFRNs are bonds that have a variable coupon, equal to a money market reference rate, like the Canadian Dollar Offered Rate (CDOR), plus or minus a spread.

<sup>3</sup> Jensen, C. M. and M. Spange. 2015. "Interest Rate Pass-Through and the Demand for Cash at Negative Interest Rates." Danmarks Nationalbank. *Monetary Review 2nd Quarter*.

persistently negative since 2014. Repo volumes have been steady over this period (**Chart 3**) and there is no evidence of market disruption or increased fail rates.<sup>4</sup> The lack of settlement failures in Europe could also be an indication that the reputational cost of failing is not negligible.

**Chart 3: Volumes in core funding markets have not declined with negative interest rates**



Source: Bloomberg

Last observation: 30 November 2015

In special repo markets, however, persistently negative overnight interest rates could lead to increases in settlement failures in repo transactions. Similar frictions exist but are more acute in the special repo market than in the GC repo market. The purpose of a trade in special repo markets is to borrow one specific bond. Since interest rates for special repo trades are below those for GC repo trades, the interest rate faced by the security borrower and cash lender could reach zero sooner than that for the GC repo participant. Since the settlement failures tend to occur in a cascade, the security borrower can blame the failure to deliver on other parties; thus, the reputational cost of failing is lower.

Despite the presence of these more acute frictions, there has not been a reduction in trading volumes or price deviations in euro-denominated bonds during the negative interest rate period, suggesting limited impact on this market to date.

**European banks have not fully passed on negative interest rates.** In Switzerland, Denmark and Sweden, commercial bank deposit rates have not declined to the same extent as the central bank target rates in the negative rate environment. Banks have not charged retail clients negative deposit rates, although Swiss banks have passed on the negative rates to their large corporate accounts. In addition, many banks

<sup>4</sup> “Box 1: The Financial System Implications of Negative Interest Rates,” Bank of Canada *Financial System Review* (June 2015): 7.



have not passed on the rate cut to mortgages.<sup>5</sup> This may be due in part to the banks' desire to protect their interest rate margin.

**European MMFs have adjusted to negative rates by waiving fees and changing their payout structure by converting to floating share prices.** Returns on mutual funds are equal to share price appreciation plus dividend payouts. Since many MMFs have a constant share price (also called a constant net asset value or CNAV), the payout to these MMF shareholders is equal to the dividend payout, which must be positive and is equal to the money market rate less expense fees. The constant share price MMF is therefore losing money when money market rates are below fund expense fees. European MMFs, however, have waived their expense fees during long periods of low or negative interest rates, absorbing the losses rather than passing them on to their investors. There have not been abnormal redemptions from European MMFs during the current episode of negative rates in Europe. Some European MMFs have converted from a fixed share price structure to a floating share price structure, in which the return to MMF shareholders could be negative since the share price would then be able to decrease.<sup>6</sup> Other funds have closed to new business.<sup>7</sup>

**The FRN market has explored ways to adapt to a negative rate environment.** The coupon rate on FRNs in Europe has not fallen into negative territory even though the three-month Euro Interbank Offered Rate (EURIBOR) has been setting in negative territory since April. FRNs are securities that have a coupon payment priced off a short-term benchmark interest rate, such as the EURIBOR (CDOR in Canada). Several FRNs have explicit clauses preventing interest rate payments from falling below zero; investors perceived other European FRNs without explicit clauses to have an implicit floor at zero. For example, European investors are now seeking contractual guarantees that they are not liable to borrowers when floating rates become negative.<sup>8</sup> Issuers of FRNs have also adjusted by reopening old issues that traded at a wide positive coupon spread to EURIBOR or by issuing FRNs at a premium and, in turn, a wider coupon spread to EURIBOR to reduce the possibility that the coupon payment approaches negative territory.

## The Effective Lower Bound for the Bank of Canada Policy Rate is Somewhere Below Zero

We do not know where exactly the ELB for the Bank of Canada policy rate is, nor do we know how long policy rates could stay negative without disrupting markets or causing a surge in the demand for cash. What we do know is that central banks should proceed cautiously if they were to enter a negative rate environment. In such an environment, they should monitor the effect of negative rates on core funding markets, banks and other market participants.

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<sup>5</sup> [http://www.snb.ch/en/mmr/speeches/id/ref\\_20151119\\_amr/source/ref\\_20151119\\_amr.en.pdf](http://www.snb.ch/en/mmr/speeches/id/ref_20151119_amr/source/ref_20151119_amr.en.pdf)

<sup>6</sup> <http://www.bloomberg.com/news/articles/2012-10-19/jpmorgan-readies-clients-for-negative-euro-money-yields>

<sup>7</sup> <http://www.bloomberg.com/news/articles/2013-02-18/blackrock-re-opens-euro-money-market-fund-amid-climbing-yields>

<sup>8</sup> "Box 1: The Financial System Implications of Negative Interest Rates," Bank of Canada *Financial System Review* (June 2015): 7.