

Central Bank Crisis Interventions: A Review of the Recent Literature on Potential Costs

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Abstract

Central banks may engage in large-scale lending and asset purchases to stabilize financial markets and implement monetary policy during crises. The ability of these actions to restore financial market functioning is well documented; however, they come with costs. We provide a literature review of the costs associated with these central bank actions, without commenting on the net benefits they provide. We find support for the premise that crisis actions may negatively impact market liquidity, distort asset prices, create conflicts between monetary and financial stability objectives and increase rent-seeking and unproductive uses of the liquidity provided by the central bank. We discuss measures that may mitigate the negative impacts of crisis actions.

Topics: Central bank research; Financial institutions; Financial markets; Financial stability; Lender of last resort

JEL codes: E5, E58, G10, G20

Résumé

En période de crise, les banques centrales peuvent être amenées à offrir des facilités de prêt à grande échelle et à procéder à des achats massifs d'actifs afin de stabiliser les marchés financiers et de mettre en œuvre la politique monétaire. Il a été largement démontré que ces actions aident à rétablir le fonctionnement des marchés, mais elles comportent des coûts. Nous présentons une revue de la littérature sur les coûts associés à ces actions des banques centrales, sans nous attarder sur les avantages nets qu'elles procurent. Nos constatations corroborent l'hypothèse selon laquelle de telles interventions de crise sont susceptibles d'avoir une incidence négative sur la liquidité du marché, de fausser les prix des actifs, de mettre en conflit les objectifs de politique monétaire et ceux de stabilité financière et de favoriser la recherche de rente et l'utilisation improductive des liquidités fournies par la banque centrale. Nous analysons des mesures qui pourraient atténuer ces effets négatifs.

Sujets : Recherches menées par les banques centrales; Institutions financières; Marchés financiers; Stabilité financière; Fonction de prêteur de dernier ressort

Codes JEL : E5, E58, G10, G20

1 Introduction

Central bank interventions in a financial crisis can be effective at both maintaining market functioning and implementing unconventional monetary policy. Lending programs by central banks can ensure solvent market participants are able to access liquidity in exchange for good collateral, one of the original recommendations from [Bagehot \(1873\)](#). Asset purchases can both guarantee the liquidity of relevant assets and serve as a key unconventional monetary policy tool. [Bernanke \(2022\)](#) argues that, in the latter case, quantitative easing (QE) can add between 3 and 4 percentage points to the central bank’s effective lower bound for interest rates.

Liquid government bond markets are key to well-functioning financial systems. A high level of liquidity in these markets can ensure participants are confident in their ability to access liquidity in exchange for high-quality assets. In turn, there is a lower probability of asset fire sales and contagion between financial institutions. The ability to avoid these negative outcomes means that central bank interventions, which maintain the liquidity of high-quality assets, can create strong benefits for the financial systems.

Despite these benefits, large-scale actions such as asset purchases and lending facilities at central banks are bound to have side effects and unintended consequences. An analysis of central bank interventions requires a proper accounting of not only the benefits but also these costs. Even among central bankers these large-scale asset purchases and lending facilities remain somewhat controversial. A 2017 survey of central bank governors showed a plurality of respondents (38.2%) deemed that it was “too early to judge” whether QE using government debt should remain in central bank tool kits after the 2008–09 global financial crisis (GFC), while 20.6% responded that it should be discontinued ([Blinder et al. 2017](#)). An evaluation of costs poses two difficulties: costs may be difficult to measure, and the line between intended and unintended consequences from central bank facilities may be unclear. Despite these

limitations, a growing academic literature addresses the unintended consequences and side effects of central bank crisis actions. In our paper, we review this literature.

We focus on two major forms of central bank actions: large-scale asset purchases and large-scale lending facilities. Other central bank activities, such as conventional monetary policy actions, forward guidance or regulatory actions, are outside the scope of this review. We focus on the costs and side effects of these facilities to the financial system, rather than addressing all possible outcomes; for example, we do not address broader macroeconomic costs or accounting issues.

In our literature review we highlight papers that propose mechanisms by which central bank actions may create costs or side effects as well as papers that document the existence and magnitudes of those same effects.¹ We categorize financial system costs into four groups, which the existing literature has provided evidence in favour of:

- impacts on market and funding liquidity (section 2)
- pricing distortions (section 3)
- conflicts between monetary policy and financial stability objectives (section 4)
- rent-seeking and other unproductive uses of central bank liquidity (section 5)

Finally, we discuss actions central banks have taken to mitigate the costs and side effects of their intervention programs (section 6). Table 1 in the appendix provides a summary of papers discussed in each section.

2 Impacts on market and funding liquidity

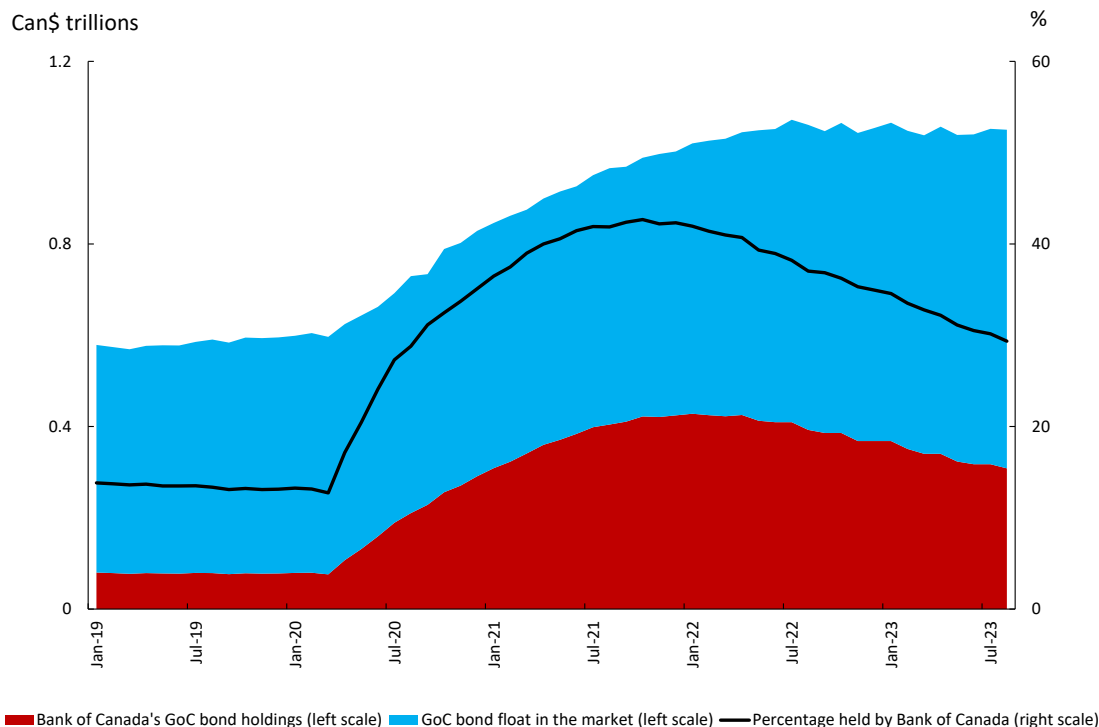
Central bank interventions, whether in terms of asset purchases or lending programs, are often intended to improve the liquidity of eligible assets during a crisis. A central bank

¹For additional information, a more focused, policy-oriented review of these costs can be found in Logan and Bindseil (2019), while a high-level discussion of these costs is presented in Bernanke (2022).

provides an outlet, outside of private markets, for participants to either sell or borrow against their assets. By acting as a large and committed buyer, the central bank could increase liquidity provision by dealers, reduce their inventory risk, stimulate trading activity through portfolio rebalancing and reduce contagion effects from disorderly asset sales (Diamond and Rajan 2005; Bessembinder et al. 2016; Boneva et al. 2022). However, recent evidence suggests that the impact of these actions may not be unidirectional. For example, Boneva, Islami, and Schlepper (2021) differentiate between the short-term flow effects and long-term stock effects of central bank fixed-income purchases on market liquidity, suggesting that while interventions improve liquidity measures contemporaneously, long-term impacts may be quite different. As a central bank removes assets from the market during large-scale purchases, liquidity measures may deteriorate because fewer bonds are available in private markets. An alternative mechanism, proposed by Boermans and Keshkov (2018), suggests that central bank asset purchases tend to attract price-elastic investors who in turn sell their bonds to the central bank. This exit of price-elastic investors then leads to an increase in the concentration of bond holdings among price-inelastic investors, hampering future liquidity by reducing the quantity of bonds available for trade. In a similar vein, Ferdinandusse, Freier, and Ristiniemi (2020) show that asset purchases are effective at initially improving liquidity, but as scarcity is induced and yields fall sufficiently to discourage new buying, liquidity begins to fall.

The work above suggests that market liquidity can be significantly affected by the underlying supply (float) of bonds available for market participants. The supply of bonds on the private market depends on the actions of both the fiscal and monetary authorities during a crisis. During the COVID-19 pandemic, many central banks purchased a large percentage of available government bonds. For example, the Bank of Canada (BoC) had \$428 billion of Government of Canada (GoC) bonds on its balance sheet at its peak (January 2022), up from \$80 billion in January 2019. At the same time, total bond issuance by the Government of Canada increased from \$579 billion to \$1.02 trillion. As a result, the BoC's holdings moved from 14% to 42% of all issued GoC bonds, as seen in Chart 1. Following October

Chart 1: The Bank of Canada’s purchases of Government of Canada bonds during COVID-19



Note: Chart 1 illustrates the Bank of Canada’s holdings of Government of Canada (GoC) bonds, compared with the total float of those same bonds, during the COVID-19 period. The combination of Bank of Canada holdings of GoC bonds (red) and the GoC bond float (blue) is equal to total GoC bonds outstanding. GoC bonds include nominal and real return bonds. All amounts are in par values.

Source: Bank of Canada calculations

Last observation: August 31, 2023

2021, the BoC’s proportional holdings of GoC bonds began to fall as the GoC bond float began to increase, representing a reversal of this trend.

A straightforward signal that fewer bonds are available for trade following a central bank intervention is a decrease in either realized trading volumes or potential trading volumes through measures like market depth. Kurosaki et al. (2015) show that, following the Bank of Japan’s (BoJ) quantitative and qualitative easing in the fall of 2014, the median volume of limit orders at the best-ask and best-bid price in the Japanese Government Bond futures

market, a proxy for market depth, declined to 25% of its peak in mid-2014. Similarly, [Schlepper et al. \(2020\)](#) show that order book depth in interdealer markets fell by EUR1.3 million following a EUR100 million German government bond purchase by the European Central Bank (ECB) through its public sector purchase programme (PSPP).

Central bank asset purchases have gone beyond government bonds and, in turn, there may be additional costs from buying corporate bonds, mortgage-backed securities (MBS) or equities. [Kandrac \(2018\)](#) shows that an increase in the Federal Reserve's stock of MBS resulted in a deterioration of trade sizes and trading volumes and the total number of trades. Specifically, the average daily amount of MBS purchased by the Federal Reserve during the reinvestment phase of the MBS program reduced trade sizes, on average, by 7.6% from the previous day, and the average purchase amount during the Federal Reserve's third phase of QE (QE3) reduced trade sizes by 5.7% from the previous day. The impact on trading volumes was, on average, an increase of 2.6% during the reinvestment phase and a decline of 3.4% during the QE3 phase.

Another group of liquidity measures are those related to bid-ask spreads. [Pelizzon et al. \(2018\)](#) suggest that the impact of the BoJ's QE program may have a time component, with bid-ask spreads increasing as bonds became scarcer over the course of QE. Depending on the stage of the BoJ's QE program, bid-ask spreads for a given Japanese government bond increased between 0.33 and 1.5 basis points for a 1% increase in the share of the amount outstanding held by the BoJ. In the later stages of the BoJ's QE program, bid-ask spreads on a given bond changed by an additional -0.48 to 2.2 basis points for a 1% increase in the share of the amount outstanding of that bond's close substitutes held by the BoJ. Similarly, [Abidi and Miquel-Flores \(2018\)](#) suggest the bid-ask spreads of corporate bonds start to increase three weeks after the announcement of the ECB's corporate sector purchase programme (CSPP), increasing by 4.4 basis points in the third week and up to 17 basis points by the sixth week.

Another possibility is that asset purchase programs may increase bid-ask spreads only under specific circumstances, explaining why some studies, such as [Kandrac \(2018\)](#) and [Schlepper et al. \(2020\)](#), find mixed results. It is difficult for theory to provide a satisfactory explanation for why specific bond purchase thresholds by a central bank may create negative impacts. As a result, the literature has relied on ex-post analysis of different thresholds to explain the differential impacts of government purchases. [Blix Grimaldi, Crosta, and Zhang \(2021\)](#) find that, in the case of the Sveriges Riksbank, negative impacts on asset volatility were up to four times higher once they had purchased at least 40% of a particular bond's outstanding quantity. [Han and Seneviratne \(2018\)](#) show evidence that 40% of a bond's value outstanding being held by the BoJ corresponded to an increase in that bond's estimated bid-ask spread just above one standard deviation. [Boneva et al. \(2021\)](#) show that relative impacts of the ECB's German corporate bond purchases on bid-ask spreads were worse for older bonds compared with more recently issued ones, suggesting that older bonds with a lower free float were more negatively impacted.

Signs of market liquidity issues may be visible in lending markets (i.e., repo markets) rather than for outright fixed-income transactions (i.e., cash markets). A common measure of a bond's availability in the repo market is its "specialness," the difference between the general collateral repo rate and the repo rate for transactions using that specific bond. The logic of this measure is simple: if a bond is in scarce supply, borrowers who pledge this bond as collateral can borrow cash at lower rates. [D'Amico, Fan, and Kitsul \(2018\)](#) show that QE purchases by the Federal Reserve increase specialness of treasuries, and that this specialness lasts up to three months. They find that specialness increases not only for recently issued treasuries but also for seasoned treasuries. Specialness would increase by 1.84 basis points for the average purchase amount of recently issued treasuries by the Federal Reserve on the day of an operation and by 0.12 basis points for the average purchase size of seasoned treasuries. The impacts of QE on repo specialness translated to lower yields on treasuries relative to a fitted yield curve, demonstrating visible scarcity effects in both repo and cash

markets for treasuries. Similarly, [Arrata et al. \(2020\)](#) show that the ECB’s asset purchases increased specialness by 0.78 basis points for a purchase of 1% of the underlying bond’s amount outstanding, while [Corradin and Maddaloni \(2020\)](#) show that this specialness was also associated with a 0.32% higher probability of failures to deliver.

Finally, given that repo markets are an important source of funding for market participants, many central banks implement some of their lending facilities through repo markets. A known issue with lending facilities is that those who access the facilities, often bank-owned dealers, are not always the ultimate demander of liquidity. These dealers are often intermediating liquidity through matched repo transactions to other market participants such as non-bank financial institutions (NBFI). Because these other participants typically do not have direct access to central bank facilities, dealers retain some market power in the transaction. [Hüser \(2021\)](#) shows that although aggregate repo spreads increased during the COVID-19 crisis, these increases differed sharply across NBFI sectors, which indicates that rates from emergency facilities are not fully passing on from dealers to NBFIs.

Dealers may be unable to pass through lending as a result of their own constraints. Exploiting a regulatory change in reporting requirements of the leverage ratio that affected only a subset of dealers, [Kotidis and Van Horen \(2018\)](#) compare repo activity between UK dealers affected by the regulatory change and thus more bound by the leverage ratio with the repo activity of unaffected UK dealers. They show that for a given client, repo volumes on average decreased by 66 percentage points, and the number of repo transactions declined by 39 percentage points among affected UK dealers relative to unaffected dealers.²

To explain movements in US Treasury yields and rates on repo transactions during the height of the COVID-19 crisis, [He, Nagel, and Song \(2022\)](#) show that dealers charge a spread on repo transactions over their own borrowing cost equal to their balance sheet cost. They find that repo spreads have increased by about 20 basis points around quarter-end dates,

²The 66% decrease in repo volume reflects a decrease in volume by affected UK dealers and an increase in repo volume by unaffected UK dealers.

when balance sheet constraints are known to bind more for European banks. Overall, they demonstrate how intermediary constraints can lead to higher costs for market participants seeking to engage in repo activity during crises, when dealer balance sheets tend to expand. Supporting the importance of balance sheet constraints, [Breckenfelder and Hoerova \(2023\)](#) find that, in response to ECB facilities, dealers with worse financial conditions during the COVID-19 crisis increased lending to investment-grade corporate bond mutual funds 1.4 to 1.6 times more than dealers with stronger financial conditions. The authors also highlight that the effectiveness of repo facilities at supporting mutual funds is capped by the regulatory limits on mutual funds' borrowing.

3 Pricing distortions

A second category of consequences from central bank interventions is changes in the pricing of securities. Often, central bank interventions are intended, at least to some degree, to modify the pricing of securities. During a financial crisis, this may be because market participants are engaging in fire-sale behaviour, artificially depressing the prices of otherwise safe assets below their fundamental values. In this case, interventions may be intended to return securities to their “fair” value. However, not all price changes caused by interventions are either intended or desirable. For example, interventions may distort long-term relationships between securities by lowering the yields of relatively riskier securities below those of safer counterparts.

[Pasquariello \(2018\)](#) argues that interventions may induce violations of the law of one price by complicating signals about the fundamental value of assets targeted by central banks. Similarly, [Steeley \(2015\)](#) argues that while the Bank of England's (BoE) QE program narrowed bid-ask spreads, it did so at the cost of creating return anomalies, thus reducing the efficiency of market prices. In particular, between the BoE's first and third phase of QE, gilt prices were slower to adjust to the arrival of new information, as shown by higher

correlations between past and present gilt returns relative to their pre-QE levels. This autocorrelation could be exploited to generate excess returns (after accounting for transaction costs) during the period between the first and second phase of QE. [Barbon and Gianinazzi \(2019\)](#) argue that, in Japanese equity markets, the use of price-weighted instead of value-weighted baskets by the BoJ tilted its holdings in a manner that distorted the composition of aggregate systematic risk held by the private sector. This act distorted prices by generating abnormal returns around announcements for those stocks that experienced the greatest reduction in systematic risk as a result of the BoJ's purchases.

Price distortions may be seen through changes in the prices between otherwise similar assets and modifications of arbitrage relationships. [Pelizzon, Subrahmanyam, and Tomio \(2023\)](#) show that bond scarcity induced by ECB QE purchases increased transaction costs (bid-ask spreads) and the costs of borrowing securities (specialness), thereby distorting the arbitrage mechanism between futures and cash markets (a mechanism that we revisit when discussing monetary policy pass-through). Specifically, a 10% increase in the ECB's holdings of either German or Italian bonds widened the bid-ask spread of those bonds by 25% and increased their specialness to a level five times higher than it was before QE. This, in turn, corresponded to an increase of the cash-futures basis by 46 basis points, which started from a level of near zero before the commencement of the ECB's QE program.³ [Lucca and Wright \(2022\)](#) show that, after the Reserve Bank of Australia's (RBA) yield targets under its yield curve control (YCC) program were no longer consistent with expectations of the monetary policy rate path, yields of targeted bonds decoupled from the yields of other government bonds and other comparable fixed-income markets. This created kinks in the government bond yield curve because targeted bonds remained relatively lower than yields of neighbouring bonds with similar maturities, which rose via the expectations channel.

In a similar vein to market liquidity, the impact of interventions on asset prices may depend on the scale of purchases by a central bank. Later rounds of asset purchases may

³The cash-futures basis is the spread between an asset's current price in the cash market and the price of the respective futures product.

have decreasing, or even inverse, impacts on prices compared with earlier rounds. [Hesse, Hofmann, and Weber \(2018\)](#) show that while facilities had initial positive impacts, subsequent extensions of these facilities had smaller results. In a starker result, [Meaning and Zhu \(2011\)](#) find that while sovereign bond yields declined by 30–80 basis points and 36–50 basis points around the initial announcements of the Fed’s large-scale asset purchases and the BoE’s asset purchase facilities, respectively, during the GFC, sovereign bond yields actually increased by several basis points upon the announcements of subsequent expansions of those facilities. With respect to equity prices, [Harada and Okimoto \(2021\)](#) show that the impact of the BoJ’s exchange-traded fund (ETF) purchases on returns of eligible stocks relative to ineligible stocks waned over time. They find that on days the BoJ purchased ETFs, the returns of those stocks in the afternoon of the day, relative to stocks ineligible for the BoJ’s facility, declined in the periods between each successive expansion of the facility, with an overall decline of 65% from 2013 to 2017.

Finally, another way in which a central bank may distort prices is by changing perceptions of market risk. Indeed, a central bank may wish to calm markets during a crisis by removing the possibility of tail-risk scenarios. Since assets are priced, in part, based on their potential risks, changes to these risks should result in similar changes to their prices. All else being equal, a reduction in a given asset’s risk would generally be accompanied by an increase in that asset’s value. Removal of the risk by the central bank can be controversial, since these actions can be seen as encouraging moral hazard on the part of market participants.

There is ample evidence in the literature that interventions distort prices through changes in various bond spreads. [Gilchrist et al. \(2020\)](#) and [Boyarchenko, Kovner, and Shachar \(2022\)](#) show that the Federal Reserve’s Secondary Market Corporate Credit Facility (SMCCF) had different impacts on eligible bonds compared with their ineligible counterparts. [Gilchrist et al. \(2020\)](#) find that corporate bonds’ credit risk premiums for eligible bonds declined by 47 basis points relative to ineligible bonds in a 2-day window around the announcement of the Fed’s SMCCF and then declined to 28 basis points 10 days later. [Boyarchenko, Kovner,](#)

and Shachar (2022) find that over a 3-day window around the Fed’s announcement of the SMCCF, duration-matched credit spreads on A to AAA eligible bonds and BBB eligible bonds declined by 14.89 and 17.68 basis points per day relative to spreads of ineligible bonds. In Xu and Pennacchi (2023)’s analysis of the SMCCF they find a similar change in credit spreads, arguing that the exclusion criteria increased stigma around ineligible bonds. Boneva, De Roure, and Morley (2018) also find that the BoE’s corporate purchase program reduced credit spreads of an issuer’s eligible bonds by 13–14 basis points compared with the issuer’s ineligible foreign bonds.

Finally, using options-implied tail risk, Haddad, Moreira, and Muir (2023) show that central bank programs reduce left-tail risk not only during but also after interventions, implying that participants internalize the possibility of future actions. Kelly, Lustig, and Van Nieuwerburgh (2016) find a similar reduction in tail risk associated with combinations of central bank programs and government stimulus measures during 2007 to 2009. They find that price deviations between out-of-the-money put options for financial sector ETFs and corresponding options on the underlying companies increase by 31% in the first five days following positive announcements of both central bank interventions and fiscal stimulus for the financial sector, demonstrating that the market perceived these interventions as sector-wide tail-risk insurance.

4 Conflicts between monetary policy and financial stability

Central bank interventions, whether in terms of asset purchases or lending, may be conducted under different objectives—principally, monetary policy or financial stability, with the latter sometimes being referred to as *market functioning*. For example, lender-of-last-resort-type operations may be used during the acute phase of a financial crisis to ensure solvent institutions are able to borrow against good collateral. Purchase operations may serve similar

financial stability goals during the onset of a crisis but may also be used for monetary policy (as QE) during a prolonged period of low rates. When central banks take these actions, their objectives may come into conflict if they are responsible for both monetary policy and financial stability.

One way objectives could conflict is when financial stability and monetary policy actions act in opposite directions. For example, [Lucca and Wright \(2022\)](#) show that at the beginning of the COVID-19 crisis, the RBA's YCC program reinforced the central bank's forward guidance of maintaining low policy rates until inflation reverted to the target, which they did not expect for another three years. The two policies mutually reinforced one another such that the RBA was able to maintain its yield targets under the YCC with minimal actual purchases. However, once inflation rose and policy rate expectations were pulled forward, the RBA's YCC target was no longer consistent with the RBA's stated commitment to keep policy rates low. This resulted in the RBA purchasing large amounts of targeted government bonds shortly before discontinuing its YCC program. More recently, before the 2022 UK gilt crisis, the bank rate in the United Kingdom had begun increasing from a low of 0.10% before December 2021 to 1.75% in August 2022, representing a period of tightening. Following an initial unexpected increase in long-term gilt yields during September 2022, leveraged investors amplified such increases by selling long-term gilts for cash to meet larger margin requirements. The BoE was required to intervene to reduce yields on these same gilts and restore market functioning ([Breedon 2022](#); [Hauser 2020](#)). The result was that BoE financial stability actions reduced long-term yields, albeit from a highly elevated position, during a period when they were increasing short-term yields. In that vein, [Fleming et al. \(2022\)](#) explain that market-function-type purchases can lead to unanticipated policy easing.

Alternatively, actions intended to impact one market may have unintended spillovers into others. [Cimon and Walton \(2022\)](#) show theoretically that central bank purchases of one asset type create similar impacts on other covariant assets through the dealer balance sheet

channel.⁴ Empirically, [Morais et al. \(2019\)](#) show that quantitative easing in the United States and United Kingdom created spillovers in Mexican markets, this time through the bank-lending channel.⁵ In response to a one-standard-deviation increase in the Federal Reserve’s assets relative to GDP, a proxy for QE, US banks operating in Mexico expanded credit volume by 2.5%, lengthened loan maturities by 7.1%, and experienced 6.5% higher future loan defaults. Moreover, one standard deviation in the proxy for QE leads to an 8.6% increase in future loan defaults for firms with loans that had higher than average ex-ante interest rates—evidence consistent with the interpretation that QE induced banks to engage in reach-for-yield behaviour by lending to riskier firms.

A third possibility is that asset purchases may interfere with the transmission of monetary policy. [Pelizzon, Subrahmanyam, and Tomio \(2023\)](#) show that ECB asset purchases induced scarcity in German and Italian government bonds, thereby increasing the costs of arbitrage, shown by a wider cash-futures basis, wider swap spreads and differences between model-fitted yields and observed yields across the term structure. This market inefficiency ultimately limited the pass-through of monetary policy from government bonds to other related assets by limiting the degree to which other assets responded to changes in government bond prices. [Ballensiefen, Ranaldo, and Winterberg \(2023\)](#) argue that, in another channel, ECB asset purchases created separation in repo markets between funding-driven and collateral-driven repos, where interest rates on the latter are less sensitive to the ECB’s target benchmark repo rate. Bond scarcity induced by QE dampens this effect because the sensitivity of interest rates on repo transactions involving QE-eligible bonds to the ECB’s benchmark repo rate was 17 basis points lower than for those involving non-eligible bonds. This led to higher dispersion among funding-driven and collateral-driven repo rates. Based on the notion that monetary policy should perfectly pass through to all money market rates ([Corradin et al.](#)

⁴The dealer balance sheet channel is the way by which dealers’ balance sheet costs and frictions impact trading and prices in the markets they intermediate.

⁵The bank-lending channel is the method by which banks’ lending choices impact financial markets and financial market participants.

2021), the higher dispersion among repo rates suggests the ECB had less control over the monetary policy transmission process.

5 Rent-seeking and other unproductive uses of central bank liquidity

A concern regarding interventions by central banks is that they can create opportunities for market intermediaries to extract economic rents, which are ultimately borne by investors and taxpayers. Dealers who intermediate over-the-counter (OTC) markets may find themselves with a new, reliable counterparty in the form of the central bank. This reliability is intentional, as it allows dealers to respond more efficiently to liquidity demand by their clients, preventing market dysfunction; however, it has costs. These costs typically arise from the design of auctions and facilities through which central banks implement their interventions.

One design choice that can create profit opportunities for dealers is the central bank's rules for allocating the auctioned amounts across dealers' bids. [Song and Zhu \(2018\)](#) suggest that since dealers could partially infer the specific bonds and prices that the Fed was willing to accept, dealers could short specific bonds into the Fed's QE auctions at a profit and later close their position in private markets. The authors estimate that one standard deviation in the "cheapness" of a bond (the bond's yield relative to a model-fitted yield) induced the Federal Reserve to purchase \$276 million more of that bond and increased the auction cost on that bond by 2.6 cents per \$100 par value. Similarly, [Breedon \(2018\)](#) finds that round-trip transaction costs, the difference between bond yields at auction and yields on days around the auction, equalled 0.5% of the total value of the BoE's QE program, and that some of this cost is attributed to dealers being able to exploit the allocation rules of the BoE's QE auctions.

Profit opportunities can also arise from the predictable trade sizes of the central bank and the publicly known set of dealers a central bank transacts with. [An and Song \(2023\)](#) estimate that, in the Fed’s agency MBS auctions, dealers charged the Fed higher than private market clients by 2.5 cents per \$100 par value, representing half of dealers’ average gross profit margin. The authors find some evidence that this higher markup for the Fed was a result of the Fed’s larger trade sizes compared with those of private market clients, and of the Fed’s fixed set of dealer counterparties. In a study of the BoE’s QE auctions, [Boneva, Kastl, and Zikes \(2020\)](#) suggest that dealers earned a rent of 2.6 basis points intermediating such auctions. The authors suggest that when a central bank intends to provide liquidity to dealers in an equitable way, no mechanism could fully eliminate these rents that dealers can extract due to their informational advantages.

Apart from intermediaries, security issuers may be enticed by the low rates caused by central banks’ actions to engage in unproductive uses of liquidity provided by the central bank. [Todorov \(2020\)](#) shows that firms that issued bonds eligible for the ECB’s CSPP used these issuances to increase corporate dividends four times higher in the two quarters following the announcement of the CSPP relative to the first quarter before the announcement. At the same time, the cash holdings, working capital, research and development, and property, plant and equipment accounts of these firms did not change. However, given data limitations, the authors caution against interpreting these results as purely a result of the ECB’s CSPP. [De Santis and Zaghini \(2021\)](#) analyze the same program and show that while firms did increase investment in capital expenditures and intangibles, eligible firms also repurchased their own securities and held more cash. [Darmouni and Siani \(2022\)](#) show that corporations that were more exposed to the Fed’s corporate credit facilities during the COVID-19 crisis were more likely to increase cash and less likely to increase real investments, perhaps because these firms were not initially financially constrained. Strikingly, for every dollar of new bonds issued, 45 cents were used to increase cash, 15 cents to pay back bank debt and 30 cents to refinance existing bonds, with no increase in real investment.

Firms may also use central bank facilities to increase leverage or to issue securities with riskier profiles. Indeed, [Foley-Fisher, Ramcharan, and Yu \(2016\)](#) show that, in response to the Fed's maturity extension program (MEP), firms with a preference for long-term debt, as proxied by the share of total debt that matures beyond three years, chose to issue additional long-term debt. During the MEP period, a one-standard-deviation increase in the authors' proxy for long-term debt preference corresponded to an 8 percentage point increase in long-term debt growth. [Pegoraro and Montagna \(2021\)](#) show that firms took advantage of decreased risk premiums and increased issuance of riskier bonds in response to the ECB's CSPP: more of these bonds were unsecured or non-guaranteed, with longer maturities, more fixed coupons and a more general (rather than specific) purpose. Bond characteristics aside, [Acharya et al. \(2022\)](#) show that in response to Fed QE programs during the GFC, firms vulnerable to a credit rating downgrade increased their bond issuance and used the proceeds to engage in more merger and acquisition activity. The authors show that this was riskier and prolonged rating downgrades that crystallized during the COVID-19 crisis.

Finally, interventions may simply be ineffective at improving market outcomes once banks become satisfied. These further interventions may incur costs but generate fewer benefits in exchange. [Karadi and Nakov \(2021\)](#) show that, once bank constraints are no longer binding, QE crowds out private lending and becomes ineffective at further easing credit conditions. [Ertan, Kleymenova, and Tuijn \(2020\)](#) show that banks that were more affected by the accumulated purchases through the ECB's CSPP increased their loans to small and medium-sized enterprises by 2% relative to the unaffected banks. However, these effects dissipated one year following the introduction of the ECB's CSPP.

6 Mitigation of costs and side effects

The existence of costs from central bank actions does not imply that central banks are unable to mitigate or manage them. On the contrary, central banks can take several actions

to reduce these side effects. In a report prepared for the Bank for International Settlements Markets Committee, [Logan and Bindseil \(2019\)](#) categorize these mitigants into three groups:

- program design (purchase protocols, lending program protocols, transparency, minimizing uncertainty, minimizing information asymmetry and flexibility of implementation)
- securities-lending programs (primary, secondary and backstop)
- liability management practices and remuneration policies (absorbing excess liquidity, floor systems and reserve remuneration tiering)

In this section, we focus on program design and securities-lending programs.

A key element of program design is the choice and quantity of securities purchased by the central bank. When securities are purchased according to a specific index composition (e.g., price-weighted versus value-weighted), private markets may be distorted ([Barbon and Gianinazzi 2019](#)). [Duffie and Keane \(2023\)](#) argue that central banks can reduce distortion through the use of “delivery choice” reverse auction designs, which share some characteristics with “product mix auctions” ([Klemperer 2010](#)). In this design, central banks do not make offers on specific securities; instead, bidders are able to offer any eligible security at a spread to some maturity benchmark. Such a system can reduce inefficiencies from misallocated securities where scarcities exist among participants. They also argue in favour of transparent programs, which limit political economy costs and rent-seeking by eligible participants.

As a more specific measure, central banks may be able to mitigate collateral shortages and mispricing of specific bonds by engaging in securities-lending programs. Broadly speaking, these programs lend out securities on the central bank’s balance sheet to market participants, increasing the supply of these securities in the private market. Use of these programs by the ECB has been shown to reduce bond scarcity that results from QE programs and increase the supply of collateral available in private markets ([Pelizzon et al. 2023](#); [Greppmair and Jank 2022](#)). Similar programs in Canada have been shown to mitigate the negative consequences of settlement failures ([Fontaine, Garriott, and Gray 2016](#)).

In some circumstances, measures taken by central banks or financial market infrastructures treat the symptoms of these costs, rather than addressing the underlying costs themselves. One example of such a measure is a fail fee for repo transactions, where parties are charged a daily fee if they fail to deliver the security. Indeed, the introduction or increase of a fail fee has been shown to reduce the probability of failures to deliver (Corradin and Maddaloni 2020). However, such a fee simply discourages parties from failing to deliver bonds as a result of scarcity but does not resolve the bond scarcity itself.

7 Conclusion

It is clear from existing literature that, despite the benefits, there are unintended costs, distortions and side effects of central bank interventions. While it is possible that the benefits outweigh the costs, based on the extreme economic costs of financial crises, it is important for policy-makers to be cognizant of the large unintended consequences they may provoke. This paper set out to categorize these potential unintended costs and to review recent literature that provides evidence of their existence. The full economic impacts of these interventions are still not understood, and there is ample space for future work to that end.

Future work could analyze whether the side effects and unintended costs of central bank actions are attenuated or in fact exacerbated when they interact with NBFIs rather than dealers. Traditionally, central banks have often intervened through a network of bank-owned dealers. These dealers have played a central role in fixed-income markets and are often involved with central banks through mechanisms such as the issuance of government debt. Since these dealers are often subsidiaries of commercial banks, they are also highly regulated entities and may be viewed as relatively safe counterparties. However, the ultimate target of central bank actions may not be these dealers; instead, central banks may satisfy liquidity demand by NBFIs such as pension funds, insurance companies, mutual funds or hedge funds. Indeed, d'Avernas, Vandeweyer, and Darracq Paries (2020) argue that the

existence of a large NBFIs sector may limit the reach of traditional central bank programs. Some central banks have facilities that cater directly to these participants. For example, in 2020 the Bank of Canada introduced the Contingent Term Repo Facility to lend to non-bank counterparties, while in 2023 the Bank of England announced plans for lending tools for insurance companies and pension funds (Hauser 2023).

Another area of interest is the impact of changes to market structure on the costs of central bank actions. Traditionally, fixed-income securities were often traded exclusively through dealers with little transparency, even post-trade. If the securities targeted by central banks move toward an all-to-all market structure, are centrally cleared or are exchange traded, the balance of costs from these interventions could change. Alternatively, the size and scope of central bank interventions may be fundamentally different for primarily exchange-traded securities or securities that are intermediated by non-bank dealers.

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A Tables

Table 1: Summary of papers, by topic area

Topic	Subtopic	Study	
Market liquidity	Trading volumes and market depth	Boneva et al. (2021)	Kandrac (2018)
		Boermans and Keshkov (2018)	Kurosaki et al. (2015)
		Ferdinandusse et al. (2020)	Schlepper et al. (2020)
	Transaction costs (bid-ask spreads)	Abidi and Miquel-Flores (2018)	Han and Seneviratne (2018)
		Blix Grimaldi et al. (2021)	Kandrac (2018)
Boneva et al. (2021)		Pelizzon et al. (2018)	
Repo market specialness	Arrata et al. (2020)	D’Amico et al. (2018)	
	Corradin and Maddaloni (2020)		
Pass through of repo facilities	Breckenfelder and Heroova (2023)	He et al. (2022)	Hüser (2021)
			Kotidis and Van Horen (2018)
Asset pricing distortions	Changes in prices	Barbon and Gianinazzi (2019)	Lucca and Wright (2022)
		Harada and Okimoto (2021)	Meaning and Zhu (2011)
		Hesse et al. (2018)	Pasquariello (2018)
			Pelizzon et al. (2023)
	Changes in risk	Boneva et al. (2018)	Steeley (2015)
	Boyarchenko et al. (2022)	Haddad et al. (2023)	
	Gilchrist et al. (2020)	Kelly et al. (2016)	
		Xu and Pennacchi (2023)	
Conflicts between objectives	Unintended expansion	Breeden (2022)	Hauser (2020)
		Cimon and Walton (2022)	Lucca and Wright (2022)
		Fleming et al. (2022)	Morais et al. (2019)
	Monetary policy transmission	Ballensiefen et al. (2023)	Pelizzon et al. (2023)
	Corradin et al. (2021)		

Rent-seeking and unproductive uses of interventions	Dealer rent-seeking	An and Song (2023) Boneva et al. (2020)	Breedon (2018) Song and Zhu (2018)
	Unproductive uses of interventions	Acharya et al. (2022) Darmouni and Siani (2022) De Santis and Zaghini (2021) Ertan et al. (2020)	Foley-Fisher et al. (2016) Karadi and Nakov (2021) Pegoraro and Montagna (2021) Todorov (2020)
Actions to mitigate costs	Facility design	Barbon and Gianinazzi (2019) Duffie and Keane (2023)	Klemperer (2010) Logan and Bindseil (2019)
	Securities lending facilities	Fontaine et al. (2016) Greppmair and Jank (2022)	Logan and Bindseil (2019) Pelizzon et al. (2023)
	Repo fail fees	Corradin and Maddaloni (2020)	