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Abstract

This paper investigates the goals, costs, and benefits of official-sector purchases of government securities for the purpose of restoring market functionality. We explore the design of market-function purchase programs, including their communication, triggers, operational protocols, exit, and wind-down strategies. We further discuss whether, under some circumstances, fiscal buybacks might be a useful alternative or complement to central-bank market-function purchase programs, and how these buybacks could be funded. The use of fiscal buybacks to support market functionality can be aligned with the fiscal authority's goal of minimizing the government's interest expense and can reduce challenges that can be faced by a central bank when asset purchases are not naturally congruent with monetary policy. Depending on the setting and circumstances, fiscal buybacks can also mitigate perceptions of risks to the central bank's independence.

Key words: government securities, financial stability, bond markets, central banking, debt management

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1. Introduction

Sudden changes in economic conditions can trigger extreme demands by investors to liquidate government securities. The resulting need for dealers to warehouse large positions while finding buyers can potentially overwhelm their balance sheets. Even if dealers have the capacity to keep markets somewhat liquid, fire sales can cause price impacts that set off further sales, risking a spiral into financial instability. When lender-of-last-resort facilities have been insufficient to stem market dysfunction, central banks have occasionally resorted to purchasing government securities.

In some of these situations, the monetary-policy objectives of central banks are well aligned with the goal of restoring market functionality by purchasing assets. This alignment was clear after the COVID pandemic was declared in March 2020, triggering massive selling of government securities by investors and purchases of government securities by the corresponding central banks. There are also times, however, at which purchases of government securities by a central bank to restore market functioning are not naturally aligned with optimal monetary policy and can make policy-related communications more challenging. On September 22, 2022, for example, the Monetary Policy Committee of the Bank of England voted to begin selling gilts for the purpose of quantitative tightening. Within a day of this announcement, a UK fiscal policy shock triggered fire sales of gilts by liability-driven investors (LDIs) that destabilized the gilt market. On September 28, the Financial Policy Committee of the Bank of England instituted a program of gilt purchases that restored market stability.¹ On October 22, Bank of England Governor Andrew Bailey stated that “There may appear to be a tension here between tightening monetary policy as we must, including so-called Quantitative Tightening, and buying government debt to ease a critical threat to financial stability. This explains why we have been clear that our interventions are strictly temporary and have been designed to do the minimum necessary.”²

These observations support our objective in this paper of investigating the goals, costs, and benefits of official-sector purchases of government securities for the purpose of restoring market functionality. We also explore the design of the associated purchase programs, including their communication, triggers, operational protocols, exit, and wind-down strategies.

We further discuss whether, under some circumstances, fiscal buybacks might be a useful alternative or complement to central-bank market-function purchase programs,

¹ See Andrew Hauser “[Thirteen Days in October: How Central Bank Balance Sheets Can Support Monetary and Financial Stability](#),” Speech given at the ECB’s 2022 Conference on Money Markets, November 4, 2022.

² Andrew Bailey, “[Monetary Policy and Financial Stability Interventions in Difficult Times](#),” speech presented at the G30 meeting in Washington DC, October 22, 2022.

and how these buybacks could be funded. The use of fiscal buybacks to support market functionality can be aligned with the fiscal authority's goal of minimizing the government's interest expense and can reduce challenges that can be faced by a central bank when asset purchases are not naturally congruent with monetary policy. In some cases, fiscal buybacks can also avoid perceptions of risks to the central bank's independence. This is not to suggest that fiscal buybacks will always be an appropriate response or that central bank actions have been suboptimal. Still, given the rarity and idiosyncratic nature of episodes of market dysfunction, it seems worthwhile to contemplate both fiscal buybacks and central-bank market-function purchases. We will also discuss how fiscal and monetary authorities could, in some jurisdictions, coordinate market-function asset purchases, for example with fiscal buybacks that are temporarily funded by central-bank reserve creation, subject to legislative remit and closely circumscribed to avoid fiscal dominance.

2. The case for market-function purchase programs

Secondary markets for government securities can become dysfunctional when demands for liquidity overwhelm the intermediation capacity of the market. By virtually all accounts,³ this happened immediately after the World Health Organization declared in March 2020 that COVID-19 had become a global pandemic. Many investors around the world reacted by selling government securities in large volumes. Selling pressures were acute in the US Treasury securities market,⁴ where bid-offer spreads widened dramatically, the yield curve was much less smooth than normal, settlement failures jumped, the on-the-run premium was sharply elevated, and market depth plummeted. The Fed responded quickly with liberal repo financing of primary dealer positions in Treasuries, and --- when this failed to cure the dysfunction in the market for Treasuries -- with large purchases of Treasuries.⁵ Over time and in combination with other actions, the Fed's purchases aided a return to market functionality. Most other large central banks faced similar problems and reacted similarly.⁶

³ See, for example, Lorie Logan, "[Treasury Market Liquidity and Early Lessons from the Pandemic Shock](#)," Remarks at Brookings-Chicago Booth Task Force on Financial Stability (TFFS) meeting, Panel on Market Liquidity, October 23, 2020, Federal Reserve Bank of New York.

⁴ See "The Global Dash for Cash: Why Sovereign Bond Market Functioning Varied across Jurisdictions in March 2020," https://www.newyorkfed.org/research/staff_reports/sr1010

⁵ See Lorie Logan, "[Federal Reserve Asset Purchases: The Pandemic Response and Considerations Ahead](#)," Remarks at New York University's Stern School of Business, March 2, 2022, Federal Reserve Bank of New York, and "[The Federal Reserve's Market Functioning Purchases](#)," Michael Fleming, Haoyang Liu, Rich Podjasek, and Jake Schurmeier, *Economic Policy Review*, Federal Reserve Bank of New York, Volume 28, Number 1, June 2022.

⁶ See "[A global database on central banks' monetary responses to Covid-19](#)," by Carlos Cantú, Paolo Cavallino, Fiorella De Fiore and James Yetman, BIS Working paper Number 934, Bank for International Settlements, Basel, March 2021.

Research supports the effectiveness of government-securities purchases in March-April 2020 in contributing to a restoration of market functionality.⁷ Improvements in market functionality in turn support financial stability, allocative efficiency, and monetary policy transmission. Market-function purchase programs, if sufficiently transparent, also lower the cost to taxpayers of funding government deficits because the likelihood and severity of future episodes of market dysfunctionality are priced into government securities when they are issued. Whether or not government securities markets are suffering from illiquidity, official-sector purchases lower yields by reducing the supply of these securities available to private-sector market participants. However associated quantitative-easing effect of market-function purchases is limited if the purchases are targeted to a backstop price and are transparently communicated to be temporary. Market-functioning purchases are intended to operate through an additional channel: lowering dealer inventories of government securities so as to enable dealers to handle more investor demands for liquidity, thus improving the allocation of government securities, increasing the liquidity of financial markets, and enhancing financial stability.⁸ Boneva, Kastl, and Zikes (2023) provide evidence for this channel by showing that in reverse auctions conducted by the Bank of England dealers sell gilts more aggressively when they have unwanted inventory, or when they took additional gilt positions just before the reverse auctions, or when they are more constrained by the leverage-ratio rule.⁹ The authors also find that purchases by the Bank of England provided significant liquidity benefits to dealers, writing that “by acting as a backstop in the secondary market for gilts, the BoE’s QE purchases have played a role in helping to alleviate market dysfunction and reducing price volatility.”

⁷ Supporting research includes [“The Treasury Market in Spring 2020 and the Response of the Federal Reserve,”](#) Annette Vissing-Jorgensen, NBER Working Paper No. 29128, August 2021; [“The market stabilization role of central bank asset purchases: high-frequency evidence from the COVID-19 crisis,”](#) by Marco Bernardini and Annalisa De Nicola, Working paper 1310, Banca d’Italia, December, 2020; and “The Federal Reserve’s Market Functioning Purchases,” by Michael Fleming, Haoyang Liu, Rich Podjasek, and Jake Schurmeier, *Economic Policy Review*, Volume 28, pp. 210-241, July, 2022.

⁸ In his American Economic Association Presidential Address, [“The New Tools of Monetary Policy,”](#) Ben Bernanke addressed whether Large Scale Asset Purchases are merely effective for addressing short-term liquidity concerns, or also have impacts for monetary policy implementation through the commonly discussed portfolio-balancing channel, writing “A possible interpretation is that the initial [2008-2009] rounds of QE were particularly effective because they were introduced, and provided critical liquidity, in a period of exceptional dysfunction in financial markets.” In [“QE at the Bank of England: A perspective on its functioning and effectiveness,”](#) *Quarterly Bulletin*, Bank of England, May, 2022, Filippo Busetto, Matthieu Chavaz, Maren Froemel, Michael Joyce, Iryna Kaminska, and Jack Worlidge write: “In exceptionally stressed circumstances, when dealers’ capacity to intermediate trades is limited, large-scale asset purchases can improve wider market liquidity and mitigate the risk of a broader tightening in financial conditions that might disrupt the monetary transmission mechanism. The strength of this channel therefore depends on the degree of market dysfunction and the amount of gilts held by dealers.”

⁹ See Lena Boneva, Jakub Kastl, and Filip Zikes, [“Dealer balance sheets and bidding behavior in the UK QE reverse auctions,”](#) Working paper, Princeton University Economics Department, February, 2023.

An approach that works through a channel similar to that of market-function purchase programs would be flexible capital requirements. This could include lowering a countercyclical capital requirement or exempting government securities and central bank deposits from leverage-rule capital requirements. The latter was done by the Federal Reserve for a temporary period beginning in the Spring of 2020. The central bank can also provide additional backstop financing for government securities, thus reducing investor demands to sell. For example, since March 2020, the Federal Reserve has set up a [Standing Repo Facility](#) and a [Foreign and International Monetary Authority \(FIMA\) Repo Facility](#). In simultaneous related work, Buitier, Cecchetti, Dominguez, and Sánchez Serrano (2023)¹⁰ explore the complimentary roles of “lending and market making as a last resort.” In this paper, however, we focus on purchase programs rather than financing facilities.

As a stylized illustrative example, consider a sudden change in fundamental macroeconomic conditions that, in an efficient market, would cause ultimate investors to immediately trade an unusually large amount of Treasury securities of various specific issues with each other, and would cause yields to rise in the 10-year sector by about 2 basis points. Suppose that dealers’ regulatory capital requirements and internal risk limits leave dealers with the short-run capacity to hold roughly \$100 billion more of Treasury securities, say on a 10-year-duration-equivalent basis, after considering the new heightened level of yield volatility. In order to intermediate the large demand for new trades, however, given the time lags necessary to find ultimate buyers for specific issues and to settle trades, suppose that dealers would need to temporarily warehouse an additional \$200 billion of Treasuries, again on a 10-year duration-equivalent basis. But, in the short run, dealers have only about half of this needed balance-sheet capacity. Dealers therefore reduce the depth of their liquidity provision, quoting bid and offer prices in a manner that roughly exhausts their \$100 billion of available balance-sheet space. As a result, only about half of the efficient volume of trade is feasible in the short run, and yields rise substantially more than 2 basis points. The prices and liquidity of off-the-run -- and therefore harder-to-place -- issues are especially adversely affected. This generates an adverse feedback effect. Abnormally high price volatility, uncertainty concerning the attribution of yield changes to fundamental conditions versus market dysfunction, and an apparent lack of interest among dealers in purchasing additional assets could lead many investors to try to sell even more Treasuries and other assets, especially if they are forced to reduce their leverage in the face of margin calls. This exacerbates the shortfall in dealer intermediation capacity. The official sector can

¹⁰ See Willem Buitier, Stephen Cecchetti, Kathryn Dominguez, and Antonio Sánchez Serrano, “[Stabilising financial markets: lending and market making as a last resort](#),” Report of the Advisory Scientific Committee Number 13, European Systemic Risk Board, January, 2023.

respond by immediately purchasing at least \$100 billion of Treasuries from dealers, thus leaving more room on dealer balance sheets for intermediating additional trades. The official-sector purchases also restore confidence among intermediaries and market participants concerning the restoration of market functionality and the existence of a backstop demand. Restoration of market confidence can reduce the need for official purchases, but cannot be assumed under all circumstances, such as a “dash for cash.”

While highly over-simplified for illustrative purposes, this example motivates the role of market-function purchases, as distinct from quantitative easing. Even if dealers have the capacity to keep markets relatively liquid, the market for government securities can nevertheless be destabilized by fire sales.¹¹ Many ultimate buyers may be unable or reluctant to commit large amounts of capital on short notice. Price impacts could be large enough to cause a further unwinding of levered positions, potentially leading to an adverse feedback loop. As we have discussed, this seems to be roughly what happened in the UK gilt market in late September 2022, when the Bank of England’s gilt purchases stabilized the market.

In addition to the financial-stability benefits of market-function purchase programs at times like March-April 2020 and in the UK gilt market in September-October 2022, these programs generate additional benefits in normal times. The awareness by investors that market-function purchase programs stand ready to be activated in future crises adds to the safe-haven quality of government securities. Investors would treat this as a feature of these securities, which is therefore priced into primary-auction bids, lowering the cost to taxpayers for financing government expenditures. Other benefits of market-function purchase programs include improvements in the transparency of risk-free yields when market dysfunction could otherwise cloud the fundamental risk-free yield curve and unnecessarily raise uncertainty over the hedging quality and value of government securities. However, if purchases go beyond the level necessary to restore market functioning, for example to the point of “yield curve control,” the informativeness of market prices could be reduced.

An expectation of official-sector support for government securities markets under stress could induce some investors to take additional leverage in normal times or could reduce the impetus to improve the structural resilience of the market for government securities. Further, dealers may have reduced incentives to commit levels of market-making capital that are sufficient to handle stressed markets if it is understood that the

¹¹ In “[Asset Price Dynamics with Slow-Moving Capital](#),” by Darrell Duffie, *Journal of Finance* 2010, Volume 65, pp. 1238-1268, a model is presented in which bid-offer spreads are zero, but only a subset of investors are continually active in the market, while others may react with a delay. As a result, price impacts can significantly “overshoot” in response to supply shocks.

official sector will step in with its own capital. These moral-hazard concerns can and should be addressed with ongoing improvements in regulation and market design.¹² When the intermediation capacity of the market is ultimately impaired, however, the official sector will be better able to support market liquidity and financial stability if it has developed approaches to conducting asset purchases that are more effective in these special circumstances. The extent of moral hazard depends in part on the degree to which market-function purchase programs are understood and reflected in prior prices. It is therefore beneficial for the official sector in each jurisdiction to communicate its contingency plans for market-function purchase operations, whether by the central bank, the fiscal authority, or their coordinated action. It would be counterproductive and costly for taxpayers if investors were to collect a yield premium for bearing perceived market-dysfunction risk, with some investors even failing to insure themselves against crises by storing safe-haven stocks of Treasuries, and yet to have the official sector ultimately intervene in a crisis with purchases to restore market function. If market participants understand in advance the intention of the official sector to step in with these purchases in a future liquidity crisis, then that support will be reflected in lower Treasury issuance yields. Taxpayers will benefit correspondingly from reduced costs to fund the government and there will be an improved allocation of safe-haven stocks of Treasuries to those most benefiting from them.

To be weighed against these benefits are the associated price-impact costs of purchase programs that are ultimately borne by taxpayers. For example, fiscal buybacks incur price-impact costs for issuing and purchasing additional securities. Buybacks are implemented by debt management offices (DMOs) only when the net savings are viewed as sufficiently large.¹³

¹² See Interagency Working Group, "[Recent Disruptions and Potential Reforms In the US Treasury Market: A Staff Progress Report](#)," Interagency Working Group Staff Report, Washington DC., November, 2021; Interagency Working Group, "[Enhancing The Resilience Of The U.S. Treasury Market: 2022 Staff Progress Report](#)," Interagency Working Group Report, November, 2022; recent SEC proposals, including those addressing ATS and central clearing; G30 Working Group on Treasury Market Liquidity, "[U.S. Treasury Markets: Steps Toward Increased Resilience](#)," Group of 30, Washington, D.C., July, 2021; and Working Group on Treasury Market Liquidity Leadership Team, "[U.S. Treasury Markets: Steps Toward Increased Resilience Status Update 2022](#)," G30 Special Report, June, 2022.

¹³ For cost-benefit analyses of buybacks and surveys of DMO practices, see Hans Blommestein, Mehmet Emre Elmadag, and Jacob Wellendorph Ejsing, "[Buyback and Exchange Operations: Policies, Procedures and Practices among OECD Public Debt Managers](#)," OECD Working Papers on Sovereign Borrowing and Public Debt Management, Number 5, September, 2012, and OECD; "[Buybacks and exchanges](#)," in *OECD Sovereign Borrowing Outlook 2013*, OECD Publishing, Paris; Allison Holland, "[Report on bond exchanges and debt buybacks: A survey of practices by EC debt managers](#)," Debt Management Office, United Kingdom, 2001; and "[Bond buybacks and exchanges: Background note](#)," Government Bond Markets Advisory Services, World Bank, May, 2015.

In the end, some moral hazard associated with market-function purchase programs will remain unless these programs are coupled with improvements in market regulation and design that increase the resilience of the market and reduce the frequency of episodes of needed official-sector purchases.

3. Alternative purchase methods

We now describe and compare various market-function purchase methods, including the methods used in March-April 2020 by the Fed, Bank of England, Bank of Canada, Reserve Bank of Australia, and some Eurosystem national central banks. We will also outline some novel purchase protocols that are especially suggested by dysfunctional market conditions.

To implement open-market purchase operations, many central banks and fiscal authorities conduct reverse auctions of a specified total quantity of a given security or some specified sector of securities. In some jurisdictions, trades are negotiated bilaterally with dealers. For example, with the ECB's Pandemic Purchase Program, most purchases were conducted bilaterally with dealers.¹⁴ In a reverse auction, purchases are awarded to those bidders offering to sell at the highest yields (lowest prices). This quantity-based auction approach has been used in the Fed's Large-Scale Asset Purchase (LSAP) programs and in its purchases of Treasuries in response to the situation in March-April 2020.¹⁵ In an alternative price-based approach, a yield is announced and designated market participants are given the right to sell at that yield. This can be done on a full-allotment basis, as with "yield curve control," which is the approach taken in March 2020 by the Reserve Bank of Australia "to address market dislocations."¹⁶ The Bank of Japan has conducted yield-curve control on a routine basis.¹⁷

¹⁴ See Corey Runkel, "[Eurozone: Pandemic Emergency Purchase Program](#)," *Journal of Financial Crises: Volume 4* (2020), pages 1569-1600; and Felix Hammermann, Kieran Leonard, Stefano Nardelli, and Julian von Landesberger. "[Taking Stock of the Eurosystem's Asset Purchase Programme after the End of Net Asset Purchases](#)," *ECB Economic Bulletin*, March, 2019.

¹⁵ See Joseph Gagnon, Matthew Raskin, Julie Remache, and Brian Sack "[Large-Scale Asset Purchases by the Federal Reserve: Did They Work?](#)," Staff Report no. 441, Federal Reserve Bank of New York, March, 2010, and Brian Sack, "[Implementing the federal reserve's asset purchase program](#)," Remarks at Global Interdependence Center Central Banking Series Event. Federal Reserve Bank of Philadelphia, February, 2011.

¹⁶ See "[Statement by Philip Lowe, Governor: Monetary Policy Decision](#)," Number 2020-08, 19 March 2020. "A target for the yield on 3-year Australian Government bonds of around 0.25 per cent. This will be achieved through purchases of Government bonds in the secondary market. Purchases of Government bonds and semi-government securities across the yield curve will be conducted to help achieve this target as well as to address market dislocations."

¹⁷ See Bank of Japan, "[The 'Price Stability Target', under the Framework for the Conduct of Monetary Policy](#)," January 22, 2013, which was cited as the basis for its monetary policy as recently as 2023.

When market functionality is low, some securities may weigh especially heavily on the intermediation capacity of dealers, and thus trade at yields that are high relative to yield estimates that are based on the prices of similar but more liquid securities.¹⁸ An official-sector purchasing authority may not have as much real-time information as dealers about these bottlenecks when choosing the quantities of specific securities to purchase from dealers. Facing uncertainty about the quantity of each security to purchase, the official-sector purchaser can allow market participants to bid for the right to deliver the specific securities that they most want to remove from their inventories. Under these conditions, central banks and fiscal authorities often use a “multi-issue” auction that allows dealers to submit a simultaneous panel of offers to sell multiple different issues. The purchasing authority often uses discretion when choosing which offers to accept.

For example, faced with market dislocations in mid-March 2020, the Bank of Canada, initially acting as an agent for the Government of Canada, conducted reverse auctions in which it stood ready to purchase any of a posted list of securities in a given maturity sector, such as the 5-year sector or the 10-year sector.¹⁹ The auction format, which has been used by Bank of Canada to address shortfalls in market liquidity for off-the-run government securities since 1998,²⁰ is as follows:

1. The purchaser announces a list of specific issues within the maturity sector and the maximum total amount to be purchased, but not the amount of each issue to be purchased nor the purchaser’s reservation price for each security.
2. Dealers and customers of dealers submit offers. Each offer is for a specific issue on the list, stating a quantity and a price.
3. The purchaser chooses which offers to accept, with discretion across the different issues within the sector, and without necessarily buying the announced

¹⁸ An increase in the “noisiness” of yields relative to a smoothly fitted yield curve can be caused by imbalances in demands for liquidity in particular securities, and imperfect arbitrage. See Hu, Grace Xing, Jun Pan, and Jiang Wang “Noise as Information for Illiquidity,” *Journal of Finance*, Volume 68 (2013), pp. 2341-2382. In particular, yield-curve noise can be caused by constraints on the market’s intermediation capacity.

¹⁹ See Bank of Canada, “[Operational details for the upcoming Expansion of the Bank of Canada’s Bond Buyback Program](#),” March 18, 2020. The Bank of Canada discontinued purchasing as an agent for the government on March 27, and began purchases for its own balance sheet, writing: “the Bank will discontinue the Government’s repurchase operations (both cash and switch buybacks) and cash management bond buyback operations done as fiscal agent. The Bank’s secondary market purchases will provide significant support to the liquidity and efficiency of the government bond market, reducing the need for these fiscal agent operations. The Bank will announce specific operational details (including maturity sectors, timing, and the basket of eligible securities) ahead of each week’s operations through its regular Call for Tenders process. The Bank continues to monitor market developments closely and remains committed to supporting the liquidity and efficient functioning of the Government of Canada bond market.”

²⁰ See the most [recent tender format](#) used by Bank of Canada, and Toni Gravelle, “[Buying Back Government Bonds: Mechanics and Other Considerations](#),” Bank of Canada, Working paper 98-9, June, 1998.

maximum total amount. In effect, the purchaser applies a confidential reservation price for each issue.²¹ The prices awarded are those bid. In other words, this is a “discriminatory-price” auction.

The reverse auctions used by Federal Reserve for its large-scale asset purchases (LSAPs), by the Bank of England for its gilt reverse auctions, and by the central bank of the Netherlands (DNB) for its Pandemic Program Purchases, have formats similar to that used by the Bank of Canada. According to the terms of the DNB auctions, for example, “Offers will be allocated based on the attractiveness relative to a theoretical yield curve, which is fixed at the close of the offer collection period.”²² For example, if Dealer A posts an offer to sell security X at a yield 2 basis points above the estimated “theoretical” yield for security X, whereas Dealer B offers to sell security Y at a yield 3 basis points above the purchaser’s estimated yield for security Y, then the bid by Dealer B receives priority relative to the bid by Dealer A.

In its gilt QE reverse auctions, the Bank of England evaluates offers relative to yields prevailing in the secondary market shortly after the close of the auction. Offers are awarded according to the spreads between the offered yields on specific securities and the corresponding secondary market yields, ranked among all securities. Awardees are paid according to their offered yields, a multiple-price (also known as “discriminatory”) approach.²³ In Federal Reserve reverse auctions, “Propositions in FedTrade operations are evaluated based on their proximity to prevailing market prices at the close of the auction, as well as measures of relative value. Relative value measures are calculated using the Federal Reserve Bank of New York’s proprietary model.”²⁴

²¹ This auction format is related to that suggested by Paul Klemperer in [“The Product-Mix Auction: A New Auction Design for Differentiated Goods,”](#) *Journal of the European Economic Association*, Volume 8 (2010), pp. 526-536. In Klemperer’s design, “each bidder can make one or more bids, and *each* bid contains a *set* of mutually exclusive offers. Each offer specifies a price and a quantity of a specific ‘variety.’ The auctioneer looks at all the bids and then selects a price for each ‘variety.’ From each bid offered by each bidder, the auctioneer accepts (only) the offer that gives the bidder the greatest surplus at the selected prices, or no offer if all the offers would give the bidder negative surplus. All accepted offers for a variety pay the same (uniform) price for that variety.”

²² See De Nederlandsche Bank, [“Information on Reverse Auctions by DNB,”](#) May, 2020.

²³ For details on the gilt reverse auctions, see Lena Boneva, Jakub Kastl, and Filip Zikes, [“Dealer balance sheets and bidding behavior in the UK QE reverse auctions,”](#) Working paper, Princeton University Economics Department, February, 2023; Evangelos Benos and Filip Zikes, “Funding constraints and liquidity in two-tiered OTC markets,” *Journal of Financial Markets*, Volume 39 (2018), pp. 24-43; and Andrea Bicu-Lieb, Louisa Chen, and David Elliott, [“The leverage ratio and liquidity in the gilt and gilt repo markets,”](#) *Journal of Financial Markets*, Volume 48 (2020), forthcoming.

²⁴ See [“FAQs: Treasury Outright Operations,”](#) Federal Reserve Bank of New York, October 2022. For each of the 156 LSAP auctions conducted by the Fed in 2010 and 2011, the Fed announced a set of eligible securities, a minimum total purchase quantity, and a maximum total purchase quantity. Zhaogong Song and Haoxiang Zhu, “Quantitative Easing Auctions of Treasury bonds,” *Journal of Financial Economics*, Volume 128 (2018), pages 103-124.

By not revealing the purchaser's reservation prices for each security before the auction, the multi-issue reverse auction protocols used by the Bank of Canada, DNB, Bank of England, and Fed could generate "winners' curse" incentives that raise the total purchase cost.²⁵ Uncertainty regarding the purchaser's reservation prices of the auctioned assets can lead to more conservative bidding by less informed dealers. This is so because, conditional on the discovery that one's offer for one of the menu of securities has been accepted, one is relatively more likely to have undervalued that specific security. Song and Zhu (2018) provide empirical evidence that dealer informational asymmetries concerning the Fed's confidential fitted yield curve significantly increased the Fed's QE purchase costs.²⁶ We suspect that announcing the purchaser's estimated yields *before* the auction would, at least in some settings, increase the aggressiveness of offers and lower the official-sector purchase cost by reducing the winner's-curse effect associated with informational asymmetry across bidders regarding reservation prices. The reservation prices can be chosen based on market information available just before the auction, perhaps as little as an hour before. In a volatile market setting, prices can move appreciably even within an hour or two, conveying some option value from purchaser to sellers, but the prices offered in the auction would reflect the associated option value.

Separately, in comparison with the discriminatory (receive-your-own-offer-price) auction format used by Bank of Canada, DNB, Bank of England, and Fed, we anticipate that a uniform-price format might, in many situations, reduce the cost to the purchaser caused by strategic bid shading.²⁷ This is so because an auction participant may bid less aggressively if paid the price that it asks, relative to an auction in which it is paid the highest price awarded. The winner's curse and bid-shading effects that we have

²⁵Related to this point, See Bo Young Chang, Jun Yang, and Parker Liu, "[The Cost of the Government Buyback and Switch Programs in Canada](#)," Staff Analytical Note 2018-41, Bank of Canada, 2018. The authors write: "The call for tender specifies the maximum value of bonds that will be repurchased, but not the value of each bond to be repurchased. This allows the Bank to pick and choose among eligible bonds. The specifications for repurchase and multiple eligible bonds introduce greater uncertainty to dealers in determining the likelihood of their offers being accepted."

²⁶ See Zhaogong Song and Haoxiang Zhu, "Quantitative Easing Auctions of Treasury bonds," *Journal of Financial Economics*, Volume 128 (2018), pages 103-124. The authors find that "From November 2010 to September 2011, a one standard deviation increase in the cheapness of a Treasury bond (how much the market price of the bond is below a model-implied value) increases the Fed's purchase quantity of that bond by 276 million and increases the auction costs on that bond by 2.6 cents per \$100 par value, controlling for standard covariates. Our results suggest that the Fed harvests gains from trades by purchasing undervalued bonds, but strategic dealers extract some profits because the Fed's relative values can be partly inferred from price data."

²⁷ See, for example, Kjell Nyborg and Suresh Sundaresan, "Discriminatory versus uniform treasury auctions: Evidence from when-issued transactions," *Journal of Financial Economics*, Volume 42 (1996), Pages 63-104. However, there is no theory supporting the superiority of the uniform-price format for multi-unit auctions, and the supposed advantages of this format are questioned by Ken Binmore and Joe Swierzbinski in "Treasury auctions: Uniform or Discriminatory?" *Review of Economic Design*, Volume 5 (2000), pages 387-410.

described may suggest the following “delivery-choice” reverse-auction design for market-function purchase programs.

We first illustrate with an example in which the official-sector purchaser announces a reverse auction in the 5-year sector, covering a menu of government securities with maturities ranging from 4 to 6 years. The purchasing authority first announces the maximum total quantity of securities to be purchased in this sector and an estimated yield for each security in the sector. The yield estimates can be obtained by fitting a smooth discount function to recent observed transaction prices, after adjusting for security-specific effects such as on-the-run premia and repo specials.²⁸ The purchasing authority then collects offers from bidders. Each offer consists of a yield spread s and a quantity q of securities. The spread must be at least as high as the purchaser’s announced reservation spread r , which mitigates the cost to the purchaser of adverse selection (“over-paying”), while not being set so high that the quantity of purchases is too small. The offers are not for specific securities. If an offer of quantity q at a spread s is accepted by the purchaser, the bidder has the right to sell a total principal amount q of *any securities on the menu*. The sellers must communicate their chosen selection of securities by a specified time after the auction. The price they receive for each specific security is that implied by the sum of the purchaser’s announced yield estimate for that security and the stop-out spread, which is the lowest awarded spread offered. The rules of this “delivery-choice” auction are more formally described in an appendix.

For example, suppose the official-sector purchaser auctions rights to sell up to \$100 billion of securities in the 4-to-6-year sector at yields that are at least 1 basis point above the announced fitted yield curve. Suppose the stop-out spread is 2 basis points. An offer of \$5 billion at a spread of 2.5 basis points would therefore be accepted. The seller who submitted this offer might prefer, given its inventories of the various securities, to deliver \$5 billion of a specific off-the-run 5-year note, whose announced fitted yield is 2.55%. The seller would in that case receive cash for the note in the amount implied by a yield of $255 + 2 = 257$ basis points. Alternatively, the seller might instead choose to deliver \$3 billion of 4-year notes, being compensated at a yield of 2 basis points over the

²⁸ A smooth yield curve can be estimated from observed recent transaction prices by various approaches, such as a spline, after adjusting for bid-offer spreads, on-the-run premia, and repo specialness. An interesting alternative approach suggested by an early reader of this paper is to allow awardees the option to deliver any security in the sector, and to be paid at the purchase price for that security implied by a yield equal to the sum of the yield of the benchmark (on-the-run) security and the auction’s stop-out spread, with formulaic pre-set adjustments for differences in duration and convexity between the delivered security and the benchmark security. As with the delivery-choice auction format that we have described, an offer is simply a quantity and spread, allowing a uniform-price approach and delivery-choice options.

announced fitted yield of the 4-year note, and \$2 billion of the off-the-run 5-year notes, being paid at a yield 2 basis points over the fitted yield of that note.

When addressing market dysfunction caused by securities inventories that clog up dealer balance sheets, a key advantage of this delivery-choice auction design is that each dealer values the optionality of selecting for sale those specific securities that it holds in greatest excess at the time of settlement. The dealer is willing to pay for this delivery option and bids accordingly. In a period of low market functionality, including weak interdealer market liquidity, this optionality is likely to generate a faster and more efficient reallocation of securities from market participants to the official-sector purchasing authority, who has no specific-security inventory concerns within the sector and may be less aware of which securities are most problematic for the inventories of specific market participants. This is consistent with the empirical findings of Song and Zhu (2018),²⁹ who find that the LSAP auctions of 2010-2011 were effective at generating purchases by the Fed of relatively greater amounts of those securities that were relatively cheap in comparison with fitted yields.

In summary, the delivery-choice uniform-price auction format that we have described has several advantages. First, as with many existing forms of central-bank reverse auctions, the purchaser does not need to estimate and fix in advance the quantities of specific securities to purchase. Setting these quantities in advance is especially challenging when the dysfunctionality of markets has generated an inefficient allocation of specific securities across market participants. Instead, the auction itself *reveals* the quantities of each of the respective securities that market participants prefer to remove from their inventories. Even the total sectoral quantity to be purchased can be left open by taking a full-allotment approach and setting a reservation price on the delivery option. Second, and as opposed to protocols used in the past by the Bank of Canada, DNB, and Fed for multi-issue reverse auctions, the delivery-choice auction that we have described may lower the cost to the purchaser associated with the winner's curse by revealing the purchaser's estimated prices for each security in advance of the auction, thus reducing informational asymmetries across bidders.³⁰ Finally, relative to

²⁹ Song and Zhu find that “purchase quantities are significantly higher for cheaper bonds. Controlling for all else, a one standard deviation increase in a bond's cheapness in any auction [of about 23 basis points (bps)] increases the Fed's purchase of that bond in that auction by about \$276 million in par value. This is a large magnitude, as the average purchase size of any bond in any QE auction is about \$410 million.”

³⁰ Somewhat analogous to the delivery-choice auction approach that we have described, in its exchange auctions Italy's Department of the Treasury announces fixed prices for each of the old securities that it will purchase in exchange for new bonds. Primary dealers can then submit up to five bids for the new bonds in exchange for any of the old bonds on the menu, at exchange rates determined by the dealer's bid price for the new bond and the Treasury's previously announced prices for the old bonds. As opposed to the delivery-choice auction, the Italian Treasury thus uses a “discriminatory” price auction rather than the uniform-price format we have suggested. See

conventional discriminatory-price reverse auctions, the uniform-price aspect of the delivery-choice auction may reduce the cost to the purchaser caused by strategic bid shading. Instead of receiving the price implied by its own offered yield spread, a participant is given the incentive to offer to sell at relatively higher yield spreads, given the knowledge that the seller will actually be paid based on the stop-out yield spread, which is likely to be lower and typically not impacted by a marginal reduction in the seller's offer price. Although there is no clear supporting theory, the evidence for standard US Treasury primary-market issuance auctions somewhat supports the uniform-price format.³¹

The suggested cost advantages to the purchaser of the uniform-price delivery-choice auction is reduced, or could even disappear, to the extent that some bidders are able to acquire more information than other bidders about the value of the delivery option. For example, suppose it is common knowledge that Dealer A is likely to gather more information than other bidders, after the purchaser's fitted yields are announced, concerning which securities (if any) are over-valued by the purchaser. In a scenario in which the value of the delivery option is discovered by Dealer A to be high, A can bid more aggressively to acquire the right to deliver at the relatively low stop-out yield spread. Uncertainty among less informed dealers regarding this potential outcome causes an adverse-selection cost to less informed bidders, who correspondingly make less aggressive price offers. The purchaser can end up paying an unnecessarily high price to A, relative to the case of a discriminatory auction format in which each participant sells at its own offer price. The purchaser can guard against this high-cost outcome by setting a high reservation spread for the delivery option, but this reduces the quantity of securities sold, contrary to the objective of expanding the balance sheet space available to intermediaries. Another potential setting in which the uniform-price format raises purchase costs is one in which, despite the absence of private information, some bidders can simply extract more private value from the delivery option than other bidders. For example, suppose Dealer A is more able than other dealers to acquire more of the cheapest-to-deliver securities between the time of the auction announcement and the time at which securities must be delivered to the purchaser. In this case, Dealer A

"Liability management operations: Instruments and operational aspects," presentation at the Department of the Treasury, Ministry of Economy and Finance, Italy, February, 2022.

³¹ See Paul Malvey, Christine Archibald, and Sean Flynn, "[Uniform-Price Auctions: Evaluation of the Treasury Experience](#)," Office Of Market Finance, US Treasury, October, 1995; Paul Malvey and Christine Archibald, "[Uniform Price Auctions: Update the Treasury Experience](#)," Office Of Market Finance, US Treasury, October, 1998. See also "Kjell Nyborg and Suresh Sundaresan, "Discriminatory versus Uniform Treasury Auctions: Evidence from When-Issued Transactions," *Journal of Financial Economics*, Volume 42 (1996), pp. 63-104.

would bid more aggressively in a discriminatory-price auction, which would lower the purchaser's cost.³²

Overall, the delivery-choice auction approach that we have described may not be appropriate for all jurisdictions or for every episode of market dislocation. Officials might choose the protocols that have been adopted by the Bank of Canada, DNB, and Fed, or an even simpler pricing approach. One such simple approach would be a facility that makes full-allotment purchases at a fixed reservation spread (by segment or single security) to a published yield curve, similarly with the approach taken in 2020 by the Reserve Bank of Australia. Alternatively, depending on the circumstances, the official purchaser could apply a "quantity-step" operation. For example, officials could select a reservation price or spread to a published yield curve with an allotment that includes some quantity increment per day, per week, or per month. Under such a step-based scheme, a quantity step could be under-subscribed or over-subscribed. The results of past operations could be used to guide the sequential setting of quantity step sizes.

4. Starting, stopping, and unwinding market-function purchase programs

If the policy for commencing market-function purchases is transparent, then market participants can more accurately evaluate the benefits of the future availability of the program when they initially determine the prices at which they are willing to buy the securities. However, instigating market-function purchases based on specific quantitative thresholds for publicly observable illiquidity metrics could generate anticipatory strategic behavior by market participants who aim to profit from front-running the purchase program.

Nevertheless, levels of quantitative measures of market illiquidity can guide the commencement of purchases. Among such traditional indicators are bid-offer spread, market depth, price impact, price dispersion,³³ and the on-the-run premium. An additional measure of Treasury market illiquidity that is increasingly used by practitioners is yield-curve fitting noise, sometimes called root mean squared error (RMSE).³⁴ In research to appear, Duffie, Fleming, Keane, Shachar, and Van Tassel (2023)

³² This is analogous, in the context of an auction of a single object, to a situation analyzed by Eric Maskin and John Riley in "Asymmetric Auctions," *Review of Economic Studies*, Volume 67 (2000), pages 413-438.

³³ Price dispersion is the sample standard deviation of the sample of different yields at which the same security was traded on the same day between different pairs of counterparties, after adjusting for bid-offer spreads and for variation of benchmark yields within the day. In a perfectly liquid market, price dispersion is zero.

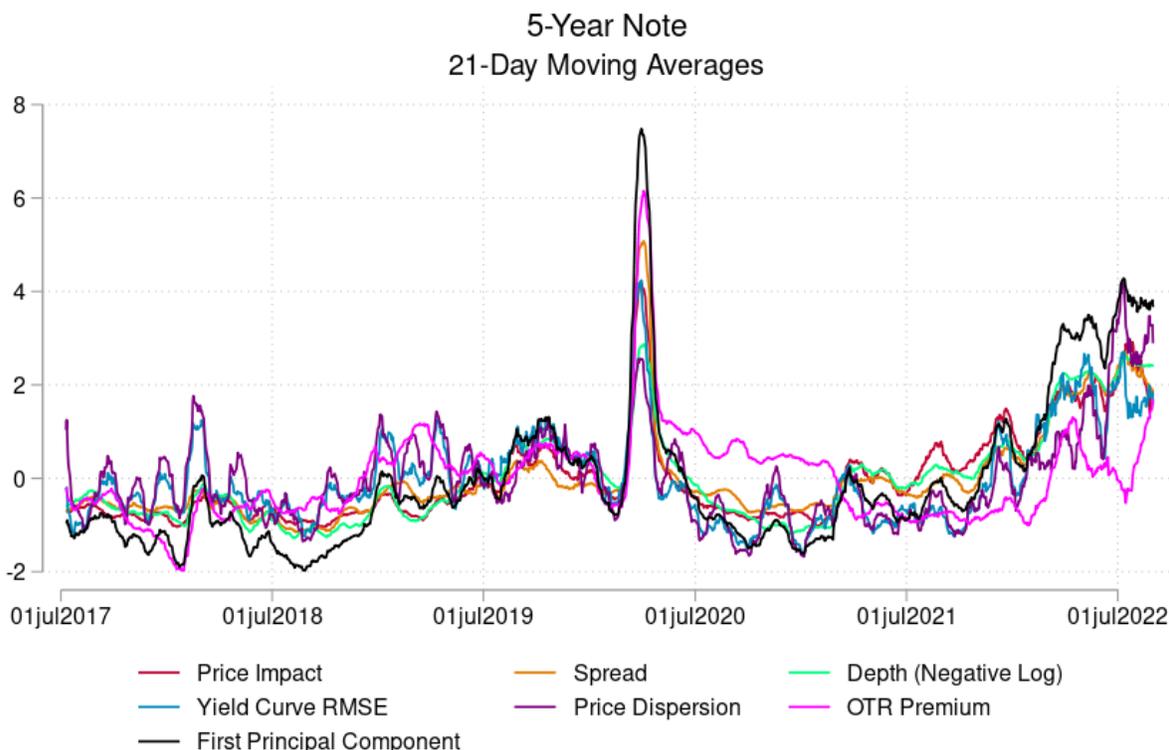
³⁴ RMSE is the sample standard deviation of the differences between observed yields and yields that are estimated from a smooth discount function. Hu, Grace Xing, Jun Pan, and Jiang Wang developed a slight variant in "Noise as Information for Illiquidity," *Journal of Finance*, Volume 68 (2013), pp. 2341-2382. Appendix Figure 4, shows that in

find that while these various measures of Treasury market illiquidity capture different aspects of market liquidity, they are positively correlated. They reach high levels — implying market dysfunction or vulnerability to its onset --- in close step with each other, as shown in Figure 1. The figure shows time series of the z-scores of these metrics (that is, with normalization of each measure to a sample mean of 0 and a sample variance of 1). The first principal component of these plotted z-scores, also shown in Figure 1, places significant positive weight on all of these illiquidity measures, a sign that they each contribute usefully to an overall gauge of market illiquidity, even after controlling for the others.³⁵

March 2020, RMSE in the 4-to-6-year segment of the US Treasury yield curve in March 2020 was roughly 3 basis points, about triple its normal prior level. Figure 3 shows the fitting errors that determined RMSE when it peaked on March 19, 2020.

³⁵ See also Michael Fleming, "[Measuring Treasury Market Liquidity](#)," *FRBNY Economic Policy Review*, September, 2003, pp. 83-108; and Tobias Adrian, [Michael Fleming](#), and Erik Vogt, "[The Evolution of Treasury Market Liquidity: Evidence from 30 Years of Limit Order Book Data](#)," Staff Report 827, Federal Reserve Bank of New York, Revised January 2023.

Figure 1. Z-scores of market illiquidity measures, and their first principal component, for the five-year sector of US Treasuries, for the sample period July 15, 2017 to October 22, 2022. The measures shown are bid-offer spread, market depth, price impact, price dispersion, on-the-run premium, and root-mean-squared error of yields in the five-year sector relative to smoothly fitted yields.³⁶ Also shown, in black, is the first principal component of the z-scores. Figure source: Duffie, Fleming, Keane, Shachar, and Van Tassel (2023).



Duffie, Fleming, Keane, Shachar, and Van Tassel (2023) find that most of these measures of Treasury market illiquidity are reasonably well explained in normal times by the market-implied price volatility of the underlying Treasury securities. However, during episodes of market dysfunction such as March-April 2020, significant additional explanation is provided by measures of dealer balance-sheet utilization. This finding is consistent with the benefits that we propose here for a market-function purchase program, which would reduce the quantity of government securities held by dealers so that they can offer further intermediation to the market.

An effective market-function purchase program also calls for a transparent and timely exit policy, again based on quantitative measures of market liquidity. Without transparent exit criteria, it would be more difficult to communicate a clear distinction between market function purchases and quantitative easing. Market participants would

³⁶These calculations are based on zero-coupon yields fitted by Damir Filipovic, Markus Pelger, and Ye Ye “[Stripping the Discount Curve – a Robust Machine Learning Approach](#),” Swiss Finance Institute paper 22-24, August 2022.

also be less able to price the value of the market-purchase program into their initial investment decisions. A low degree of transparency regarding the exit criteria could also increase the uncertainty facing market participants when market conditions are already stressed. For example, the same quantitative measures that inform a commencement of market-function purchases could also guide the cessation of purchases, although the thresholds for starting and stopping would differ in order to avoid frequent re-starts of purchasing.

Depending on the circumstances, an announced fixed purchasing period could raise time-consistency concerns and exacerbate illiquidity if markets remain fragile as the pre-set end of the purchasing period. In other cases, however, setting a deadline for the cessation of purchases—as done by Bank of England in September 2022³⁷--can motivate market participants to more quickly improve the liquidity of their balance sheets and has the benefit of clearly distinguishing market-function purchases from monetary policy QE purchase programs, which are longer running. Similar considerations apply to the timing for reducing holdings of the purchased securities through sales, for the case of central-bank purchase.

A related transparency consideration is post-operation reporting. Transparency is improved if market-function asset purchases by a central bank are disclosed in a manner that clarifies their distinct nature. This added transparency increases accountability and is consistent with the relatively temporary nature of market-function interventions.

Official-sector purchasers will eventually want to choose between a stance of high transparency, by announcing the existence of a standing facility with stated start and stop criteria, or the alternative stance of keeping market-function purchases “in the pocket,” with the possible objective of generating “constructive ambiguity” among market participants. While we have given arguments supporting a transparent approach, we recognize that each fiscal authority and central bank must decide based on its own situation. Moral hazard considerations surrounding this choice will likely evolve, given ongoing regulatory actions and market-design improvements.

³⁷ See Andrew Hauser “[Thirteen Days in October: How Central Bank Balance Sheets Can Support Monetary and Financial Stability](#),” Speech given at the ECB’s 2022 Conference on Money Markets, November 4, 2022.

5. Intervention by fiscal or monetary authorities?

Historically, both central banks and fiscal authorities have addressed sovereign bond market functionality by conducting asset purchases.³⁸ For example, in September 1939, at the outbreak of World War II, the Federal Reserve supported the market for US Treasury securities when it became dysfunctional.³⁹ In 1965, Federal Reserve Board staff wrote to the Federal Open Market Committee (FOMC) concerning “an approach that might be taken by the Federal Reserve and the Treasury to insure an orderly adjustment of prices and yields in the Government securities market ... through the purchase of intermediate and long-term bonds.”⁴⁰ The staff continued: “Fundamentally, both agencies would seem to be interested in the same final objective--the preservation of a viable capital market, which is free to respond to the interplay of market forces and the influence of broad monetary and fiscal policy actions.”

Recent developments in monetary-policy tools and fiscal-agent liquidity practices provide new context when considering whether asset purchases to restore market function are better conducted on behalf of the fiscal authority, typically with the central bank acting as its fiscal agent, or by the central bank acting for its own balance sheet. The answer may vary across countries and across market conditions. Our discussion is meant to be general and not specific to a national jurisdiction. Examples based on the setting of the US Treasury market are intended to illustrate some specific points.⁴¹

Central banks have macroeconomic mandates such as price stability and, in some cases, maximum sustainable employment. The responsibilities of fiscal authorities include funding debt at lowest cost, over time. The central bank and the fiscal authority both

³⁸ In a survey of practices, the World Bank comments that, among other objectives, “Bond buybacks and exchanges can contribute to stabilizing the market during periods of stress by restoring price transparency.” See “[Bond buybacks and exchanges: Background note](#),” Government Bond Markets Advisory Services, World Bank, May, 2015. Here, the World Bank writes that “During periods of stress, liquidity has to be reallocated between instruments and funding sources. Turkey provided an illustration in June 2001. The DMO exchanged \$8 billion short-dated nominal domestic debt into dollar-indexed lira debt or floating-rate lira debt. This had the effect of simultaneously reducing a liquidity overhang in the domestic market and removing net currency exposure in the banking system.”

³⁹ For more details on the US historical context, including the 1939 episode and other historical instances of market-function support by the Federal Reserve of the US Treasury market, see Kenneth Garbade, *After the Accord: A History of Federal Reserve Open Market Operations, the U.S. Government Securities market, and Treasury Debt Management from 1951 to 1979*, Cambridge University Press, 2021.

⁴⁰ See “[Contingency Planning for the Government Securities Market](#),” Memo to the Federal Open Market Committee from the Staff, August 31, 1965, authorized for public release by the FOMC Secretariat on April 17, 2020.

⁴¹ For research on Treasury buybacks, see Merrick, John. 2005. “Tracking the U.S. Treasury: Footprints from the Treasury’s Buy-Back Program.” *Journal of Fixed Income*, Volume 15, no. 2 (September): pages 37-50; and Han, Bing, Francis Longstaff, and Craig Merrill. 2007. “The US Treasury Buyback Auctions: The Cost of Retiring Illiquid Bonds.” *Journal of Finance* Volume 62, pages 2673-2693.

have a strong interest in the functionality of their sovereign bond market. Central banks wish to safeguard the efficacy of monetary policy transmission. Fiscal authorities have a clear interest in lowering the interest rate paid on their debt issuances by enhancing the liquidity and safe-haven status of their debt securities. To act as a safe haven, sovereign bonds must not only have low default risk, they must also be saleable in liquid secondary markets, especially when financial market conditions are otherwise stressed. For example, some central banks hold significant stocks of US Treasuries in their foreign exchange reserves because, in future emergencies, they are able to sell large quantities of Treasuries without large price impacts and delays.

A consideration that favors having market-function purchase programs conducted by the fiscal authority is the extra protection afforded to central bank independence. A fiscal authority's market-function purchase program can be viewed as a form of liquidity insurance that has limited impact on the central bank's monetary policy stance, thus reducing questions of fiscal or financial dominance that might be raised by the alternative of central-bank purchases. This protection of central bank independence would be especially valuable if market dysfunction arises when the monetary policy stance is set to neutral or restrictive.

Fiscal-authority purchases that are funded with cash could, however, temporarily impact central bank reserves, given the necessary fluctuations in the government's cash balances at the central bank associated with any timing differences between payment for repurchased securities and new debt issuance. Nevertheless, these impacts on the central bank can be brief, as explained in the next section, and their incidental nature avoids any significant impingement on the central bank's monetary policy stance.

Related to the approach of having market-function purchases conducted directly on the fiscal account, a central bank can be indemnified by the fiscal authorities for the associated gains and losses. For example, when the Bank of England purchased gilts to address severe market disruptions in September 2022,⁴² it was explicitly indemnified in advance by the UK government for the associated gains and losses, with the stated intent of supporting the independence of the central bank.⁴³ Indemnification, however, implies a degree of coordination between the fiscal and monetary authorities that could,

⁴² See Andrew Hauser "[Thirteen Days in October: How Central Bank Balance Sheets Can Support Monetary and Financial Stability](#)," Speech given at the ECB's 2022 Conference on Money Markets, November 4, 2022.

⁴³ See the [letter of March 19, 2020, from Bank of England Governor Andrew Bailey to UK Chancellor of the Exchequer Rishi Sunak](#) and "[Bank of England Announces Gilt Market Operations](#)," Press Release, Bank of England, September 28, 2022; "[HMT response to Bank of England financial stability intervention](#)," HM Treasury, September 28, 2022, in which HM Treasury wrote: "To enable the Bank to conduct this financial stability intervention, this operation has been fully indemnified by HM Treasury. The Chancellor is committed to the Bank of England's independence."

in some jurisdictions, cut against independence of the central bank. In the end, it may be difficult to avoid some degree of coordination. Whether or not indemnification by a fiscal authority of market-function purchases by the central bank is useful or reliable may vary across jurisdictions. Tucker (2018) writes that “a degree of explicit cooperation and coordination is unavoidable if overall policy is to be coherent,” and “Suspensions are more readily assuaged if the need for coordination with government has been countenanced and telegraphed in advance.”⁴⁴ In some jurisdictions, indemnification related to asset purchases is implicit because profits and losses from central bank operations are remunerated to the fiscal account.

When asset purchases are done by the central bank, communicating the distinction between monetary-policy and market-function purchase programs can be improved with designs of the purchase programs that are distinct and transparently adapted to the setting. Market-function purchases that cannot be clearly distinguished by market participants from quantitative-easing purchases could cloud forward guidance of monetary policy. A market-function purchase program with a price-based design and with clear market-function asset-purchase start and stop criteria, as described in previous sections, provides better transparency and separation from monetary policy actions, without limiting those actions, and also might lessen the needed quantity of market functioning purchases.⁴⁵

Communicating the distinction between purchases to support market functioning and purchases to provide monetary accommodation by having the fiscal authority conduct market functioning-purchases is consistent with the natural objective of the fiscal authority to issue debt in ways that attract investor demand. In some crises, however, there can be a priority to focus fiscal resources toward other objectives, so that use of the central bank balance sheet may be unavoidable.

The distinction between monetary-policy operations and market-function programs could also be clarified if the assets purchased in a market-function program are transparently designated for liquidation once market functionality is sufficiently restored. Market-function asset purchases would naturally be expected to remain on the central bank’s balance sheet for a shorter holding period than quantitative-easing purchases. This implies that a central bank is likely to face consequential decisions over the timing and method of unwinding its market-function purchases. A shorter holding

⁴⁴ See Paul Tucker, *Unelected Power*, Princeton University Press, 2018, Princeton, New Jersey, page 493.

⁴⁵ Distinctions between the Bank of England’s “financial-stability purchases” in October 2022 and “monetary-policy purchases” are listed in Table 1 of Andrew Hauser, “[Thirteen Days in October: How Central Bank Balance Sheets Can Support Monetary and Financial Stability](#),” Speech given at the ECB’s 2022 Conference on Money Markets, November 4, 2022. This table draws distinctions based on “purpose and governance,” “duration of purchases and exit plan,” “asset selection,” and “pricing.”

period would usually require sales of at least some of the purchased assets. The central bank would need to time and size these sales in a way that balances the resulting impacts on the secondary market against the benefits of unwinding the position in a manner that, in some cases, must incorporate tradeoffs with monetary-policy objectives. In this respect, a fiscal authority has the relatively advantageous option, when exiting a program of market-function buybacks, of avoiding asset sales and simply allowing a return to its target WAM over time through regular and predictable issuances.⁴⁶ This is not to suggest that market-function purchases impose no disruption at all to fiscal debt management, however a fiscal authority does not face the central bank's tradeoffs involving monetary-policy objectives.

Beyond the specific advantages of having market-function purchases conducted by the fiscal authority instead of the central bank, having both prepared to step in with market functioning purchases, depending on circumstances, provides greater robustness than having either alone. In any case, there should be advance clarity regarding which authority is responsible for market-function purchases, or whether there will a coordinated joint approach, depending on the contingencies.

6. Funding purchases by the fiscal authority

Asset purchases conducted by the fiscal authority, often called "buybacks," can be funded by the government with a combination of new debt issuances and cash balances held at the central bank. For example, the central bank deposit account of the US government is the Treasury General Account (TGA). In some circumstances, however, limits to a fiscal authority's immediate borrowing capacity rule out reliance solely on the fiscal authority to conduct market functioning asset purchases.

When funding market-function buybacks with new liabilities, a fiscal authority would naturally use short-dated bills because these impose relatively less risk on the balance sheets of market participants than longer-maturity securities. This could be critical when many market participants are trying to shed duration risk from their balance sheets. When a fiscal authority conducts buybacks by issuing shorter term liabilities such as short-maturity bills, the weighted average maturity (WAM) of its debt would initially go down. The WAM would subsequently return toward a longer-run target as market function is restored and normal issuance patterns resume.⁴⁷ This is typical

⁴⁶ For example, see Kenneth Garbade, "[The Emergence of 'Regular and Predictable' as a Debt-Management Strategy](#)," *FRBNY Economic Policy Review*, March 2007, pp. 53-70.

⁴⁷ Whether a fiscal authority increases bill issuance to fund a buyback or issues new benchmark securities of similar maturity to the securities being bought back would depend on the circumstances at the time of the market dysfunction. From the viewpoint of the consolidated liabilities of the government and central bank, funding a buyback with short-dated bill issuance is a close substitute for central-bank purchases funded with reserves.

practice for debt managers when fiscal needs surge – they tend to immediately increase bill issuance and gradually replace bills over time with issuance across the curve.

Alternatively, the fiscal authority could conduct “switch auctions,” by which seasoned securities are sold by market participants in exchange for new on-the-run securities. Switch auctions are used by many fiscal debt management offices (DMOs) to improve the average liquidity of their outstanding issuances and to manage uneven funding requirements.⁴⁸ Switch auctions have occasionally been used by the Government of Canada to address market-functionality.⁴⁹ Switch auctions are relatively cost-efficient, given the typical on-the-run premium for benchmark securities relative to off-the-on issues and given that this premium increases in stressed market conditions. In other cases, however, dealer balance sheets can be more quickly “unclogged” if the purchased securities are exchanged for cash rather than government securities.

If a fiscal authority has insufficient deposits at the central bank to pay for the asset purchases, the central bank could in principle—if the necessary legal authority exists—finance the securities purchased by the fiscal authority with central bank deposits. In some jurisdictions, such a direct funding of a fiscal authority asset-purchase operation would be outside of the legislative remit of the central bank, or may raise concerns with respect to the independence of the central bank if not clearly circumscribed. Under this approach, a central bank could participate in the following joint operation: the fiscal authority conducts purchases of government securities from market participants. These purchases are settled on the next day with reserves generated by immediate repo financing provided by the central bank.⁵⁰ This would be secured financing, with an open-ended available quantity, given the central bank’s unlimited capacity to issue reserves. It could be done smoothly, in an operational sense, at a repo rate that is set administratively, like that for FIMA and the Standing Repo Facility (SRF) in the United States. Repos between the central bank and the fiscal authority could be rolled for as long as is necessary for the fiscal agent to issue debt.

⁴⁸ For surveys, see Hans Blommestein, Mehmet Emre Elmadag, and Jacob Wellendorph Ejsing, “[Buyback and Exchange Operations: Policies, Procedures and Practices among OECD Public Debt Managers](#),” OECD Working Papers on Sovereign Borrowing and Public Debt Management, Number 5, September, 2012, and OECD; “[Buybacks and exchanges](#),” in *OECD Sovereign Borrowing Outlook 2013*, OECD Publishing, Paris; Allison Holland, “[Report on bond exchanges and debt buybacks: A survey of practices by EC debt managers](#),” Debt Management Office, United Kingdom, 2001; and “[Bond buybacks and exchanges: Background note](#),” Government Bond Markets Advisory Services, World Bank, May, 2015.

⁴⁹ See Toni Gravelle, “[Buying Back Government Bonds: Mechanics and Other Considerations](#),” Bank of Canada, Working paper 98-9, June 1998, and Bank of Canada, [Operational details for the upcoming Expansion of the Bank of Canada’s Bond Buyback Program](#), March 18, 2020.

⁵⁰ If repo transactions are outside its legal remit a central bank might also consider providing overnight cash to the fiscal authority through a securities loan secured financing.

Yet another funding approach for the fiscal authority is to maintain a precautionary stock of central bank deposit balances. After the Global Financial Crisis of 2008-2009, some fiscal authorities, along with a range of market participants, enhanced their liquidity profiles. For instance, as shown in Figure 2, since 2015 the US Treasury has held a sizable liquidity buffer in the TGA to mitigate the risk of auction failure or more generally to cover any temporary inability to tap the Treasury market for funds.⁵¹

Would such relatively new sources of fiscal liquidity make it more plausible that market-function purchase programs could be conducted for the account of the government rather than the central bank? Are there some market conditions which limit the scope for fiscal action? Under what conditions might fiscal authorities alternatively choose to conduct market-function purchases funded with short term bills, or with “switch auctions” that replace seasoned issues with more liquid on-the-run issues? Yet other liquidity resources may be available to a fiscal authority. For instance, the US fiscal authority has at times reacted to debt-ceiling constraints with “special measures” to address its liquidity needs. Are there any similar measures that provide additional temporary liquidity for a market-function purchase operation, or as a liquidity bridge until debt issuance can, over time, cover the needed funding? These various questions deserve additional analysis.

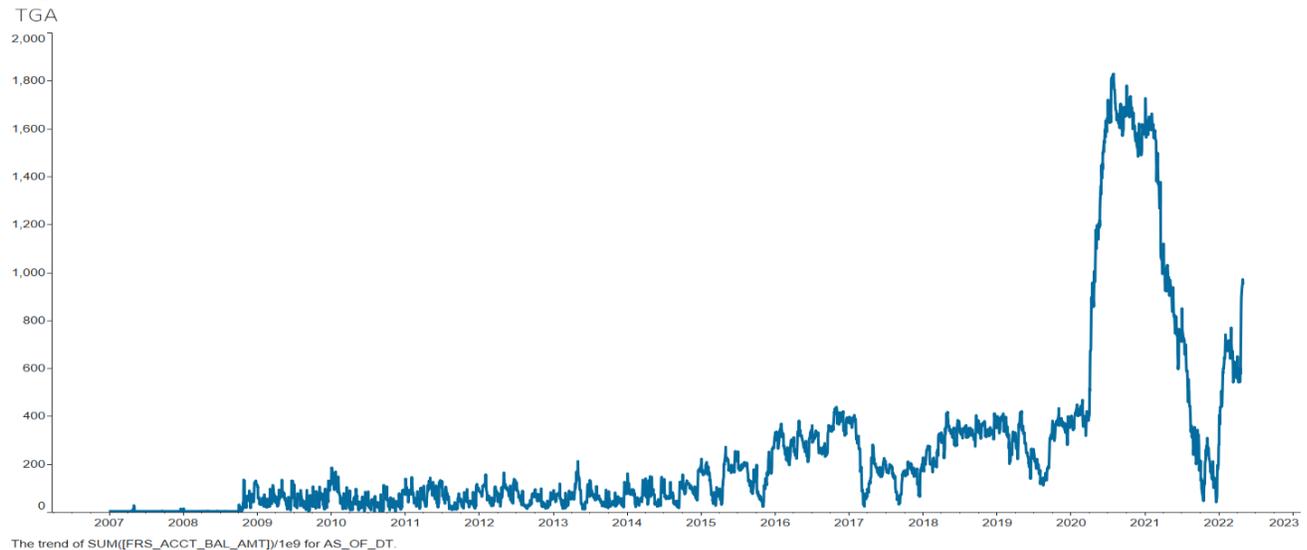
Using the government’s deposits at the central bank to fund buybacks has the same effect on bank reserve balances as central bank asset purchases – both add a dollar of bank reserves per dollar of assets purchased. The difference is that a central bank’s ability to increase reserves is unlimited, whereas the fiscal authority is cash-constrained by the speed with which it can replenish its central bank deposits.⁵² The potential speed

⁵¹ The Treasury’s TGA cash position at the Federal Reserve targets five days of expected government expenditures. In practice, the TGA balance has not been precisely limited to cover 5-days of government expenditures; it has often been above and sometimes below this aspirational level (low TGA balances are rare and related to an approaching debt ceiling event). This is least an additional intraday liquidity that fiscal authorities did not have prior to 2015 and it might also be considered as a potential bridge for temporary funding mismatches. For example, it might bridge a short mismatch in settlement of new bill issuance and the settlement of an emergency buyback with TGA drawn downs quickly replenished with new issuance proceeds.

⁵² The flow effects through the TGA on the central bank’s balance sheet give the fiscal authority influence on the aggregate level of bank reserves, which a central bank can offset or let stand. Action by a fiscal authority that changes the amount of bank reserves in the system is not without precedent. In 2008, with the US central bank operating under a scarce-reserves monetary policy framework, the Treasury established the temporary Supplemental Financing Program (SFP) to drain reserves after emergency lending by the central bank sharply increased the supply of reserves. See [Statement Regarding Supplementary Financing Program - FEDERAL RESERVE BANK of NEW YORK \(newyorkfed.org\)](https://www.federalreserve.gov/newswatch/2008/081108.htm) Without this action by the fiscal authority to drain reserves, monetary authorities would have had less control over the policy rate. To fund the SFP, the Treasury issued several hundred billion dollars of Treasury bills and deposited the proceeds in the TGA, draining reserves.

of replenishment varies across jurisdictions, and in some instances can be quite high. Ultimately a fiscal authority can add to its cash balances at the central bank only as quickly as it can issue securities.

Figure 2: Treasury General Account (TGA) balances, 2007-2022



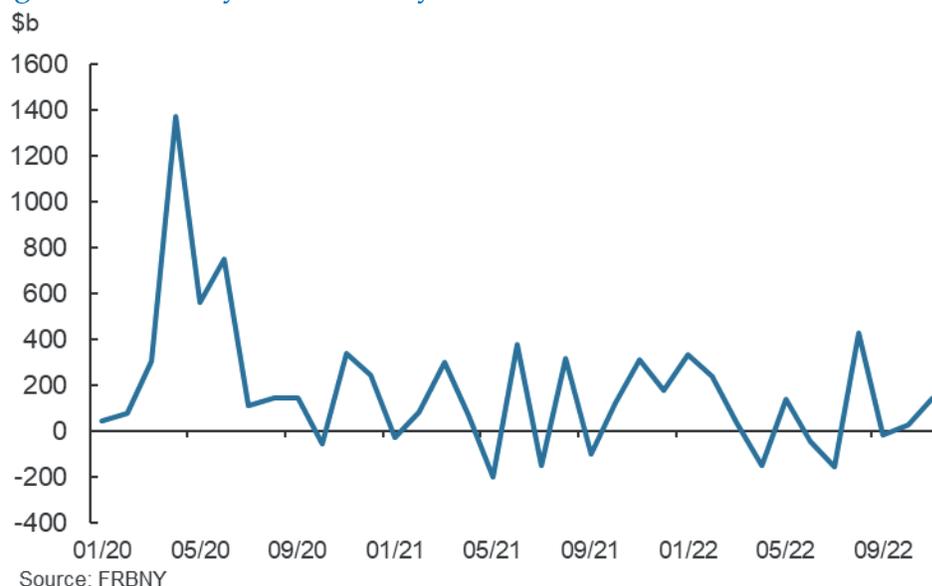
Source: Data sources: BBG (FARBDTRS Index) or Fred (<https://fred.stlouisfed.org/series/WDTGAL>).

A sizable balance of central bank deposits held by the government increases the resilience of the fiscal authority's liquidity. For example, government cash balances may provide a needed intraday source of liquidity if buybacks and related funding transactions are settled on the same day. If buybacks are needed to restore market function, the replenishment rate of the fiscal authority's cash balances could be critical in determining the size and speed of a buyback operation.⁵³ Market dysfunction could arise suddenly and severely, calling for quick and extremely large buybacks. However, as the recent intervention by the Bank of England in its gilt market showed, market-function asset purchases can also be narrowly targeted and not extremely large. March-April 2020 provides a natural experiment for examining whether the primary market for Treasury debt issuance is sufficiently deep to replenish the TGA at a rate that may be needed to support large buybacks. The velocity of issuance in these months was substantial, with a *net* issuance of about \$1 trillion in April 2020 alone, as shown in Figure 3. Although this is only one episode, and although there were competing

⁵³ Debt managers might consider other funding approaches for buybacks such as slightly longer delayed settlement of a buyback or use of switch auctions. Nevertheless, the liquidity buffer in the TGA and the rapid growth of TGA balances in Spring 2020 suggest the Treasury's ability to raise cash is substantial.

demands for these fiscal resources at the time, the March-April 2020 experience suggests a potential for substantial rate of replenishment of fiscal authority liquidity through issuance of short-term debt.

Figure 3: Monthly Net Treasury Issuance 2020-2022



The ability of the fiscal authority to replenish its cash balance would be especially strong if a central bank has the statutory authority to provide short term liquidity through secured funding, as discussed above. Even absent central bank financing the appetite of market participants for bills, in particular, is a critical consideration. Debt managers typically look to this short-maturity segment as a first step when funding needs suddenly rise. The broad composition and capacity of bill-market investors, and the high degree of segmentation between investors in bills and investors in coupon securities, imply a high capacity to raise funds in short order, even in the March-April 2020 crisis.

The extent to which fiscal cash resources should be made available to fund market-function purchases is a question for each jurisdiction to resolve. In the US setting, the Treasury’s liquidity buffer is not set statically. Instead, the Treasury’s debt managers flexibly target a cash balance sufficient to cover five days of expenditures.⁵⁴ The onset of a large buyback operation to address market dysfunction would rapidly increase this five-day coverage amount. Debt managers would likely ramp up bill issuance to

⁵⁴ See “[Quarterly Refunding Statement of Acting Assistant Secretary for Financial Markets Seth B. Carpenter](#),” US Treasury Department Press Release, May 5, 2015.

sustain the TGA balance in line with the principle of five-day coverage. If debt managers replenish the fiscal agent’s liquidity balance through bill issuance, then a buyback increases the holdings of bills by the public and reduces outstanding long-duration securities.

A more committed approach would be to formally increase the fiscal liquidity buffer by some incremental amount as a precaution against any future needed market-function buybacks. For example, the fiscal authority could accomplish this with increased bill issuance. Establishing fiscal cash resources as a standby funding source for buybacks does not appear to conflict with existing policy objectives for fiscal liquidity buffers, although fiscal authorities in various jurisdictions may face different constraints and costs. Such an increase in the liquidity buffer could be a relatively small fraction of a potential future buyback quantity, given that the buffer could be replenished through high-frequency issuance of short-term debt. Appendix C shows the evolving nature of discussions around US government liquidity buffers.

Buybacks to restore market function are distinct from “regular and predictable buybacks,” which in many other jurisdictions regularly use to enhance market liquidity or to mitigate issuance price impacts, whether on an ongoing or targeted basis.⁵⁵ These uses of buybacks have been discussed by the Treasury Borrowing Advisory Committee (TBAC) in 2015 and 2022, and 2023. However, to this point TBAC, has not recommended buybacks that are intended to restore market function, or “emergency or exigent” buybacks.⁵⁶ Indeed, TBAC was explicit in 2023, writing that “Treasury buybacks are intended to support healthy market functioning but not mitigate episodes of acute stress in markets.”⁵⁷ That said, if regular and predictable buybacks are in place, this may over time provide opportunities for further analysis or inform future consideration of whether buybacks can sometimes support market function under exigent circumstances.

⁵⁵ See [“Buyback and Exchange Operations: Policies, Procedures and Practices among OECD Public Debt Managers,”](#) Hans Blommestein, Mehmet Emre Elmadag and Jacob Wellendorph Ejsing, OECD Working Papers on Sovereign Borrowing and Public Debt Management, Number 5, September, 2012, and OECD; [“Buybacks and exchanges,”](#) in *OECD Sovereign Borrowing Outlook 2013*, OECD Publishing, Paris; Allison Holland, [“Report on bond exchanges and debt buybacks: A survey of practices by EC debt managers,”](#) Debt Management Office, United Kingdom, 2001; and [“Bond buybacks and exchanges: Background note,”](#) Government Bond Markets Advisory Services, World Bank, May, 2015.

⁵⁶ See [“Revisiting Treasury Buybacks,”](#) TBAC, September, 2022 and [“Considerations for Designing a Regular and Predictable Treasury Buyback Program”](#) TBAC January, 2023. In October 2022, [the Treasury Department surveyed primary dealers](#) regarding their views on buybacks, without explicitly raising the issue of buybacks for market functioning.

⁵⁷ See [“Considerations for Designing a Regular and Predictable Treasury Buyback Program”](#) TBAC, January, 2023.

7. A summary of conclusions

Official-sector interventions to restore the functionality of government bond markets will occasionally be necessary. At the 2021 U.S. Treasury Market Conference, John C. Williams, President and CEO of the Federal Bank of New York, observed that “...two lessons are clear. First, the unforeseeable and unpredictable will happen, and can result in significant stresses in the Treasury and related markets that may spread to broader financial conditions. Second, when disruptions have been sufficiently severe and persistent, the market has not been able to quickly self-correct without official-sector intervention.”⁵⁸ Central bank “lender of last resort” financing is a first choice for restoring market functionality, but the need for purchases of government securities cannot be ruled out.

Common knowledge of the existence of standby purchase programs that address future episodes of market dysfunctionality is conceptually similar to having the fiscal authority add “liquidity insurance” to its offering circular. We therefore believe that official-sector market-function purchase programs should be made transparent by having an explicit intent; clear criteria for commencing, ending, and unwinding purchases; and clear disclosure of the corresponding purchases and their purpose. This clarifies the value of the liquidity backstop that accrues to holders of government securities so that this support can be better “priced into” bids for the securities when they are issued. This transparency and price discovery also improves the allocation of government securities to those investors with a greater usefulness for liquid safe-haven securities.

When intermediary balance sheets become clogged, different asset-purchase protocols have different degrees of effectiveness. Reverse auctions improve the allocation of specific securities from the private sector to the official sector and reduce the purchase cost to the official sector if they provide optionality to awardees with respect to which securities can be delivered. Efficiency is further improved by auction designs that generate low winner’s-curse and bid-shading disincentives. With these two principles in mind, we offered an example of a delivery-choice auction design in which the purchasing authority announces, before the auction, its reservation yields for each of the securities to be purchased. Auction awardees can then choose which securities on the menu to deliver, and are paid for delivered securities at a stop-out spread to the reservation yields that does not depend on the security or the seller.

⁵⁸ See John C. Williams, [“Preparing for the Unknown,”](#) Remarks at the 2021 U.S. Treasury Market Conference, Federal Reserve Bank of New York, November 17, 2021.

The nature of official-sector interventions will likely depend on the jurisdiction and on prevailing market conditions. In some cases, the central bank will purchase assets, while in other cases the fiscal authority will buy back debt. Central banks should in any case clearly communicate in real time whether their asset purchases have market-functioning or monetary-policy objectives, or both. Assets purchased to sustain market functionality should be held in a distinctly disclosed portfolio, further supporting the transparency of the program and avoiding the risk of conflation with quantitative easing.

Beyond the specific advantages of having market-function purchases conducted by the fiscal authority, as opposed to the central bank, having both actors prepared to step in with market functioning purchases, depending on circumstances, provides greater robustness for market resilience than having either alone prepared to do so. In some jurisdictions, legislative action might enhance the joint ability of fiscal and monetary authorities to share market-function restoration responsibilities. Explicit fiscal authorization and indemnification for central-bank asset purchases--as in the US under Dodd-Frank and Federal Reserve 13.3 programs--can be considered in the context of protecting central bank independence.

There should be advance clarity regarding which authority has responsibility for market-function purchases, depending on the contingencies, or whether there will a coordinated joint approach. A lack of clarity here could threaten or limit the effectiveness of a market-function purchase program.

If fiscal-authority market-function buybacks are available as a contingency, they can be funded by the government with a combination of new debt issuances and cash balances held at the central bank, with low-to-negligible impact on the central bank's balance sheet, thus avoiding potential concerns about central-bank independence. Fiscal authority liquidity buffers can be planned accordingly. In some jurisdictions, existing liquidity-buffer targets can be adequate to support at least intraday funding for a market-function buyback program.

All stakeholders in markets for government securities, official and private, should support efforts to improve market resilience to shocks so that official interventions occur as infrequently as possible, and with the smallest possible footprint, subject to supporting market functionality. Improvements in market structure and regulation, such as those being examined in the US by the Interagency Working Group on Treasury

Market Surveillance (IAWG),⁵⁹ should continue to be prioritized, with the objective of lowering the frequency and severity of episodes of market dysfunctionality.

⁵⁹ See Interagency Working Group on Treasury Market Surveillance, [“Recent Disruptions And Potential Reforms In The US Treasury Market: A Staff Progress Report,”](#) U.S. Department of the Treasury, Board of Governors of the Federal Reserve System Federal Reserve Bank of New York, US Securities and Exchange Commission, US Commodity Futures Trading Commission, November 2021, and [“Enhancing The Resilience Of The U.S, Treasury Market: 2022 Staff Progress Report,”](#) Interagency Working Group, November, 2022.

Appendix A: A delivery-choice auction design

This appendix states the protocol of a “delivery-choice” auction that is more loosely described in the body of the paper, as well as some variants.⁶⁰

The purchasing authority announces a schedule y_1, \dots, y_n of estimated yields for the n notes in the sector, a total quantity Q , and a reservation spread r . An offer is a quantity-spread pair (q, s) , whose spread s must be at least r . Each designated market participant is invited to submit any number of offers. The entire collection $(q_1, s_1), \dots, (q_k, s_k)$ of submitted offers is arranged in decreasing order of spreads. Offers are awarded in decreasing order of spreads until the total of quantity of awarded offers exceeds Q , assuming that the sum of offers is at least Q . If the total quantity of offers is less than Q , all offers are accepted. Otherwise, the quantity q_j of the final awarded offer is replaced with the residual quantity $Q - q_1 - q_2 - \dots - q_{j-1}$, so that the total quantity of awarded bids is Q . The stop-out spread s^* is the spread s_j of the final awarded offer, that with the lowest accepted spread. In case of multiple offers at the stop-out spread, these offers are allocated quantities pro rata to the offered quantities. Any awarded offer (q_i, s_i) then gives its submitter the right to sell any quantities z_1, \dots, z_n of the n respective notes whose total is q_i in exchange for the total cash amount $\sum_i z_i f_i(y_i + s^*)$, where $f_i(y)$ denotes the price of note i implied by a yield of y .

⁶⁰ This auction format is closely related to that described by Peter Crampton and Lawrence Ausubel in [“Virtual Power Plant Auctions,”](#) *Utilities Policy*, Volume 18 (2010), pp. 201-208. This is also similar to an approach that has been used by the Ministry of Finance of Poland in its government securities switch operations. “The MoF announces the price for the source bond on the last working day before the auction. Primary dealers submit then bids in terms of nominal amount of source bonds and price for the destination bond. Finally, the MoF makes a decision about the lowest accepted price (minimum or stop price) of the destination bond.” See page 42 of [“Buyback and Exchange Operations: Policies, Procedures and Practices among OECD Public Debt Managers,”](#) Hans Blommestein, Mehmet Emre Elmadag and Jacob Wellendorph Ejsing, OECD Working Papers on Sovereign Borrowing and Public Debt Management, Number 5, September, 2012, and OECD, [“Buybacks and exchanges,”](#) in *OECD Sovereign Borrowing Outlook 2013*, OECD Publishing, Paris. For related practices, see Allison Holland, [“Report on bond exchanges and debt buybacks: A survey of practices by EC debt managers,”](#) Debt Management Office, United Kingdom, 2001; and [“Bond buybacks and exchanges: Background note,”](#) Government Bond Markets Advisory Services, World Bank, May, 2015.

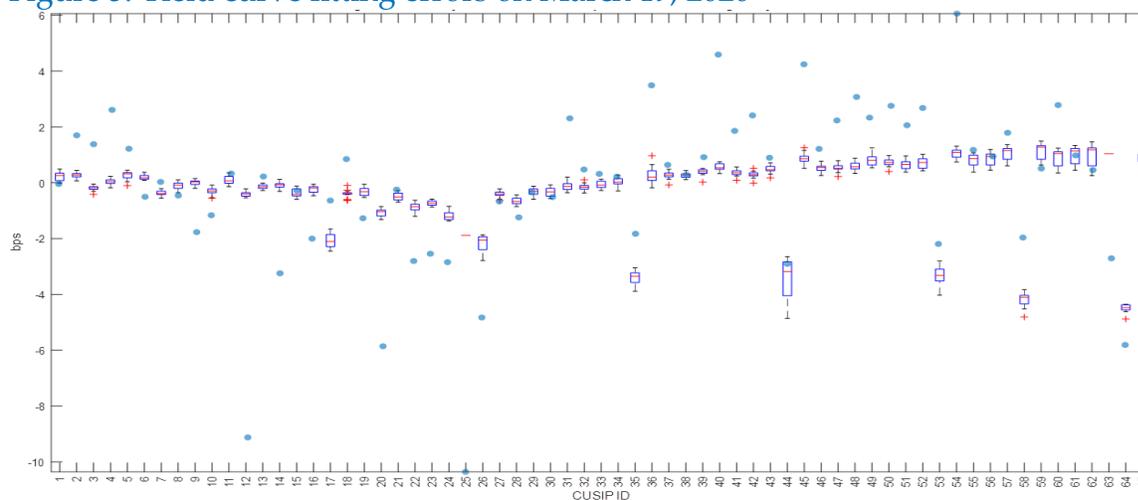
Appendix B: Additional exhibits

Figure 4: The yield curve lost smoothness in March 2020



Notes: The vertical axis is the square root of the mean squared yield fitting errors for U.S. Treasury securities with times to maturity of between 4 and 6 years. The fitted curve was constructed with the Matlab implementation of Anderson and Sleath (1999), using their default parameters governing the penalty on roughness in the optimization, and using quarterly knot frequency. The three vertical lines indicate, respectively, the taper tantrum (5/22/2013), the flash rally (10/15/2014) and the repo market disruption (9/16/2019). None of these events resulted in enough market dysfunction in Treasury cash markets to require official intervention.

Figure 5: Yield curve fitting errors on March 19, 2020



Notes: Yield fitting errors, in basis points, on March 19, 2020 (blue dots), errors for the 65 US Treasury securities with times to maturity of between 4 and 6 years, based on the yield fitting procedure described in the footnote to Figure 4. Box plots show the distribution of yield errors in February 2020. Box plot mid-lines show, for each CUSIP, the median fitting error. The bottom and top edges of the box indicate the 25th and 75th percentiles, respectively. The whiskers extend to the most extreme data points not considered outliers. Outliers are plotted individually using the + symbol.

Appendix C: Evolving fiscal authority liquidity resources

Throughout 2014 and the first half of 2015 the Treasury Borrowing Advisory Committee (TBAC) and Treasury debt managers discussed the establishment of a liquidity buffer and increased use of buybacks to enhance market liquidity. Below are several short readouts from TBAC minutes and the Treasury quarterly refunding statement announcing the new cash management policy in May 2015.

April 2014 (TBAC) “The presenting member noted that a higher cash balance should be considered by Treasury, citing the notable gap between Treasury’s daily cash balance and its anticipated funding needs. The member stated that the cost to the taxpayer from holding a significantly higher cash balance could be low. He also noted that Treasury remained an outlier relative to other developed market debt managers in terms of holding a cash balance policy that would insure against the risk of situations where normal access to funding markets may be disrupted or delayed. A spirited debate ensued among the participants. The Committee agreed that Treasury should present a proposal for a cash balance framework that better accounts for these risks at the August meeting. TBAC suggested that this proposal include possibilities regarding potential ways to fund such a liquidity buffer.”

August 2014 (TBAC). “While the Treasury Market has not been closed for more than 2-3 days in the past, we believe a 5-day liquidity buffer may be prudent.”

November 2014 (TBAC) “The Committee (TBAC) reiterated its recommendation that the Treasury increase its structural cash balance, on the order of \$500 billion, to mitigate operational risk.”

February 2015 (TBAC) “The presenting member noted that buybacks could serve several debt management purposes including enhancing liquidity of Treasury securities, reducing short-run variation in bill issuance or cash balances, reducing maturity peaks in outstanding debt, and as a tool to adjust Treasury’s debt profile.”

In Q2 2015 Treasury announced a new cash balance policy, but was not as forward leaning with respect to buybacks, committing to small value testing but no change in policy. “At the August 2014 Refunding, the Treasury Borrowing Advisory Committee (TBAC) recommended that Treasury review its cash balance policy as part of an overall risk management process. Events that have occurred over the last 15 years, such as the terrorist attacks on September 11th and Superstorm Sandy, have caused disruptions to the broader financial system and Treasury’s auction

capabilities. Treasury further stated at the February 2015 Refunding that it believed holding a higher cash balance was prudent and that it continues to study the idea. ... Based on our review, the TBAC's recommendations, and an assessment of emerging threats, such as potential cyber-attacks, Treasury believes it is prudent to change its cash management policy starting this month. To help protect against a potential interruption in market access, Treasury will hold a level of cash generally sufficient to cover one week of outflows in the Treasury General Account, subject to a minimum balance of roughly \$150 billion."