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Quasi-Fiscal Implications of Central Bank Crisis Interventions: Case Studies

John Hooley, Claney Lattie, and Peter Stella

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Prepared by John Hooley, Claney Lattie, and Peter Stella

Authorized for distribution by Jihad Alwazir and Carolina Renteria
June 2023

ABSTRACT: This paper presents case studies of central bank crisis interventions during the Covid-19 and the Global Financial Crises in four jurisdictions (Canada, Chile, the United Kingdom, and the United States). The paper serves as an Annex to the main IMF Working Paper WP/23/114 'Quasi-Fiscal Implications of Central Bank Crisis Interventions.'

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Author's E-Mail Address:	JHooley@imf.org, CLattie@imf.org, PStellaconsult@gmail.com

WORKING PAPERS

Quasi-Fiscal Implications of Central Bank Crisis Interventions: Case Studies

Prepared by John Hooley, Claney Lattie, and Peter Stella[1]

[1] Prepared under the guidance of Jihad Alwazir and Carolina Renteria.

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Canada[2]

The large expansion of the Bank of Canada's (BOC) balance sheet during the Covid-19 crisis was in stark contrast to its small increase during the GFC, when asset purchases were conducted by the government. This divergence illustrates how crisis interventions with similar objectives can, in principle, be implemented by either the central bank or the fiscal authority. Canada also provides an example of i) governance arrangements that can shield the central bank balance sheet from most of the financial risks associated with Covid-19 interventions, and ii) the potential gains from coordination with the fiscal authority to facilitate a smooth exit from QE.

Overview

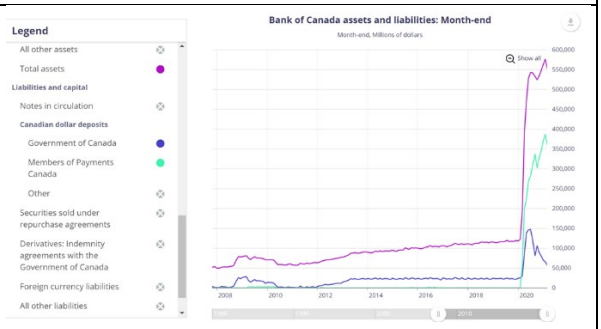
The BoC balance sheet expanded by over 20 percent of GDP during the Covid-19 crisis, funded by new reserves. 11 new programs were introduced in 2020, driving an increase in total assets from 5 to 25 percent of GDP (Table 1). 80 percent of the new assets were financed with new commercial bank reserves, which expanded by C$ 345 billion (16 percent of GDP). The remainder were financed by increase in demand for banknotes as well as an increase in Government operational deposits and indemnity and derivative support (reflected in Other Liabilities), while securities were not sold.

Table 1. Change in Bank of Canada Balance Sheet (12/31/2020 minus 12/31/2019, percent of GDP)

Assets		Liabilities	
Canadian Government Securities	11.9	Bank notes in circulation	0.8
Liquidity Providing Repos	6.4	Financial Institution Deposits	15.7
		Government Operational Deposits	2.7
Other Assets	1.4	Prudential Liquidity Management Plan	0
		Other Liabilities	0.5
		Equity	0
Total Assets	19.7	Total Liabilities	19.7

Source: Bank of Canada and author's calculations

Figure 1. Bank of Canada Assets and Liabilities (Billions of Canadian Dollars, month end)



The large balance sheet expansion was in stark contrast to during the GFC, when asset purchases were conducted by the government. Figure 1 shows both the relative magnitude of the balance sheet expansion and the way it was financed during the two crises. Although the BoC cut its target overnight interest rate to what it considers the ZLB (25 bps) during both the GFC and COVID crises, in the GFC bank reserves were permitted to expand by only several billion dollars at their peak point. During the GFC, the expansion of LPRs and the Term Loan Facility was financed by a reduction in the Bank's treasury bill portfolio and by larger government deposits, while outright asset purchases (mortgage-backed securities, effectively credit easing)

[2] Prepared in May 2021 by Peter Stella.

were conducted on the government balance sheet.[3] Had the MBS purchases been financed by the Bank of Canada during the GFC, its pre-2008 balance sheet would have more than doubled in size.

Drivers of the (larger) Balance Sheet Expansion During the Covid-19 Crisis

Quantitative easing (QE) was used as a policy tool for the first time. The BoC's bond market purchase program[4] funded by reserves (QE) was first employed by Canada in response to the COVID-19 crisis[5] and was the most quantitatively significant program. The purchases under QE were aimed specifically at certain yield curve segments and designed to lower yields in secondary markets, in contrast to the BoC's traditional government bond purchases, whereby the BoC purchases government securities as an equi-proportional non-competitive bidder in primary market auctions (in order to have a neutral impact on the yield curve).

The BoC also purchased other public and private securities. The BoC introduced 7 new asset purchase programs during 2020 (Table 2), of which the bankers' acceptances purchase program was the most important after QE, hitting a peak of C$ 39 billion shortly after its introduction, about double the combined peaks of the Canada Mortgage bonds[6], Provincial money market securities, commercial paper and corporate bond purchase programs combined.

Table 2. Bank of Canada Asset Purchase Programs Introduced in 2020
(peak amount in C$ billions)

	Dates	Peak	Peak Amount
Bankers' acceptances	Mar-Oct 2020	4/1/2020	38.8
Canada Mortgage bonds	Mar-Oct 2020	12/1/2020	9.7
Provincial Money Market securities	Mar-Nov 2020	7/1/2020	7.6
GOC Bonds Secondary Market (QE)	Apr 2020-	Latest*	375.5
Commercial Paper	Apr 2020-	4/1/2020	3
Provincial Bonds	May 2020-	Latest*	19
Corporate Bonds	May 2020-	3/1/2021	0.2

* 5/19/2021

Expansion of liquidity facilities. The remaining four programs were largely modifications of existing tools with defined durations. BoC expanded its provision of liquidity in 2020 by transacting more frequently with a broader range of counterparties, for longer terms, and against a wider range of eligible securities. There were three new liquidity-providing repo programs and one liquidity withdrawing repo, which provided a temporary source of GOC bonds and bills to primary dealers on an overnight basis.

[3] The Insured Mortgage Purchase Program (IMPP) allowed Canadian financial institutions to sell their insured residential mortgages to the federal government-owned Canada Mortgage and Housing Corporation (CMHC). A total of $69.3 billion in NHA MBS was purchased by CMHC through a competitive auction process between 2008- 2010. The IMPP matured in March 2015 and all loans and borrowings from the Government were repaid. See CMHC (2015) and Arjani and Paulin (2013).
[4] The official title is "Government of Canada bonds secondary market purchase program"
[5] The Bank relied on forward interest rate guidance and an expansion in repos. The Bank's term lending facilities were priced to be unattractive once markets calmed and demand for them had abated by spring 2009.
[6] Note that at its peak the Canada Mortgage bonds purchased by the BoC amounted to far less than what was purchased by the CMHC during the GFC (C$ 69 billion).

Governance and Coordination Arrangements with the Fiscal Authority

The risks associated with new asset holdings were indemnified by the Treasury. The government indemnified certain programs through injections of government deposits (shown in Other Liabilities in Table 1), though this represented only a small fraction of the expansion in assets. However, the increase in market or interest rate risk having been incurred by the BoC in relation to its QE program is the subject of derivatives agreements with the Government. The BoC and Government also entered into indemnification agreements whereby the government will cover any credit losses associated with the securities the Bank purchased under the Provincial Money Market Purchase Program or Commercial Paper Purchase Program. And any realized losses resulting from the sales of assets acquired under the Canada Bond Purchase Program, the Provincial Bond Purchase Program and the Corporate Bond Purchase Program are indemnified by the Government of Canada and any realized gains on disposals will be remitted to Government.[7]

The government's efforts to lengthen the maturity of its debt issuances potentially offset some of the impact of QE, highlighting the importance of ex-ante coordination. As the BoC withdraw longer-term government debt from the market and exchange it for overnight interest-bearing debt, the Government decided to expand longer term issuance to lengthen the term structure of the debt.[8] Issuance of bonds at maturities of 10 years or greater more than doubled in 2020, increasing from 7 to 18 percent of total issuance increased further in 2021 (Figure 2)[9] In fact, while 63 percent of government issuance in 2020 was medium- and long-term debt, from the consolidated (net) perspective only 24 percent of the increase in debt fell into medium- and long-term debt (Figure 3). At the same time, sovereign reliance on short-term debt (including reserves) in 2020 was not only more than double the figure shown for government alone, but reliance on short-term debt was also proportionally higher than in 2019 (pre-COVID).

Ex-post coordination between the Treasury and BoC could also facilitate a smooth exit from the inflated crisis balance sheet. At the end of 2020, Bank Deputy Governor Beaudry[10] pointed out the three options available to the Bank once it is deemed time to end QE—it could simply reinvest the proceeds from maturing bonds into new bonds, allow maturing bonds to roll off the balance sheet, or actively sell bonds to shrink the balance sheet. Re-investment in short term bills would give the central bank flexibility to accelerate shrinking the balance sheet by allowing those bills to roll-off much sooner although, of course, it could ultimately roll over short-term bills continuously for many years should the monetary policy stance so warrant. A gradual conversion of BoC's holdings into short-term bills would also lessen its exposure to interest rate risk. Alternatively, the BoC could coordinate with the central bank a swap of bills for the Bank of Canada portfolio, accelerating the flexibility to shrink the balance sheet more quickly and more gradually.[11]

[7] These agreements are carried at fair value on the balance sheet with changes recognized in income (loss).

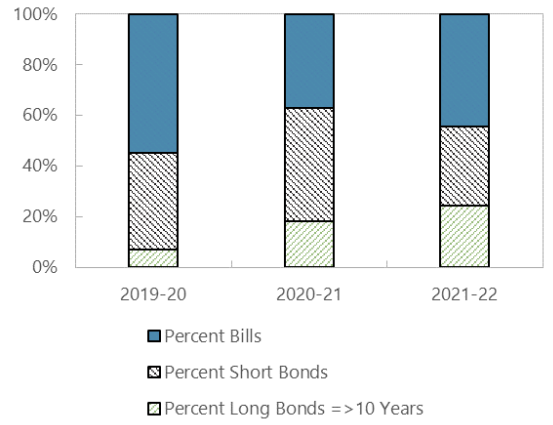
[8] A swap of bills for the BoC portfolio would offer increased flexibility to shrink the balance sheet more quickly and gradually.

[9] See Canada (2021), "For 2021-22, the government will seek to maximize the financing of COVID-19-related debt through long-term issuance." The proposals would result in the longest average term to maturity in four decades, protecting from rollover risks.

[10] Beaudry (2020).

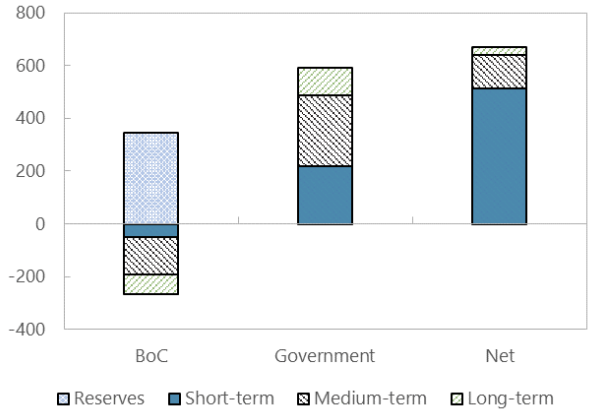
[11] See Stella (2020) for a discussion of how other countries have financed large central bank balance sheets through government over issuance and the maintenance of large government deposits at the central bank.

Figure 2. Government of Canada Gross Issuance of Bills and Bonds (percent of total, actual and projected in 2021 budget)



*Last data available 5/19/2021

Figure 3. BoC and GoC policy impacts on maturity of sovereign debt outstanding
(billions of C$)



Notes: BoC changes in government debt shown with a negative sign as they withdraw securities from the market and the increase in BoC reserve liabilities is added to short-term debt.

Chile[12]

The Central Bank of Chile's (CBC) balance sheet doubled during the Covid-19 crisis, in contrast to its relatively contained expansion during the GFC. Interventions mainly consisted of purchases of private securities and credit for lending programs, collateralized with bank loans. As a result, the share of peso-denominated assets increased, leading to improvements in net income but also increased financial risks. Transparency practices are relatively strong: the CBC provides annual updates on its balance sheet exposures and associated financial risks, although information on the scope and extent of any government guarantees extended to the CBC for the sizeable credit support programs would help in establishing clearer lines of financial risk allocation and promote accountability.

Overview

The CBC balance sheet expanded by approximately 13.0 percent of GDP during the Covid-19 crisis, funded by new reserves. By the end of 2020, total assets had doubled from a pre-crisis level of 15 percent of GDP (Figure 1). The programs that drove the balance sheet expansion included purchases of securities from banks and pension funds and liquidity facilities to support bank credit —the Credit Facility Conditional on Increased Lending (FCIC) and the Credit Line Facility (LCL) (Table 2).[13] Close to 80 percent of the increase was financed through new commercial bank reserves, which expanded by 11 percent of GDP (Table 1). The CBC reduced its monetary policy rate to what is considers a 'technical minimum' of 0.5 percent by March 2020, followed by a sharp expansion in reserves which expanded to its peak of 15.4 percent of GDP. The balance

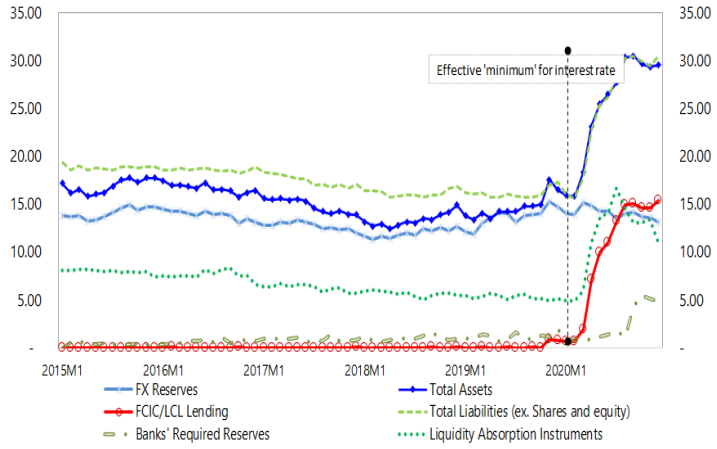
[12] Prepared in November 2021 by Claney Lattie.
[13] The government also extended credit-support policies during COVID-19 through loan guarantee programs (FOGAPE-COVID and FOGAPE-REACTIVA).

sheet response during the COVID-19 crisis diverged significantly from the GFC; both in terms of quantity and the duration of the measures implemented.[14]

Table 1. Change in CBC Balance Sheet (12/31/2020 minus 12/31/2019, percent of GDP)

Assets		Liabilities	
Foreign Assets	-1.6		
Government Securities	0.0	Bank notes in circulation	1.9
Liquidity Providing Repos	2.6	Financial Institution Deposits	0.9
Special Credit Operations	7.6		
Special Asset Purchases (SOMA)	3.3		
		Government Operational Deposits	-0.4
Other Assets	1.2	Prudential Liquidity Requirement	6.0
		Liquidity Absorbing OMOs	3.4
		Other Liabilities	1.2
		Equity	-0.1
Total Assets	**13.05**	**Total Liabilities and Equity**	**13.05**

Figure 1. Selected CBC Assets and Liabilities (in percent of GDP)



Sources: Central Bank of Chile Financial Statements 2019 and 2020, Annual Report 2020, Monetary and Financial Statistics, IMF and authors' calculations

Drivers of the Balance Sheet Expansion During the Covid-19 Crisis

Credit for lending was incorporated as a new liquidity instrument. The objective of the programs was to encourage banks to continue funding for households and small and medium-sized firms that had limited access to capital markets, and they helped to ease stress in peso funding markets for corporates and commercial borrowers. The majority of new CBC reserve creation was in fact conditioned on the growth in banks' credit portfolio and was conducted across three tranches (Figure 2). The first tranche was announced in March 2020 at the onset of the COVID-19 crisis and was set at USD 4.8 billion, with incremental amounts announced to accumulate to approximately USD 50 billion (Table 3). Unlike standard refinancing operations that carry short maturities, credit for lending loans had maturities of up to 4-years.[15]

[14] During the GFC, Chile faced relatively little exposure to distressed financial products, while liquidity provision to the financial system was also supported by the Chilean government placing funds with Chilean banks to help them with liquidity issues.

[15] Loans are granted and disbursed in pesos. Stocks outstanding are shown in USD to eliminate the impact of exchange rate movements.

Table 2. Domestic Currency Intervention Measures - Central Bank of Chile (in USD billions)

	Dates	Target/ Announcement	Cumulative Usage [1/] (October 4, 2021)
Asset purchase programs (including) bank bonds, corporate bonds, other pension fund assets	Mar - Jun 2020	16.00	8.65
Credit Support Programs			
LCL-FCIC-I [2/]	Mar - Apr 2020	24.00	22.38
FCIC-II	Jul-20	16.00	4.55
FCIC-III	Mar-21	10.00	8.74

[1/] Operations are made in pesos and are converted to USD using the exchange rate as at the reporting date.
[2/] The LCL is a liquidity line determined as a limit of the average reserve requirement in pesos. The FCIC initial line was set at 3% of commercial and consumer loan portfolio, with an additional amount accessible of up to 12% of the loan base, depending on the composition of such loans.
Source: Central Bank of Chile and IMF staff.

The CBC also purchased securities from banks and pension funds in response to the crisis but did not buy government securities. The eligible securities for the asset purchase program included financial corporate bonds up to a limit of USD 8.0 billion over a six-month period to contain volatility scenarios in funding markets. Special purchases were conducted with pension funds for eligible bank securities and time deposits, contributing some CLP 6.6 billion and CLP 2.2 billion, respectively in reserves. These special purchases facilitated the authorized withdrawals from pension fund savings and were intended to preserve financial stability and support asset markets. Although the constitution was amended to allow the CBC to buy and sell government bonds under the exceptional circumstances, this mode of intervention was not used.

Financial Risks from COVID-19 Interventions

The measures taken resulted in a significant change in the composition of assets and the risk profile of the Central Bank's balance sheet. Prior to the Covid-19 crisis, the majority of CBC's assets were foreign reserves, but following the various liquidity programs implemented in 2020, there was a rise in peso-denominated assets as a share of the total assets. The shift towards peso-denominated assets introduced new risks for the balance sheet, especially as the CBC expanded the pool of eligible collateral to include financial corporate bonds and commercial bank loans, similar to other central banks in the crisis (Figure 3).[16] Total credit related to FCIC loans amounted to 15.0 percent of GDP of which 7.6 percent of GDP had been extended up to Dec 2020.

The CBC took most of the market risk associated with the credit-support programs onto its balance sheet. To manage the risks from the FCIC's broader pool of eligible collateral, a minimum credit risk rating of A4[17] was initially instituted for eligible commercial loans and a maximum loan-to-value ratio of 50 percent for loans. Subsequent operations expanded the portfolio of eligible commercial loans to include loans rated at A5 and A6, subject to state guarantee. However, the absence of a robust risk management framework, including for example, differentiated haircuts across collateral types, left the central bank open to market risk.[18] The

[16] "Expanding the Central Bank's Collateral Framework in Times of Stress", IMF Special Series on COVID-19, 2020.
[17] The credit rating on commercial loans range from A1 (the highest quality loans) to A6 (loans of the lowest quality).
[18] The CBC applies a uniformed 10 percent haircut across all collateral types.

distribution of collateral held against FCIC loans shows A3- and A4-rated assets represented a combined 67 percent of the total collateral holdings as of September 2021.

Figure 2. Credit for Lending Operations Stocks outstanding (in USD billions)

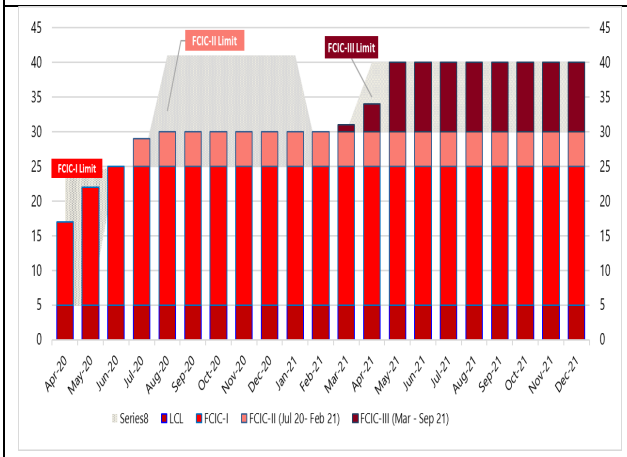
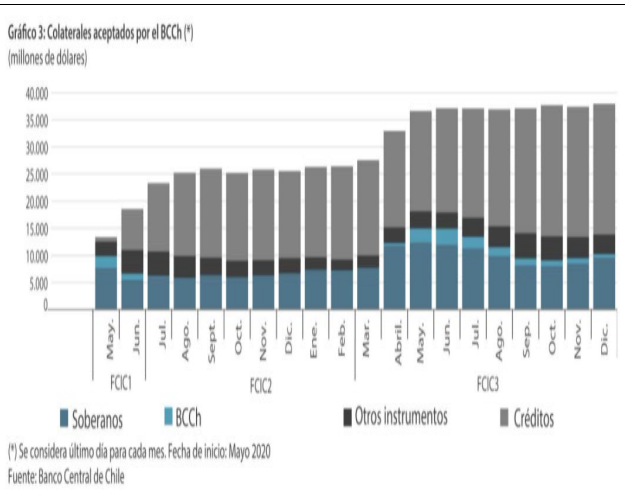


Figure 3. Collateral Distribution for FCIC Programs[16]



Sources: Central Bank of Chile

Purchases of bank bonds were not backed by government guarantees. Any default or fluctuation in valuation of the bank bonds purchased would therefore directly impact the CBC's balance sheet. For example, based on the CBC's assessment,[19] the net gain on bank bond purchases for the first seven months of the bond purchase program was CLP 120 billion, while for the first six months of 2021, the bond purchase program was estimated to generate an estimated loss of CLP300 billion.

Transparency

The risks associated with new peso-denominated assets are communicated regularly by the CBC. The 2021 financial statement provided an initial assessment of the financial implications of the credit-support measures, and updates on its risk credit risk exposures are published on its website. Information on valuations, including risk measurements, is also included. Additionally, the increase in credit risk arising from the loans extended under the FCIC programs and bond purchases is explicitly mentioned in financial statements (Table 1). The CBC also provides detailed risk assessments regarding its balance sheet and equity. The assessments to September 2021 indicated that its net worth remains vulnerable to sizeable valuation losses primarily on the bank bond portfolio.[20]

Yet, the scope and extent of government guarantees for credit programs are difficult to identify. Whereas profit distribution and recapitalization requirements are incorporated in the central bank law, the

[19] "The Central Bank of Chile's Balance Sheet", Monetary Policy Report, September 2020 (pg. 49-51) and September 2021 (pg. 78-83); Central Bank of Chile.

[20] The main losses for the first half of 2021, emanated from the mark-to-market losses on the bank bond portfolio, which were only partially offset by the gains from the interest from the credit-support programs.[20] Interestingly, the central bank forecasts that the overall equity position would improve over the medium term (by 2025), with possible distribution of profits to the treasury by 2027[20].

treatment of financial outcomes from the Covid-19 exceptional measures are not. By law, the central bank retains at least 10 percent of its surplus for reserve accumulation or cover future losses. Alternatively, the arrangements for the exceptional measures are operationalized through memoranda of understanding (MOUs) between the central bank and the government, and these documents are classified as 'reserved' (CBT Detailed Review Report, May 2021). Possible further financial loss from the bank bond purchase programs (particularly in the context of monetary tightening)— either from valuations or bond sales, could adversely affect the central bank's equity accumulation. To mitigate these risks, government guarantees could be extended, or options such as the transfer of the residual private bond holdings to the government could be considered.

Table 2. Risk Measures and Outcomes for COVID-19 Intervention Programs

	Key Risk Measures	Outcomes
Credit Risk	Minimum credit rating of A4 for eligible commercial loans generally; inclusion of A5-A6 commercial loans with government guarantee.	Loans rated from A1-A3 account for **85 percent** for the bank bonds used as collateral.
	Minimum credit rating of A for bank bonds purchased	Bank bonds with AAA to AA- rating dominate the portfolio of purchases - **97.2 percent**
	Maximum purchase amount from a single issuer	Largest issuer of bank bonds account for **18.2 percent** of bank bond holdings.
	Monitoring of banks' credit ratings	**96 percent** of loans in the credit for lending programs (FCIC) attributed to banks rated AAA - AA.
	Net Credit Exposure on FCIC loans* (in CLP million)	-1,607,223.8
Market Risk	Duration (months):	
	-Bank Bond/Time Deposit Purchases	41.9
	-CBC Securities	1.1

Financial institutions cannot use a bond issued on their account as collateral with the CBC

* The net credit exposure is measured as the difference between the gross loan amount outstanding less the collateral valuation. Collateral is typically valued at fair value(market value), except bank loans that are valued at nominal value.

Source: Financial Statement for the Central Bank of Chile, 2020

United Kingdom[21]

The large expansion of the Bank of England (BoEs) balance sheet during the Covid-19 crisis - largely from additional purchases of government securities- added to an already-inflated balance sheet as a legacy from the GFC. The BoE's significant holdings of government debt raise questions about its ability to respond in future crises, and its exit strategy emphasizes active asset sales. The BoE also provided considerable support to the non-financial private sector (lending and asset purchases) during the Covid-19 crisis, though implicitly recognizing its quasi-fiscal nature, the Treasury played a key role in the design of the schemes and fully indemnified losses. The BoE has strong mechanisms to preserve its policy and financial independence, including remunerated commercial bank reserves, Monetary Policy Committee control over the amount of asset purchases financed by reserves, mark-to-market accounting and a strong recapitalization framework.

[21] Prepared in November 2021 by John Hooley. The author would like to thank Bank of England staff for providing helpful comments.

Overview

The BoE balance sheet expanded by over 14 percent of GDP during the Covid-19 crisis, funded by newly created reserves. Total assets increased from 26 to 40 percent of GDP (**Table 1 and Figure 1**). Almost all the increase was due to new purchases of government securities through an expansion of the size of the existing asset purchase program, although there was also around 1 percent of GDP in additional support provided to the non-financial sector through purchases of securities and a new commercial paper facility. The purchases of government and private securities and the commercial paper scheme were funded by issuance of additional reserves (financial institution deposits at the central bank), which grew by almost GBP 300 billion.

The increase in assets during Covid-19 built on an already-inflated balance sheet, a legacy from the GFC. The expansion in the BoE's balance sheet during the GFC (15 percent of GDP over 2008-2012) took place more gradually but was ultimately of a similar magnitude to the expansion in 2020. However, neither the assets accumulated during the GFC (mostly Gilts purchased under the Bank's QE program), nor the additional reserves created to fund them, had been unwound by the time the Covid crisis hit. This meant that the asset expansion during 2020 occurred on an already-inflated balance sheet (the pre-GFC balance sheet was less than 5 percent of GDP).[22]

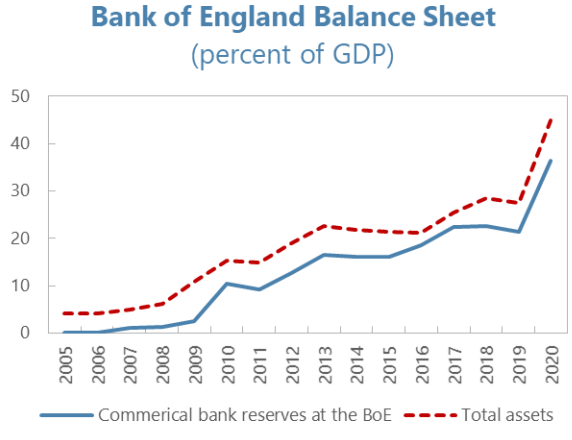
Relative to the GFC, the BoE extended more support to the non-financial sector in Covid-19 but less support to the financial sector - reflecting the different nature of the two crises. Figure 2 shows both the relative magnitude of the balance sheet expansion and the way it was financed during the two crises based on two definitions of the GFC (2008-9 and 2008-2012). Support to the financial sector was around 0.5 percent of GDP in 2020, compared to around 2 percent of GDP in first year of the GFC. However, the in support to the non-financial sector in 2020 was much larger than during the GFC (1 percent of GDP versus less than 0.1 percent of GDP).

Table 1. Change in Bank of England Balance Sheet (12/31/2020 minus 12/31/2019, percent of GDP)

Change in Bank of England Balance Sheet
12/31/2020 minus 12/31/2019
(in percent of GDP)

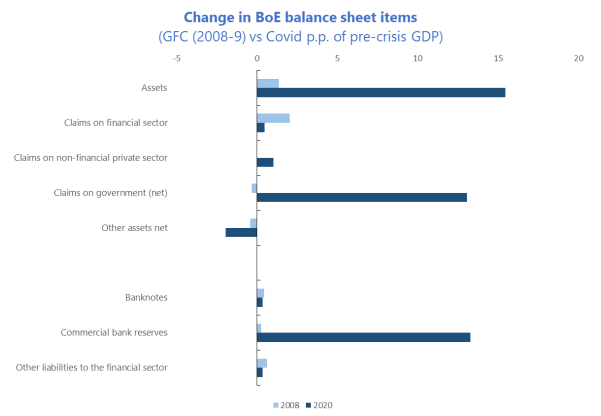
Assets		Liabilities	
Bond holdings	0.0	Bank notes in circulation	0.3
Asset purchase facility	13.5	Financial Institution Deposits	13.3
Gilts	13.1		
Corporate bonds	0.4		
Liquidity Providing Repos	-0.2	Reverse repos	0
Term funding scheme	-3		
Term funding scheme SME	3		
CCF	1		
FX reserves	0	Government deposits	0
Other Assets	0	Other Liabilities and equity	1
Total Assets	14	Total Liabilities and Equity	14

Figure 1. Bank of England Total Assets and Reserves (percent of GDP)



[22] The Bank of England has a unique legal structure, with segmentation of its balance sheet into the Issue and Banking departments. This case study uses consolidated data where possible.

Figure 2. Change in Bank of England Balance Sheet Items: Covid-19 vs GFC



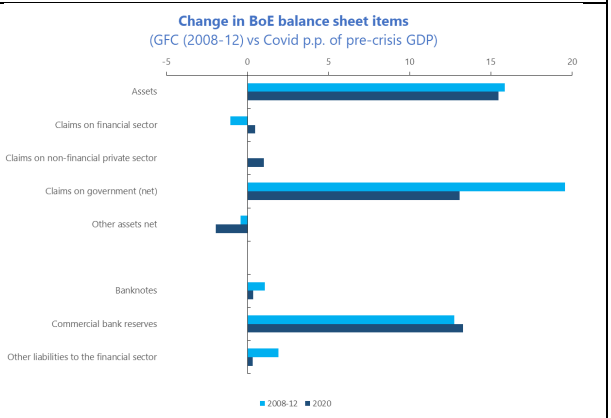


Figure 3. BoE corporate bond holdings, October 2021 (Corporate Bond Purchase Scheme)

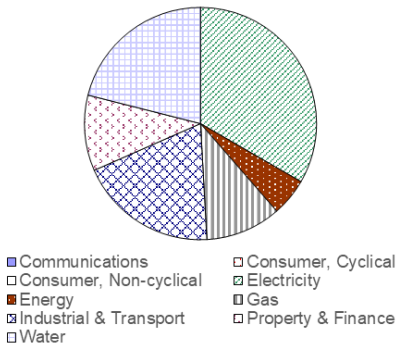
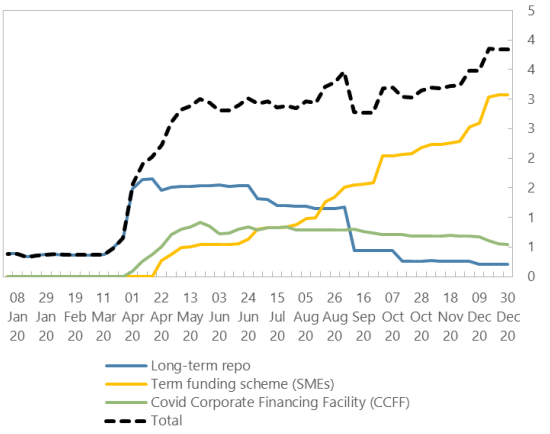


Figure 4. Bank of England liquidity support operations (percent of GDP)



Source: Bank of England and author's calculations

New Schemes

The BoE's purchases of government and corporate securities were conducted off balance sheet by the existing Asset Purchase Facility (APF).[23] The APF was first created in 2009 to implement asset purchases, financed with Tbills transferred from the DMO, though its mandate was subsequently extended to include purchases of UK government bonds (Gilts) on the secondary market and funding from newly created reserves.[24] The APF is a subsidiary of the Bank and acts as the Bank's Agent to purchase assets with the proceeds from newly created reserves (that the Bank onlends to it). During 2020, the APF's purchases of Gilts were aimed specifically at medium and longer-term bonds with a residual maturity of at least three years,

[23] Direct lending support to the government was also made available through a temporary extension of the Ways and Means overdraft facility but this was not used.

[24] The APF's funding through Treasury bills transferred to the Bank from the Debt Management Office was subject to a 10 billion limit (although in practice, purchases were mostly funded by reserves).

spread evenly across three maturity segments: 3-7, 7-20 and over 20.[25] The APF's purchases of corporate securities took place through an expansion of the existing Corporate Bond Purchase Scheme (CPBS)[26] and the stock of securities held increased from 10 billion to 20 billion, across a range of sectors (**Figure 3**).

A new form of direct lending support to the non-financial sector was provided, through purchases of commercial paper. The BoE provided a new direct lending facility to non-financial firms (the Covid Corporate Financing Facility, or CCFF), through the purchase of commercial paper, in both primary and secondary markets. The facility was set up in an entity separate from the bank (although remained on its balance sheet) and funded by issuance of additional central bank reserves.[27] The CCFF lent over GBP 37 billion (1.8 percent of GDP) to 107 companies before closing to new purchases in March 2021.

The BoE introduced two new financial sector liquidity facilities on its balance sheet. The Bank continued to provide liquidity through its regular facilities, notably the Indexed Long-Term Repo (ILTR). The Bank also introduced two new schemes: a Contingent Term Repo Facility (CTRF) and a new term funding scheme (TFSME), to lower banks' funding costs and improve supply of credit to SMEs funded by additional central bank reserves.[28] The CTRF offered unlimited liquidity against a broad range of collateral at a spread of 15 basis points above Bank Rate, while the TFSME provided four-year funding at or close to the Bank Rate, conditional on banks increasing lending to SMEs (the scheme was closed to new loans in October 2021 after a 6-month extension). Whereas there was relatively little uptake of the repo facilities in Covid-19, TFSME drawings increased significantly (**Figure 4**).

Governance and Coordination Arrangements with the Fiscal Authority

APF operations have inbuilt risk mitigation and losses are indemnified by the Treasury. The APF can only purchase assets if the BoE is satisfied that they are of 'high quality and of equivalent standard to investment grade'; and expect there to be a 'viable private market demand for such assets when conditions in financial markets return to normal.' The Treasury makes prompt (quarterly) cash budgetary transfers to the APF to cover any losses while surpluses (net of costs) are transferred to the Treasury (so the APF never shows a profit or loss).29 The APF's financial statements are prepared according to IFRS accounting standards and so mark-to-market losses are recognized in real time on the income statement.

All operations on the Bank's balance sheet are backstopped by a robust capital and income framework. The financial relationship between the Treasury and the Bank is based on the 2018 Memorandum of Understanding (MOU), which codifies a new capital and income framework. Its objectives are to ensure that the Bank is fully funded and has capital resources consistent with the monetary and financial stability remits. It includes a risk-based capital target whereby if capital falls below a floor, rapid recapitalization is triggered and if

[25] https://www.bankofengland.co.uk/markets/market-notices/2020/apf-asset-purchases-and-tfsme-march-2020

[26] Prior to Covid-19, the Bank had purchased private sector securities through the APF under several programs Schemes included the Commercial Paper Facility, Secured Commercial Paper Facility and the Corporate Bond Secondary Market Scheme, aimed to help improve liquidity in credit markets that were not functioning normally.

[27] https://www.bankofengland.co.uk/letter/2020/exchange-of-letters-hmt-bank-of-england-ccff

[28] Previous schemes similar to the TFSME included the Funding for Lending scheme and the Term Funding Scheme (TFS), designed to improve the supply of credit in the aftermath of the GFC and the Brexit referendum respectively. These schemes closed to new loans in January 2018 and February 2018 respectively.

[29] Gilt coupon payments (net of interest costs) are automatically transferred to the Treasury. See the Governor's letter to the Chancellor (9 November, 2012) and the 2021 APF Annual Report .

it exceeds a cap, net profits are transferred to the Treasury (between thresholds, there is a 50 percent dividend transfer). This comprehensive recapitalization framework means indemnity of individual operations have become less important for mitigating risks to the Bank's balance sheet.[30] Consistent with this, the Bank's Term Funding schemes (previously on the APF balance sheet) were transferred to its main balance sheet in 2019, financed by general capital.[31]

The Treasury has played a role in the design of support operations to the non-financial sector but the level of central bank reserves is determined by the Monetary Policy Committee's (MPC). Although the expansion of the APF was officially requested by the BoE, the request letter established a role for the Treasury to provide views on the design of private sector asset purchases 'in light of their broader economic objectives and in view of the risks posed to the public sector balance sheet'. The CCFF, on the other hand is explicitly 'the Treasury's facility operated by the Bank as an agent'. The Treasury is responsible for CCFF's financial exposures (an indemnity is provided) and determines which firms are eligible to take part in the facility. However, since this scheme is financed with the creation of central bank money, the MPC took the size of the CCFF into account when it took its decisions on the target stock of government and corporate bonds financed by reserves.[32]

Disclosure, information-sharing and accountability practices are strong. The BoE provides regular information on the usage of all its crisis-interventions schemes and details of the modalities of the operations are set out in published 'Market Notices'. In the case of the CCFF, the names of businesses and outstanding amounts were published weekly. In addition, the APF produces quarterly reports with details of all transactions undertaken. Information-sharing agreements with the Treasury are set out in the 2018 MOU, although some of the APF's operations are subject to enhanced information sharing. No additional accountability mechanisms were introduced for the Bank's Covid operations, but the existing framework is relatively strong and includes the Bank's Annual Report, public appearances by officials before the Treasury Select Committee and audits by the National Audit Office. The Office for Budget Responsibility also produces a fiscal risks report, which includes risks from the BoE's operations for the public finances. Finally, the government also publishes Whole of Government Accounts (WGA), which also consolidate the BoE, although these are only available with a considerable lag.

Increased sensitivity of public debt to interest rate rises, and likely losses related to the BoE's Gilt holdings, highlight the challenges from exit. The £895bn of Gilt purchases funded by overnight reserves that are remunerated at the official interest rate (Bank rate) has made public sector debt highly sensitive to interest rate changes. The Office for Budget Responsibility estimated that a one percentage point rise in Bank rate would lead interest payments (on consolidated public sector liabilities) to increase by around 0.51% of GDP in the first year (an increase of 0.15 percent of GDP relative to pre-Covid). Such a material cost to the Treasury has stimulated some public debate around remuneration of reserves and ideas of a tiering system,

[30] Principles 2 and 3 of the MOU deal with the nature and size of the Bank's operations. They state that secured lending & asset purchase operations under conventional monetary policy implementation ought to be backed by the Bank's own capital, provided that the absolute amount of risk (measured in capital requirements), is less than actual loss-absorbing capital. This also applies to the TFSME.

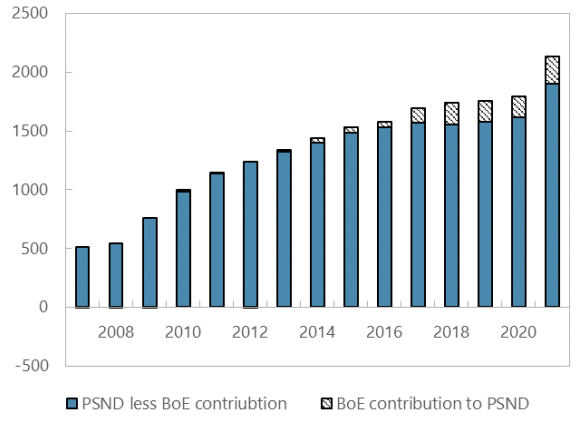
[31] The Bank's previous Funding for Lending scheme remained off balance sheet, however. According to the 2020 Annual Report it is 'a fully collateralised scheme, classified as off balance sheet under a collateral swap arrangement, which allows participants to borrow UK Treasury bills in exchange for eligible collateral'

[32] From Governor Bailey's letter to the Chancellor (17 March, 2020): 'The Committee will continue to decide on the overall amount of asset purchases that are financed by central bank reserves. It will therefore take the size of the CCFF into account when it takes its decisions on the target stock of government and corporate bonds financed by reserves.'

whereby only a small amount of banks' reserves would be fully remunerated. However, such suggestions have been firmly rejected by the Bank, on the grounds that they would interfere with the setting of monetary policy and impose an effective tax on the banking sector. At the same time, a flattening in the yield curve since the start of the pandemic (partly a consequence of APF purchases) implies the market value of the Bank's Gilt holdings is greater than the face value by around GBP 230 billion[34] (**Figure 5**). If the Treasury were to repurchase the Bank's holdings to facilitate exit, this would imply realized mark-to-market losses and a further increase in government debt, meaning this option would be challenging to execute.

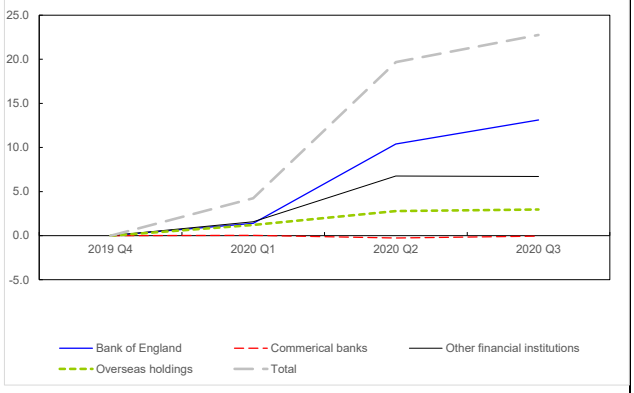
Reflecting the challenges from such a large balance sheet, an exit strategy was outlined in August 2021 with the objective to begin shrinking the balance sheet in market-led way *prior* to the normalization of interest rates. The exit strategy for the Bank's private sector lending programs is clear: end dates (beyond which no new loans can be made), fixed maturities and in some cases, the possibility of early repayment (e.g., the CCFF and TFSME). For Gilt holdings, an exit strategy was announced in August 2021, and reductions in the stock outstanding began after the policy rate rose to 0.5 percent (initially through non-reinvestment of proceeds, then active selling once rates reached 1 percent). The Governor outlined the Bank's objective is to actively shrink the balance sheet, reflecting the long-maturity of its gilt holdings but also in order to have ammunition for future crises.[35] The securities are to be sold back to the market, rather than bought back by government, supporting transparency and accountability. Importantly, the way in which the BoE conducts gilt sales does not affect the arrangement whereby the Treasury fully indemnifies losses.

Figure 5. UK Public Sector Net Debt (PSND) (GBP billion)



Source: ONS
Public Sector Net Debt nets off liquid assets. Public sector holdings of debt within the public sector are consolidated.

Figure 6. Change in Holdings of UK Government debt (percent of GDP, indexed: 2019Q4=0)



Source: OBR

[34] See Figure 9 in ONS Public Sector Finances, UK: September 2021.
[35] https://www.ft.com/content/fc71adfe-8b8d-4656-bafa-24add419b18f

United States[36]

The consolidated balance sheet of the US Federal Reserve Banks expanded by 15 percent of GDP during 2020, through increased holdings of Treasuries and Mortgage-backed securities (MBS). Several liquidity programs were extended, some of which had been previously used in the GFC and some new programs, particularly those focused on supporting households and firms. Several programs were structured in SPVs to which the Treasury provided strong ex-ante loss protection. The amounts provided to each individual facility were also determined after discussions between Treasury and Fed officials highlighting close coordination. On the liability side, there was a large buildup of Treasury deposits at the Fed of over 6 percent of GDP, as the Treasury increased debt issuance to pre-finance a large but uncertain amount of pandemic-related spending. Although direct financing of government by the central bank is prohibited by law, the Fed's secondary market purchases facilitated Treasury borrowing, through their impact on market liquidity and the yield curve.

Overview

During 2020, the consolidated balance sheet of the US Federal Reserve Banks (Fed) expanded from 19.4 to 34.2 percent of GDP, primarily owing to an increase in US Treasuries and MBS held. Of the 17.2 percent of GDP increase in securities held, about half was financed by an increase in bank reserves and other deposits. On the liability side, US Treasury deposits held at the Fed increased over $1.3 trillion (6.6 percent of GDP) as the Treasury decided to pre-finance a large but uncertain amount of pandemic-related spending. The Treasury sold $1.3 trillion more securities in the primary market than it needed to finance the 2020 calendar year deficit while the Fed bought approximately twice as much debt ($2.4 trillion) in the secondary market during the same period.

There was thus an unusually large disparity between the increase in gross and net central bank claims on government and, correspondingly, between the Fed's acquisition of interest-earning assets and issuance of interest-bearing liabilities—with the former roughly double the latter. This disparity was reversed in 2021 as Treasury balances at the Fed fell by $1.4 trillion. During 2021, Fed securities held outright increased by $1.5 trillion while interest-bearing reverse repos and bank reserves increased by $2.7 trillion (12-month change ended December 8, 2021, *to be updated)*. This compares with the 2020 figures of $3.2 trillion and $1.3 trillion respectively.

The Fed introduced 13 credit facilities in 2020, 5 of which are subsumed below in the FRB of Boston's "Main Street" LLC.[37] Although the potential utilization of these facilities was large—possibly more than $2 trillion, in the event the take up was slight, amounting to 1 percent of GDP measured by the size of the facilities as of end-2020. The US Treasury provided capital support to the 9 facilities structured as VIEs through authorization provided by the CARES Act. As of end-2020, Treasury support amounted to 0.5 percent of GDP so that, measured "ex post" the Fed was extremely well protected against losses. The 4 other facilities received support either through the Treasury ESF[38] prior to the passage of the CARES Act or took fully government-

[36] Prepared in December 2021 by Peter Stella.

[37] An extensive discussion of the Main Street Lending Program is provided in Arseneau, et. al (2021).

[38] For a discussion of the ESF and its role early in the pandemic see Congressional Research Service (2020).

guaranteed loan collateral. In 2021, the Fed returned part of the Treasury's previous equity investment in the VIEs.

Table 1. Change in the Consolidated Balance Sheet of the Federal Reserve Banks From 12/31/2019 to 12/31/2020
(in percent of GDP)

Assets		Liabilities	
US Treasuries	13.2	FR Notes Outstanding	1.8
MBS and Federal Agencies	3.6	Bank Deposits	7.5
Consolidated VIEs	0.7	Reverse Repos	-0.5
Liquidity Providing Repos	-1.2	US Treasury Deposits	6.6
Foreign Exchange Swaps	0.1	Other Deposits	0.7
Loans to Liquidity Facilities	0.3	Equity	0.0
Net Other Assets	0.1	UST Interest in VIEs	0.5
Total Assets	16.7	Total Liabilities	16.7

Sources: Federal Reserve Banks Combined Financial Statements (2021), IMF WEO Database and staff calculations

New Programs and Governance Structures in the Response to COVID-19

The Fed introduced 11 new programs during 2020 in response to the pandemic. Those lending facilities bore some similarities but also differed from those introduced at the outset of the GFC in 2008. In both cases, facilities were designed to be attractive only to borrowers who could not obtain finance at normal market rates[39]—indeed, the Primary Market Corporate Credit Facility, announced on March 23, 2020, had not recorded a single transaction as of November 15, 2020, and, as of the same date, the Municipal Liquidity Facility had completed just two transactions with a total loan value of $1.7 billion, less than half of 1 percent of the Facility's note purchase authorization of $500 billion.[40] External operational assistance was brought in during 2020 as it was during the GFC. For example, in March 2020 PIMCO was selected as the CPFF investment manager and State Street Bank and Trust as custodian and accounting administrator. On the other hand, facilities designed in 2020 had a quite different intended clientele than those introduced during the GFC both owing to the novelty of the economic consequences of the pandemic and the fact that US banks were much more liquid and well-capitalized in 2020 than in 2008.

Whereas during the GFC, the intended targets were financial institutions including systemically important banks, the emphasis during the pandemic was providing support to small and medium sized

[39] Federal Reserve Regulation A specifies that emergency lending facilities must charge an interest rate that is a premium to the market rate in "normal" circumstances.

[40] See United States Government Accountability Office (2020) pages 34 and 39.

businesses, non-profits, state, municipal and tribal governments. Hence the moniker "Main Street" chosen by the Fed for 5 of its programs contrasted well with the oft alleged criticism that during the GFC it assisted only "Wall Street". That said, the Fed did reintroduce three facilities that had been employed during the GFC, the Commercial Paper Funding Facility, the Money Market Mutual Fund Liquidity Facility, and the Primary Dealer Credit Facility. As seen in Table 2, the combined utilization of the three facilities as of end 2020 was small, less than $15 billion. A second innovation compared with the SPVs set up during the GFC was that Treasury, authorized explicitly by the CARES act, provided ex ante loss protection. Although only $112.5 billion of the $454 billion authorized to support Fed lending facilities was provided, it proved more than ample to cover potential losses owing to the modest take up of the various facilities. The amounts provided to each individual facility were determined after discussions between Treasury and Fed officials. Starting in January 2021 the loss protection provided by Treasury was gradually withdrawn.[41]

Table 2 understates the degree of protection provided by Treasury to the VIEs.[42] As part of the agreement between Treasury and Fed, VIEs were required to hold 85 percent of their respective Treasury equity contribution in non-marketable Treasury securities. Consequently, approximately 68 percent of the net assets of the VIEs, $96 billion out of a total of $140 billion, comprised risk free Treasury securities. Put differently, the Treasury equity contribution of $112.5 billion was effectively available to cover possible losses on a risky asset portfolio of only $44.5 billion compared with total on-balance sheet assets of $195 billion.

Table 2. Select Lines from Consolidated Balance Sheet of the Federal Reserve Banks
December 31, 2020
(in US$ billions)

New Program Assets		UST Loss Protection Provided	
Consolidated VIE Net Assets		UST Interest in VIEs	
Main Street (Loans to Non-Financial Entities(NFEs))	51.6	Main Street LPs	37.5
Corporate Credit Facility (Loans to NFEs)	46.5	CCF	37.5
Municipal Liquidity Facility (NFE Asset Purchases)	21.3	MLF	17.5
Commercial Paper FF II (NFE Asset Purchases)	8.5	CPFF II	10.0
Term Asset-Backed LF II (Loans to NFEs)	12.2	TALF II	10.0
Loans to/by New Facilities			
PPPLF Loans to banks to on lend to SMEs (NFEs)	50.4	PPP Loans fully guaranteed by US Treasury	
MMLF loan support to banks to support MMFs (FM)	3.6		
PDCF loan support to Primary Dealers (FM)	0.5		

[41] As of 1 December 2021, $97.2 billion had been withdrawn leaving $21.3 billion remaining. By way of comparison, the Fed remitted to Treasury $87 billion in earnings during 2020. (Fed earnings remittances to Treasury averaged $83 billion during the decade 2010-19). Thus, the Fed could have returned the entire Treasury equity contribution by retaining just 20 percent of its net income as equity. Compare the Fed's uninterrupted net income distribution (in some years greater than net income earned) with the Bundesbank's 2021 decision not to distribute a profit to the Federal Government—for the first time since 1979—owing to a greater level of risk provisioning.

[42] The SPVs are called VIEs (variable interest entities) on the Fed balance sheet as we do in the following.

Total Assets	194.7	Total Direct Credit Protection Provided	112.5

Source: Federal Reserve Banks Combined Financial Statements (2021) and staff calculations

Netting the aforementioned non-marketable Treasury securities, the quantitatively most significant new Fed program launched during the pandemic was the Paycheck Protection Program Loan Facility (PPPLF). The PPPLF supported the Treasury's Paycheck Protection Program whereby the Small Business Administration (SBA) approved loans originated by banks, nonbank financial and fintech companies to employers who pledged not to reduce their payrolls below 90 percent of the pre-pandemic level. The PPPLF provided nonrecourse financing to entities that originated PPP loans taking the loans as collateral at par value. Since the PPP loans were fully guaranteed by the SBA/Treasury, the Fed determined that no additional loss protection was required from Treasury.

The SBA approved $800 billion of PPP loans as of the availability expiration date—May 31, 2021.[43] The take-up of financing from the Fed was rather modest. The highest level of loans outstanding at any point in time under the PPPLF was $91 billion at end-June 2021. As noted above, banks by and large were not liquidity constrained during this period, so the primary beneficiaries of the program were nonbanks and fintechs without access to other Fed facilities such as the discount window.

Interpreting Fed Asset Purchases and Fluctuations in the Treasury General Account

The Treasury Financing Challenge Amidst Extreme Uncertainty

The most unusual Fed balance sheet phenomenon during the pandemic was the sharp rise in the balance held by the Treasury in its General Account at the New York Fed (TGA). The purpose of the advance borrowing by Treasury was straightforward. It was abundantly unclear how much the Treasury would need to spend to support the economy through the pandemic. There was the need to design programs that were flexible if not completely open-ended considering the fundamental uncertainty.

There were several financial unknowns related to the quantity and timing of public spending. These included stimulus checks, the extent of any deferment of income tax liabilities both at the Federal and State levels, the potential deterioration in Federal and State finances related to unemployment insurance payments, and the degree to which the PPP would keep employment high (and unemployment-related spending low) thereby delaying the cash impact of Federal spending. The success of the PPP was important. Not only was it motivated by the desire to foster a close relationship between employers and employees during what was hoped to be a temporary government-mandated shutdown of the economy and thereby enable a quick rebound in economic activity, the PPP was intended to avert a massive increase in expenditure by State-financed unemployment insurance funds. To the extent the PPP achieved its objectives, the burden on the States would be reduced and the Federal cash needs delayed until the loan beneficiaries applied for principal and interest

[43] Further details may be found in White (2021).

forgiveness[44]. Congress also decided to offer a Federal "top-up" of state unemployment benefits implying an enhanced cost of PPP failure. Given this extraordinary uncertainty it is understandable that the Treasury, balancing the risks of underfunding versus the costs of overfunding decided to tap financial markets to a historically unprecedented extent in the spring of 2020.

Treasury Debt Tactics and Strategy

As is the case for most established debt managers, the US Treasury announces a debt issuance calendar on a regular basis. For decades, the US approach to debt management has been characterized as "regular and predictable" meaning that significant changes in the types and tenors of securities issued are infrequent, gradual and telegraphed well in advance following extensive discussions with the market. This is particularly the case with longer-duration securities.

Seasonal fluctuations in demand for financing are handled by altering the scheduled auction volumes of short-term debt. These include bills, and fine tuning unexpected idiosyncratic fluctuations by the use of "cash management bills," short term discount instruments issued for irregular maturities outside the regular auction calendar. Owing to the seasonality of tax revenues, the calendar for T-bill issuance in the second quarter is usually the lightest, indeed, usually net issuance of T-bills during that time is negative. Meanwhile, net issuance of longer-term securities is typically spread out evenly over the calendar year.

Faced with an urgent massive financing need and a market unprepared to supply it under pandemic circumstances, a treasury could theoretically obtain financing directly from the central bank, but this is not permitted under US law. Although the Fed can and does participate as a non-competitive bidder in primary auctions of US Treasury debt, it can do so only to the extent it is replacing securities maturing in its portfolio. Consequently, it cannot provide *net* finance through participation in primary auctions. Support from the Fed can only come from purchases in the secondary market that augment the supply of cash in the hands of investors and only indirectly the demand for securities in the primary auction.

During Q2 2020, the US Treasury raised $2.7 trillion dollars in financing (13.5 percent of annual GDP). This amount was more than the cumulative sum raised during the preceding 3 fiscal years. Of the total sum raised, net T-bill issuance accounted for 88 percent.[45] As a result, the weighted average maturity of Treasury debt held by the public—a concept that includes the Federal Reserve Banks—fell from 70 to 62 months.

Over roughly the same period,[46] Fed holdings of marketable US Government debt rose by $1.2 trillion. Owing to the constraint mentioned above, the design of the Fed's extant large-scale asset purchase programs, and policy considerations, none of the Fed's securities purchases comprised T-bills. Although the Fed had been accumulating T-bills in its SOMA portfolio in Q1 2020[47], the Fed ended 2020 with precisely the same holdings as on March 25, 2020, $326 billion. The combined consequences of the Fed and Treasury policies

[44] The PPP was designed so that the primary distribution of cash came from banks to borrowers. Consequent on the borrowers fulfilling their payroll obligations they would apply to the SBA for loan forgiveness which, once granted, entailed a repayment of the banks from the Treasury. This deffered the need for Treasury borrowing at the outset.

[45] Over the preceding 3 fiscal years, net T-bill issuance accounted for 27 percent of the funds raised.

[46] Fed data is available on a weekly basis, the end points here are 25 March and July 1, 2020.

[47] For most of the GFC the Fed roll-over policy had been to reinvest all maturing notes and bonds in notes and bonds rather than in line with its previous policy of rolling over the entire portfolio in proportions of bills, notes and bonds determined by the weekly Treasury offerings. By 2019, the Fed had reverted to the previous policy and was thus accumulating T-bills as part of its rollovers.

during Q2 2020 were that the amount of T-bills in the hands of the public (ex FRBs) rose by the full amount of the net issuance of T-bills, $2.4 trillion, while the quantity of other Treasury securities—notes and bonds—in the hands of the public (ex FRBs) fell by $905 billion. That is, the Fed bought $905 billion in notes and bonds in the secondary market more than the rest of the market bought from the Treasury in primary auctions during Q2. This reduced the real weighted average maturity of the consolidated US debt by considerably more than the unadjusted Treasury figures above.

The TGA also rose by $1.3 trillion during the same period,. Tracing through the flows, it is evident that the Fed purchases of $1.2 trillion of notes and bonds added virtually the same amount of liquidity that the Treasury withdrew through T-bills to pre-fund pandemic spending. The Fed clearly facilitated Treasury borrowing, both by acting forcefully in the long end of the secondary market—thereby enhancing the Treasury's ability to stick with its regular and predictable note and bond auction schedule during a period of severe market turmoil[48] and by providing sufficient liquidity for Treasury to raise a historically unprecedented amount of pre-funding and grow the TGA.

During the five quarters subsequent to Q2 2021, the Treasury effected net redemptions of T-bills and significantly increased the quantity of coupon securities[49] offered so that its (unadjusted) portfolio weighted average maturity rose to 72 months, higher than prior to the pandemic. As budget forecasts suggested that quarterly borrowing may safely be reduced, Treasury planned to reduce the amount of coupon securities offered at auction. Were coupon securities to continue to be offered at recent volumes, the supply of T-bills in the market would fall below what is considered prudent and adequate to meet market needs.[50]

The pandemic coordination of monetary operations and debt management has an interesting precedent during the GFC. Following the liquidity injection necessitated by the collapses of Lehman Brothers and AIG, the Fed did not hold sufficient securities to absorb excess liquidity and the fed funds rate became unstable and fell below the FOMC target. This being prior to the Fed obtaining authority to pay interest on reserves which would have enabled it to raise the fed funds rate and prior to the decision to cut the floor target rate to zero. On September 15, 2008, the Wednesday following the Lehman insolvency, the Treasury announced a supplemental financing plan and proceeded to issue more than $600 billion in cash management bills to assist the Fed to bring the money market into equilibrium[51].

During the first months of the pandemic, the Treasury again raised its balances at the Fed quickly and massively, not to assist the Fed with monetary policy but to pre-fund expenditure. It was the Fed, employing monetary operations, who assisted Treasury to make an urgent change in debt strategy.

[48] The yield on the US 10-year Treasury bond fell from 1.86 percent in December 2019 to 0.66 in April 2020.

[49] Average auctions have increased from about $300 billion to about $650 billion per quarter.

[50] See Liang (2021).

[51] The funds raised by the Treasury were deposited in a newly created SFP account at the NY Fed.

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