

The Power of Central Bank Balance Sheets

Keynote Speech by Athanasios Orphanides

When interest rate policy is hampered by the Zero Lower Bound (ZLB), quantitative easing and other balance sheet policies become essential tools for responding to a crisis or deflationary shock. By unleashing the power of their balance sheets at the onset of the pandemic, without the hesitation observed in past encounters with the ZLB, the Federal Reserve, the European Central Bank and the Bank of Japan provided monetary easing that cushioned the economic blow, served as a backstop to government securities and private assets that prevented a financial market meltdown and facilitated the financing of an essential fiscal expansion. This paper examines how this policy success materialized, drawing on lessons learned from previous encounters with the ZLB, and discusses policy challenges after the pandemic.

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I. Introduction

When interest rate policy is hampered by the Zero Lower Bound (ZLB), quantitative easing (QE) and other balance sheet policies become essential tools for responding to a crisis or deflationary shock. By unleashing the power of their balance sheets at the onset of the pandemic, the Federal Reserve (Fed), the European Central Bank (ECB) and the Bank of Japan (BOJ) provided monetary easing that cushioned the economic blow, served as a backstop to government securities and private assets that prevented a financial market meltdown and facilitated the financing of an essential fiscal expansion.

This was a case of policy success. Central banks in advanced economies activated the power of their balance sheets without the hesitation observed in previous encounters with the ZLB. Lessons learned from the experience of these central banks in the aftermath of the Global Financial Crisis (GFC), and even earlier, Japan's encounter with zero interest rates at the turn of the century, proved valuable for providing useful policy guidance and avoiding pitfalls that contributed to less than ideal outcomes in the past.

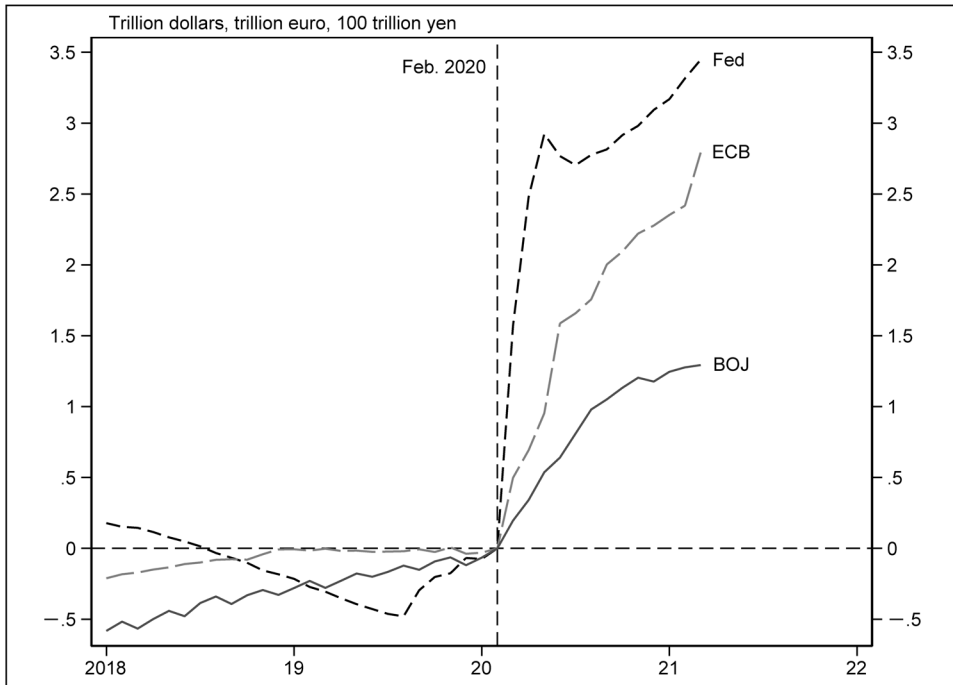
The central bank policy response to the pandemic in 2020 compares favorably to the earlier episodes in multiple dimensions. First, once the need for monetary accommodation was recognized, in March 2020, QE was prompt and decisive, without the delay associated with earlier episodes when this critical policy tool was seen as “unconventional” (as QE was referred to for a time in the aftermath of the GFC). Second, central banks proved more willing to employ the power of their balance sheet to avert a financial meltdown that was developing, as opposed to waiting for sustained market dysfunction and failures of financial institutions to justify their interventions, and acting only to contain the systemic nature of the damage. This was achieved by expanding the eligibility of assets for which the central banks deemed important to serve as a backstop, defusing an incipient panic without costly delay. Third, central banks were more sensitive to the fiscal consequences of their balance sheet policies and more supportive of fiscal expansion. By employing the power of their balance sheets to keep the cost of government debt finance low, central banks facilitated extraordinary fiscal expansions that supported rapid reflation of the economy and reduced the risk of a prolonged period of low inflation and stagnation.

This paper examines how this policy success materialized, drawing on lessons learned from previous encounters with the ZLB, and discusses policy challenges after the pandemic.

II. Unleashing the Power of the Balance Sheet at the ZLB

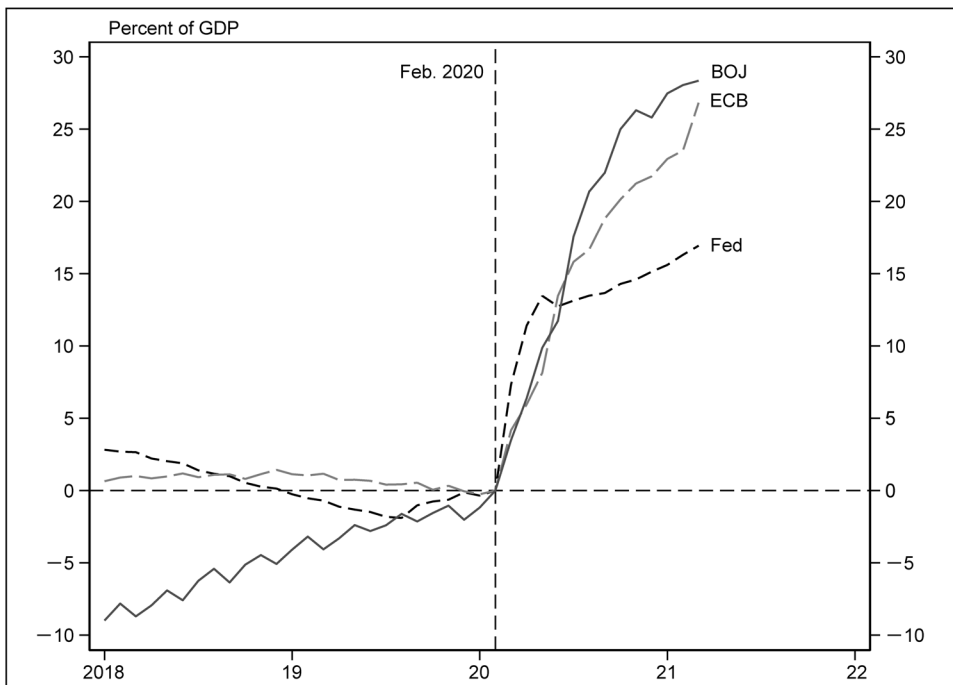
Between March and June 2020, the Fed expanded its balance sheet by \$3 trillion dollars. In three months, the Fed “printed” as much high-powered money as it did over the first 100 years of its history, from 1913 to 2013. The Fed was not alone; the BOJ and the ECB engineered similarly massive balance sheet expansions (Figure 1). The three central banks enlarged their balance sheets by creating reserves out of thin air, a power that central banks always have in a fiat currency regime. The balance sheet expansions generated monetary firepower in the range of 15% to 25% of GDP (Figure 2).

Figure 1 Size of Central Bank Balance Sheet



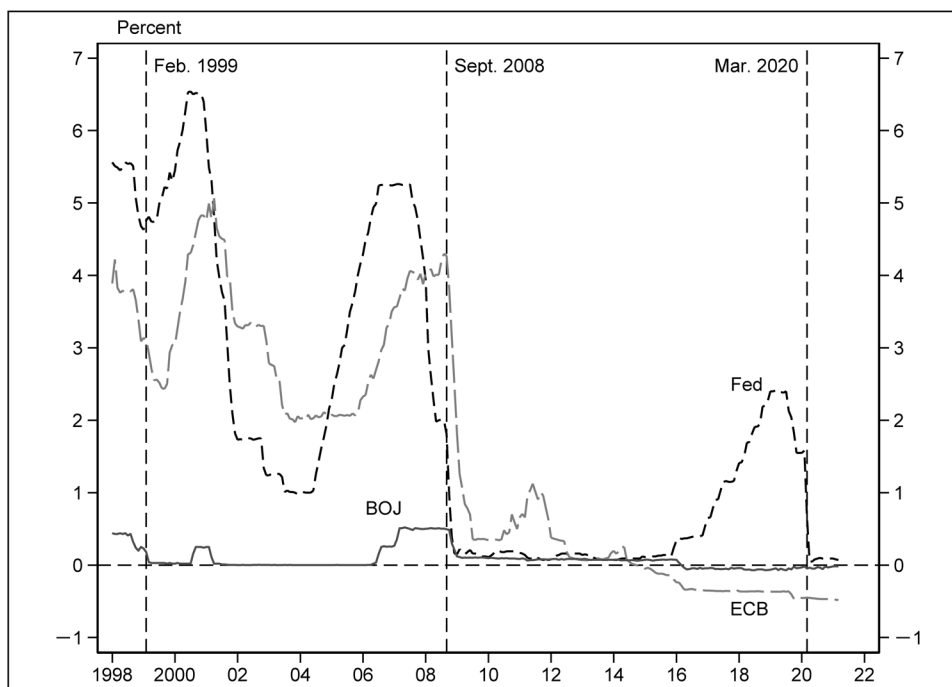
Note: Monthly data relative to February 2020.

Figure 2 Central Bank Balance Sheet as Ratio to GDP



Note: Monthly data relative to February 2020. Ratio to average GDP over previous four quarters.

Figure 3 Three ZLB Episodes: Policy Rate



Note: Monthly data.

Ordinarily, such unprecedented money printing would be cause for alarm. When misused, the power of central bank balance sheets can wreak havoc on the economy. Textbook responses to a crisis suggest cutting policy rates as the first line of defense. But when interest rate policy is hampered by the ZLB, a balance sheet expansion is the indicated policy response. Issuing reserves and using them to purchase assets and/or provide liquidity that encourages lending is an effective means of providing monetary accommodation without reducing the overnight interest rate. Balance sheet expansions can be used to compress interest rate spreads, reduce term premia, and boost asset prices—all operations that can reduce the costs of financing for households and businesses, and support aggregate demand.¹

Two previous encounters with the ZLB over the past quarter century shaped the policy response we observed last year (Figure 3). The first episode, which affected only the BOJ, occurred in the aftermath of the Asian financial crisis of the late 1990s. All three central banks needed to ease policy but the BOJ was constrained and after cutting rates 50 bps reached zero in February 1999. Additional easing was needed but could not be achieved through interest rate cuts. What was not fully appreciated at the time was that equilibrium real rates had been declining around the world and substantial

1. Since the late 1990s, an extensive literature has examined the monetary policy challenge at the ZLB (see e.g. Fuhrer and Madigan [1997] and Krugman [1998]). Reviews of alternative policy options include Goodfriend (2000), Clouse *et al.* (2003) and Bernanke (2020). Purchases of long-term government debt by the central bank—the canonical form of QE—was first proposed by Keynes in 1930 as a means to counteract the “slump” that followed the 1929 crash (Orphanides [2004]).

QE would be necessary to defend against deflation, once interest rate policy became constrained. Although some observers drew attention to the need for QE, overall the economics profession did not help. The highly stylized models of the macroeconomy that were popular for academic research at the time assumed that nothing other than the central bank's short-term interest rate matters for the monetary policy transmission, misleading some policymakers into doubting the power of central bank balance sheets at the ZLB.

The second episode, is associated with the GFC that followed the decision by US authorities to let Lehman Brothers collapse in September 2008. Within days of that decision and facing the specter of an economic collapse comparable to the Great Depression of the 1930s, the Fed, the ECB and the BOJ lowered interest rates towards the ZLB and over time developed supportive balance sheet policies (Figures 4 and 5). Over the subsequent decade, from 2009 to 2019 all three of these central banks expanded their balance sheets to support the economy.

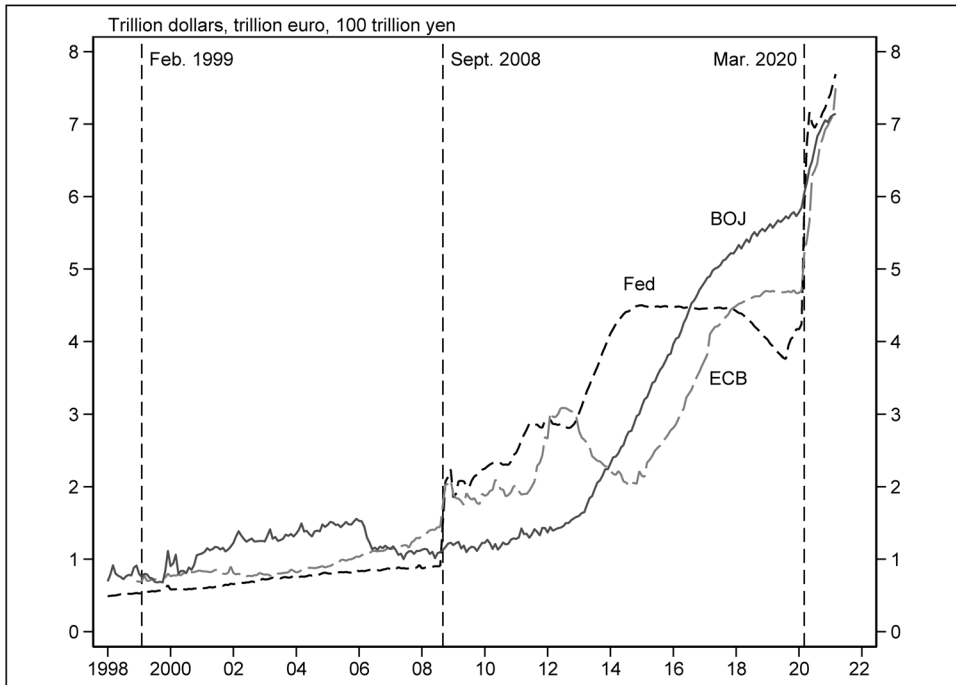
Balance sheet expansions can serve as an imperfect substitute for additional policy easing at the ZLB.² However, the policy multipliers associated with balance sheet policies are subject to greater uncertainty than those associated with interest rate policy. This multiplicative uncertainty typically argues for a more cautious approach to balance sheet expansions when the ZLB is first encountered.³ But gradualism can also prove counterproductive. An overly cautious approach to introducing “unconventional” monetary policy accommodation measures at the ZLB implies that monetary policy will be too restrictive for some time, risking a prolonged period of low inflation and stagnation. Without the necessary accommodation, inflation expectations may drift lower and become disanchored, making it harder for the central bank to raise inflation in line with its price stability objective. The experience of Japan during the 2000s served as a cautionary tale of these risks.

In retrospect, the balance sheet expansions after the GFC, during the 2010s were insufficient to raise inflation close to 2%, in line with the price stability goals of the Fed, ECB and BOJ. But the differences in the experience of the three central banks were informative. The BOJ adopted an aggressive QE program only since 2013. Though the ECB initially expanded its balance sheet after the GFC, it subsequently significantly reduced it between 2012 and 2014, a policy error that resulted in an unwelcome decline in underlying inflation. By the time the ECB started expanding its balance sheet once again in 2015, inflation expectations were disanchored and the ECB's asset purchases were not as vigorous as they needed to be to reverse this disanchoring of inflation expectations and, consequently, the problem of low inflation persisted. Of the three central banks, the Fed expanded its balance sheet more promptly and consistently after encountering the ZLB, and managed to bring inflation close to its 2% goal and start raising interest rates in the second half of the decade. Measured as a ratio of GDP the Fed's overall balance sheet expansion was smaller than that of the ECB and the BOJ, supporting evidence that prompt and decisive action is a more effective approach for

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2. See Doniger *et al.* (2019) and Hofmann *et al.* (2021) for illustrations of this substitutability.

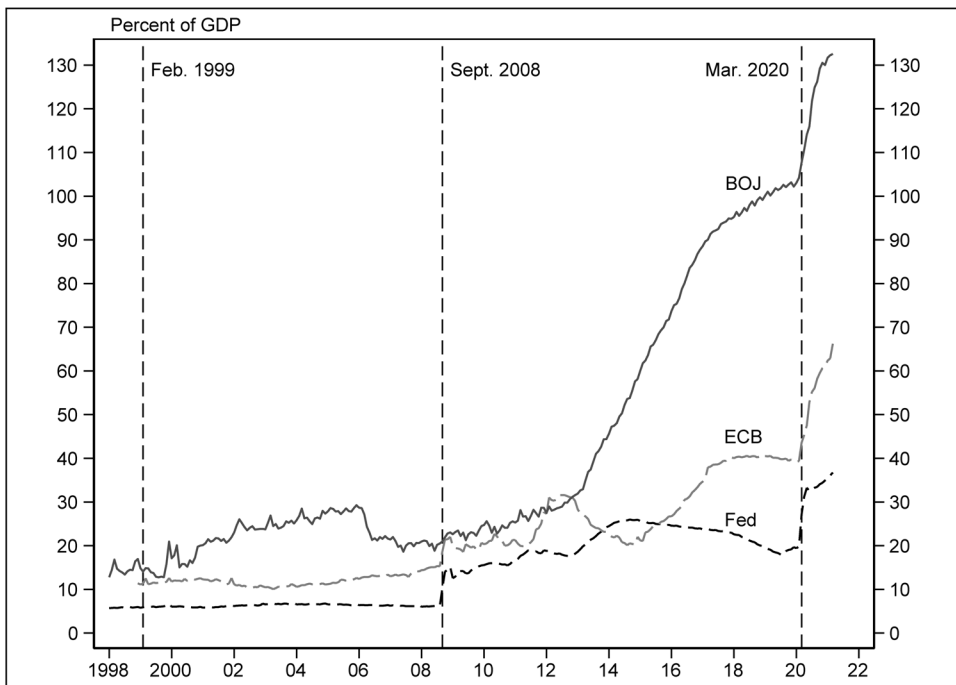
3. If the effectiveness of interest rate is subject to less uncertainty, another implication of the uncertainty of balance sheet policies is that interest rate cuts should be more forceful *before* the ZLB is reached (Orphanides and Wieland [2000]).

Figure 4 Three ZLB Episodes: Balance Sheet Size



Note: Monthly data.

Figure 5 Three ZLB Episodes: Balance Sheet Ratio



Note: Monthly data. Ratio to average GDP over previous four quarters.

escaping the ZLB.

The experience with balance sheet policies accumulated after the GFC helped refine estimates of the multipliers associated with balance sheet policies. Although it took time, in the aftermath of the GFC, it was eventually recognized that the natural rate of interest had declined even more than had been appreciated earlier. Policymakers had misjudged the stance of policy accommodation for several years.⁴ More easing would have been advisable in the decade following the GFC than was recognized in real time.

III. The Response to the Pandemic

By January 2020, inflation was lower than policymakers in all three central banks would have preferred and there was little room for the Fed, and effectively no room for the ECB and BOJ, to cut rates in response to a deflationary shock. The forceful balance sheet expansions engineered by the three central banks in the Spring of 2020 reflected the recognition that while considerable monetary policy easing was needed to respond to the pandemic, the room for interest rate policy easing was severely limited or non-existent.

Figure 6 plots the two-year OIS rate in dollars, euro and yen providing a visual summary of the limited interest rate space available to respond to the pandemic in 2020. By late February investors expected the Fed to cut rates (and the Fed quickly exhausted the room available), but that the ECB and BOJ would leave policy rates unchanged at their slightly negative levels, despite the need for additional accommodation. Figures 7 and 8 track daily developments in the stock and corporate bond markets, summarizing market participants' views of the deterioration of economic prospects as the seriousness of the pandemic was recognized and the success of the global policy response in tacking the challenge. As can be seen, market jitters already appeared in late February, with stock prices declining and risk spreads notably widening.

In an unscheduled meeting on March 3, the Fed delivered a 50 basis points reduction of the federal funds rate from about 1–5/8% to 1–1/8%. By then, the two-year OIS rate was well below 1%, suggesting more easing was expected. This first easing proved insufficient to arrest the deterioration reflected in the prices of stocks and corporate bonds.

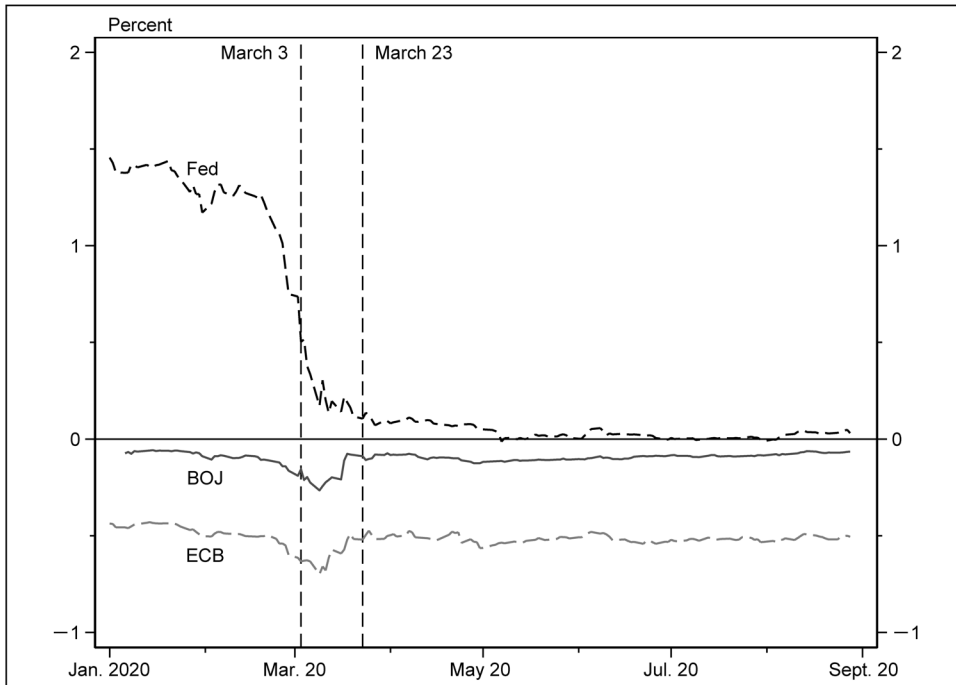
On March 11, the World Health Organization declared the outbreak of the novel corona virus a pandemic.

At the conclusion of its regularly scheduled meeting on March 12, the ECB announced a series of balance sheet easing measures, with emphasis on liquidity provision, along the lines of programs it had developed in the aftermath of the GFC. However, the overall market sentiment was that the communication did not deliver the assurance of decisive action needed to ease market participants' concerns about the fragility of the euro area.

Following yet another unscheduled meeting, on Sunday, March 15 at 5pm the Fed

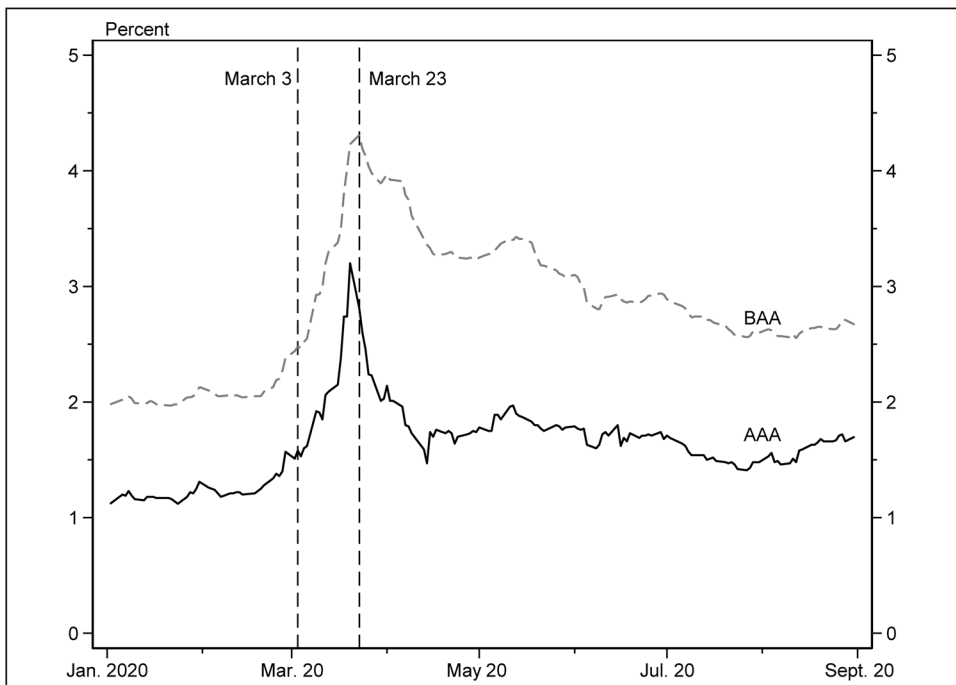
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4. Policy errors of this kind are not uncommon and, to some extent, are unavoidable in light of the limited knowledge available about the structure of the economy and its evolution over time. The economic consequences of such errors can be mitigated with policy frameworks that stress robustness, cf. Orphanides and Williams (2002).

Figure 6 The Limited Interest-rate Policy Space During the Pandemic

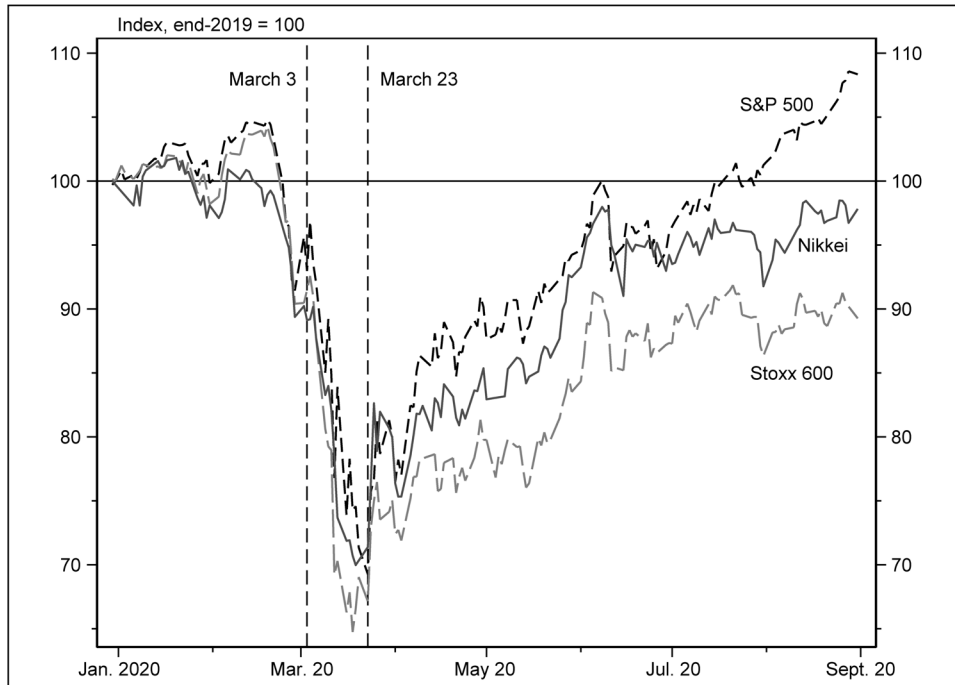


Note: Daily data. Two year OIS rate in dollars, euro and yen.

Figure 7 Corporate Debt Spreads



Note: Daily data. Spread of Moody's BAA and AAA bond yields over 10-year Treasury.

Figure 8 Equity Indexes

Note: Daily data.

announced its return to the ZLB with a reduction of the federal funds rate by the remaining 100 basis points it had available. It further announced an increase in the purchases of Treasury securities and agency mortgage-backed securities (the tools it had employed for most of its balance sheet expansion after the GFC) and additional liquidity measures supporting the flow of credit to households and businesses (Federal Reserve Board [2020a, b]).

Simultaneously with these announcements, the Fed also announced a coordinated central bank action to enhance the provision of dollar liquidity via the standing swap line arrangements (Federal Reserve Board [2020c]). This was a critical demonstration of global central bank cooperation, along the lines of arrangements that proved immensely successful during the GFC. Joining the Fed, the ECB, and the BOJ were the Bank of Canada, the Bank of England and the Swiss National Bank.

By the time this announcement was made in Washington on Sunday afternoon, it was already Monday morning, March 16, in Tokyo. The BOJ moved its scheduled meeting that was meant to start two days later and grasped the opportunity to announce a series of additional easing measures together with the coordinated swap line arrangements. These measures included additional purchases of government bonds, corporate bonds, exchange traded funds and Real Estate Investment Funds. In addition the BOJ introduced special funds-supplying operations to facilitate corporate financing (Bank of Japan [2020]). In effect, the BOJ aggressively employed the power of its balance sheet to effectively backstop not only government securities but also private assets.

On March 18 the ECB announced the Pandemic Emergency Purchase Programme

(PEPP). This represented a new policy innovation that was well received by market participants. As discussed below, it provided temporary relief to market concerns about the euro area's fragility.

Between March 17 and 22, the Fed announced a series of additional easing measures, including funding facilities and the establishment of temporary swap lines with nine other central banks, and funding facilities.

These measures by the three central banks were quite important steps for providing financial support during an episode of intense stress and undoubtedly averted a greater deterioration of market sentiment than was observed. Yet, despite the onslaught of global policy action during the first three weeks of March, equity and credit markets continued to deteriorate.

Market sentiment turned on March 23. Stock prices rallied and corporate bond spreads tightened notably following a series of new measures announced by the Fed that underscored the Fed's resolve to serve as a backstop not only to government securities, as it had already been doing, but also to private credit. Using its authority under Section 13(3) of the Federal Reserve Act, which can be utilized under "unusual and exigent circumstances", the Fed established the Primary Market Corporate Credit Facility for new bond and loan issuance and the Secondary Market Corporate Credit Facility to provide liquidity for outstanding corporate bonds (Federal Reserve Board [2020d]). The Fed would stand ready to purchase newly issued corporate debt and support trading in previously issued debt.

Arguably the most important aspect of these programs was eligibility. The Fed announced that it was ready to backstop corporate debt issued by businesses with an investment-grade credit rating (BBB). Crucially, on April 9 the Fed clarified that debt that was eligible on March 22 would remain eligible for these programs even if it were subsequently downgraded. By announcing a commitment to use its balance sheet to backstop private credit instruments, including "fallen angels", the Fed effectively short-circuited the downward spiral in bond and equities prices.⁵ That ended the global panic.

IV. Eligibility Boundaries

A central bank can short-circuit adverse market dynamics by using its balance as a potential backstop. Committing to do so promptly can protect against adverse self-fulfilling equilibria with minimal balance sheet expansion.

But what institutions/markets are considered eligible for balance sheet support? The BOJ was already engaging in support of both government and private markets, and had significant experience with equities and even real estate funds.

Before the pandemic, the Fed had relatively limited similar experience but could draw on the lessons from its policies after the GFC. By announcing a commitment to use its balance sheet to backstop private credit instruments, including "fallen angels",

5. With this decision, the Fed also protected the economy from the vulnerability induced by the procyclicality of credit ratings. The destabilizing role of inappropriate uses of credit ratings by central banks and other regulatory bodies was acknowledged after the GFC, leading to calls for modifications in practices (Financial Stability Board [2010]).

the Fed significantly expanded the use of its balance sheet to support markets and effectively short-circuited the downward spiral in bond and equities.

The key was eligibility. In the environment of panic that engulfed global markets in March 2020, it was not sufficient to support selected pockets of the financial system and risk the collapse of other segments. With their actions in March 2020, the BOJ and the Fed demonstrated an appreciation of the risks.

One segment of global markets, dependent on ECB policies, remained under intense stress beyond the end of March, even after the forceful actions by the BOJ and the Fed: European government debt markets. The reason for that is that the ECB has been relying on credit rating agencies to determine the eligibility of government debt for its monetary policy operations. This is a unique practice, not in line with how any other central bank is treating the debt of the governments they serve, and a known source of fragility in the euro area over the past decade.⁶ In times of turmoil, as experienced in March 2020, concern about downgrades by credit rating agencies can evolve into a self-fulfilling crisis. The result can be a debt rollover crisis not driven by fiscal fundamentals but induced by the ECB's policy implementation strategy.⁷

The euro area experienced another intense episode of fragility in March and April of 2020. The fragility is evident in the spreads of government bond yields to OIS rates (Figure 9). These spreads can provide information about episodes when monetary policy transmission is impaired. Ordinarily, they should be very small and fairly stable even during a crisis. With a smooth monetary policy transmission mechanism, changes in current and expected interest rate policy over the next two years are reflected, effectively one-for-one, to government bond yields with similar maturity. This is confirmed for the United States and Japan in the figure, reflecting the Fed and BOJ's success in ensuring a smooth monetary policy transmission. With an uneven transmission, these spreads reflect additional premia, as has been the case in the euro area over the past decade. As can be seen in the figure, as a consequence of the uncertainty induced by the ECB's reliance on credit ratings, spreads diverged in early March 2020, wreaking havoc in euro area government debt markets.

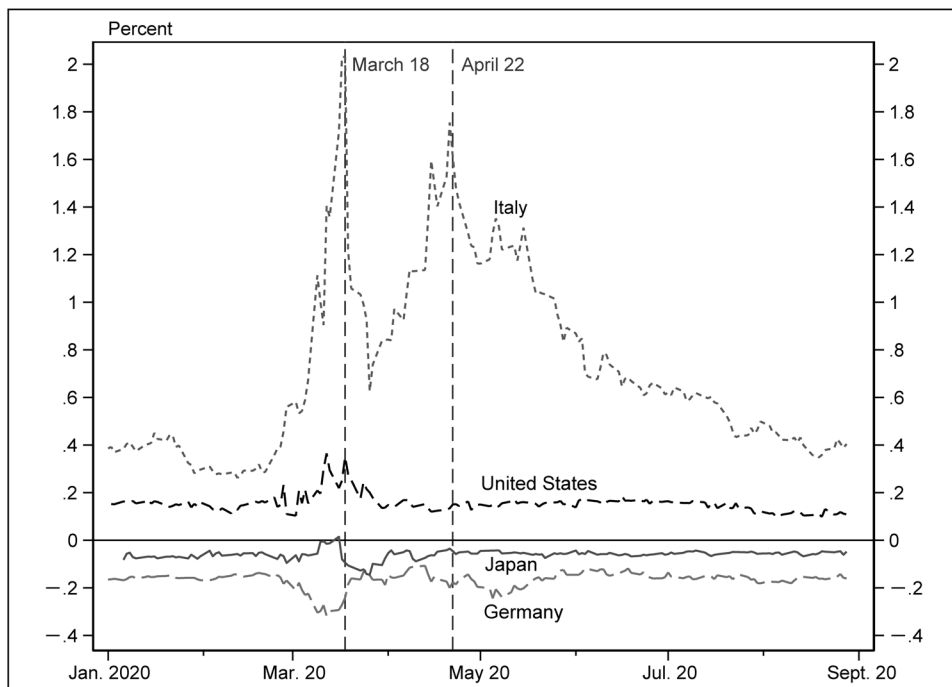
The policy easing measures announced by the ECB at its regularly scheduled meeting on March 12 did not have the desired effect because the ECB failed to address the source of this fragility. At the press conference following the meeting, President Lagarde roiled markets further by stating that the ECB was "not here to close spreads".

The ECB subsequently took two important decisions (on March 18 and April 22) aiming to tackle this fragility head on. The first of the two was the announcement of the PEPP on March 18. The PEPP entailed significant new asset purchases that would be explicitly targeted so as to "counter the serious risks to the monetary policy transmission mechanism" (European Central Bank [2020a]). This was a meaningful

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6. This peculiar element of the ECB's strategy for implementing monetary policy can be traced to an unfortunate decision of the ECB Governing Council in 2005 that delegated the determination of eligibility of euro area government debt for the ECB's monetary operations to credit rating agencies. Additional information for this decision and its consequences is provided in Orphanides (2020).

7. See Lengwiler and Orphanides (2021) for a stylized model illustrating how the ECB's collateral framework gives rise to cliff effects and multiple self-fulfilling equilibria in bond yields, inducing occasional sovereign debt crises that would not otherwise arise.

Figure 9 The ECB's Unique Challenge



Note: Daily data. Spread of 2-year government debt yields over OIS rate.

change from the ECB's earlier asset purchases programs. The new policy was initially well received by markets.

However, as is evident in the figure, spreads started to widen again soon after. The widening continued even after March 23 when, as discussed earlier, global stock and bond prices started recovering from their troughs. By mid-April, as global markets were improving, the ECB faced yet another euro crisis episode.

Once again, the key was eligibility. Doubts about the continued eligibility of euro area government debt for monetary policy operations induced by the ECB's reliance on credit rating agencies once again destabilized markets. On April 22, the ECB finally addressed this source of fragility. It announced that it would grandfather the eligibility of marketable assets used as collateral in its credit operations, and thus the eligibility for its asset purchase programs (European Central Bank [2020b]). This was the most important decision taken by the ECB during the crisis. In essence, the ECB suspended the delegation of the determination of eligibility of government debt (as well as other securities) to credit rating agencies. The government debt of member states would continue to retain eligibility as collateral and for inclusion in asset purchase programs, even if it were downgraded. With this decision, the ECB effectively employed the power of the central bank balance sheet as a backstop that could protect the euro area from self-fulfilling adverse equilibria and yet another euro crisis episode.

By expanding the eligibility boundaries for using the power of their balance sheets the three central banks managed to stabilize markets very quickly and efficiently. The

willingness of central banks to use the power of their balance sheets more broadly than they had done in the past was a critical element of the policy success in 2020.

The BOJ had accumulated experience with using its balance sheet as a potential backstop for both government debt and private assets before the pandemic and employed this experience to provide decisive support in March 2020. Faced with the elevated risks of market collapse, the Fed and ECB decided to similarly expand the use of the power of their balance sheets as a potential backstop. For the Fed, the turning point was the March 23 decision to render corporate debt eligible for support with Section 13(3) facilities. For the ECB, the turning point was the April 22 decision to suspend reliance on credit rating agencies for determining eligibility of government debt, thereby suspending the mechanism that had repeatedly caused unnecessary crises in the euro area over the previous decade.

V. Monetary-fiscal Interactions at the ZLB

Another critical element of the central bank policy success in 2020 was the recognition of the role of central banks and their balance sheet policies for facilitating a fiscal response to the crisis. Similar to the GFC, the pandemic necessitated a forceful fiscal response that could have been a challenge for government finances. The collapse of economic activity in 2020 resulted in larger primary deficits and steeper increases in debt ratios than observed in the aftermath of the GFC (Figures 10 and 11). Unlike the GFC, however, the need for extraordinary fiscal accommodation was more widely accepted in 2020 and importantly, central banks recognized their critical role in supporting the financing of this fiscal response with appropriate central bank balance sheet policies.⁸ Concerns about fiscal dominance and fears of high inflation, similar to arguments that discouraged aggressive QE in the aftermath of the GFC remained. However, these arguments did not dissuade the Fed, the ECB and the BOJ from the forceful balance sheet expansion and associated purchases of government debt that were necessary under the circumstances in 2020.

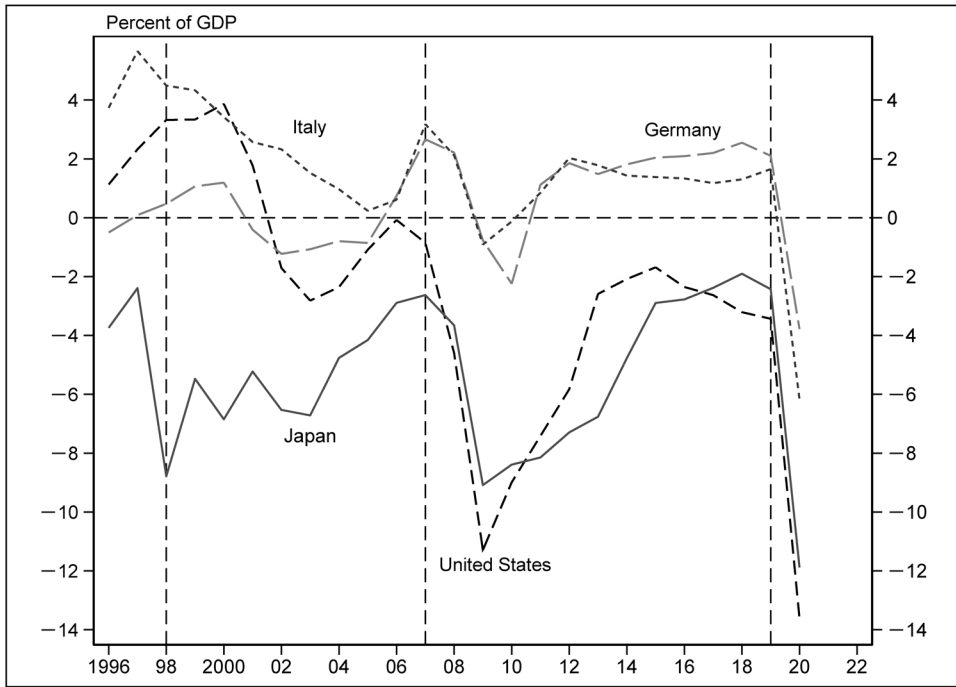
To study the role of central bank balance sheet policies for government debt dynamics, it is useful to revisit the familiar equation governing the accumulation of government debt that was already discussed earlier at this conference (Blanchard [2021]).

$$\Delta b_t = (r^L - g)b_{t-1} + d_t.$$

Here b is the debt-to-GDP ratio, d is the primary-deficit-to-GDP ratio, r^L is the real interest rate on government debt, and g is the real growth rate of GDP. The evolution of the debt-to-GDP ratio is basically driven by two things: the primary deficit of the government (d) and the difference between the interest rate and the growth rate of GDP—what is known as the “snowball effect,” $r^L - g$. For any given ratio existing debt (b_{t-1}) a favorable snowball effect ($r^L - g < 0$) provides additional fiscal space for

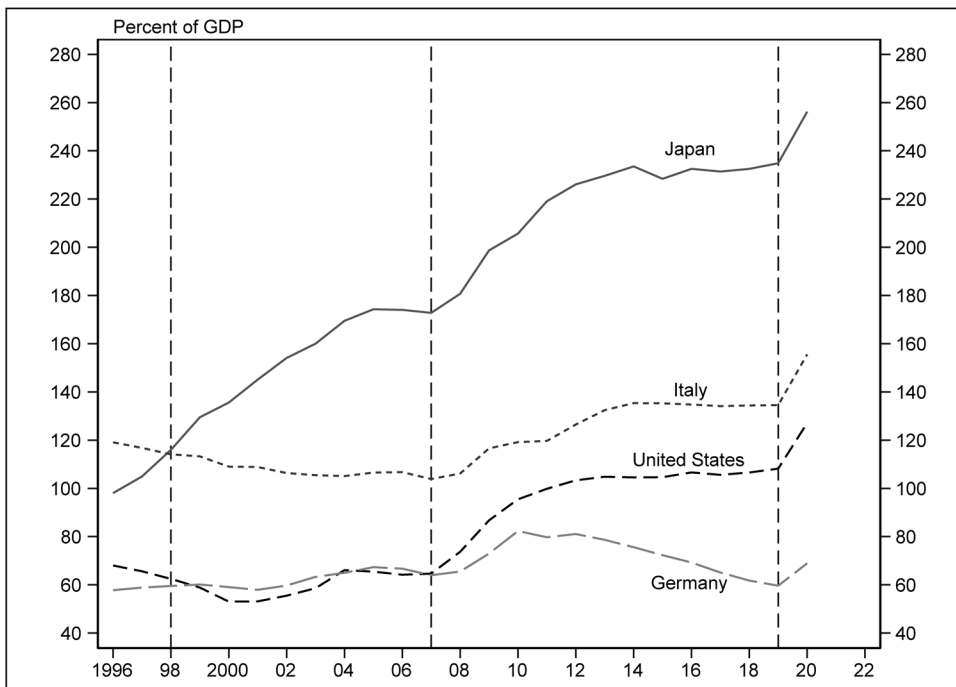
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 8. The evolution of this understanding in the aftermath of the GFC is usefully documented in the case of the IMF. See e.g. Independent Evaluation Office (2014) for an evaluation of the IMF’s premature support for austerity after the GFC and subsequent change of views.

Figure 10 Primary Balance Ratio



Note: Annual data. Vertical lines denote year before each of three ZLB episodes.

Figure 11 Government Debt Ratio



Note: Annual data. Vertical lines denote year before each of three ZLB episodes.

the government. Central bank policies are critically important for a favorable snowball effect through the effect of their policies on interest rates and growth, especially during a period of economic weakness.

Over the longer run, the snowball effect is driven by three “stars”: The first two are well known, the equilibrium real interest rate, r^* , and the natural real growth rate, g^* . Both have declined in advanced economies over the past two decades or so, but the decline in r^* has been far more pronounced. This has been a key factor towards a more favorable snowball effect in advanced economies. Figure 12 plots the evolution of estimates of these two “stars” for the United States implied in the Federal Open Market Committee’s Summary of Economic Projections.⁹ But there is another crucial star variable that matters for debt dynamics and has received less attention: The equilibrium term premium, τ^* .

Governments predominantly refinance their obligations by issuing long-term debt. The relevant interest rate for the snowball effect in the long run is not the short-term but the long-term equilibrium real interest rate—that is the sum of the short-term rate and the term premium. The snowball effect over the long run is: $r^* + \tau^* - g^*$.

The role of the term premium is particularly important at the ZLB because of its relationship with QE. At the ZLB, expanding the balance sheet with purchases of long-dated government debt compresses the term premium on long-term yields.¹⁰ The empirical magnitude of this effect is uncertain, reflecting the relative scarcity of pertinent data, but the experience of advanced economy central banks with QE since the GFC has confirmed that the effect of QE on the term premium is economically significant and persistent.¹¹

The term premium on long-term government debt is critical for understanding debt dynamics. Estimates of the 10-year term premium for the US suggest a notable decline even before the GFC and the activation of balance sheet policies by the Federal Reserve. This suggests a decline in the equilibrium term premium had taken place prior to the GFC. Part of this decline can be attributed to monetary policy. The term premium is positively related to perceived inflation uncertainty. The success of central banks to restore low and relatively stable inflation since the 1980s reduced this uncertainty considerably over the past few decades.

In addition to the likely decline in the equilibrium term premium, τ^* , and particularly relevant for the present circumstances, is the additional large decline in the term premium observed after the GFC which can be attributed to QE (Figure 13).¹² The decline of the term premium observed since the GFC can be expected to persist for

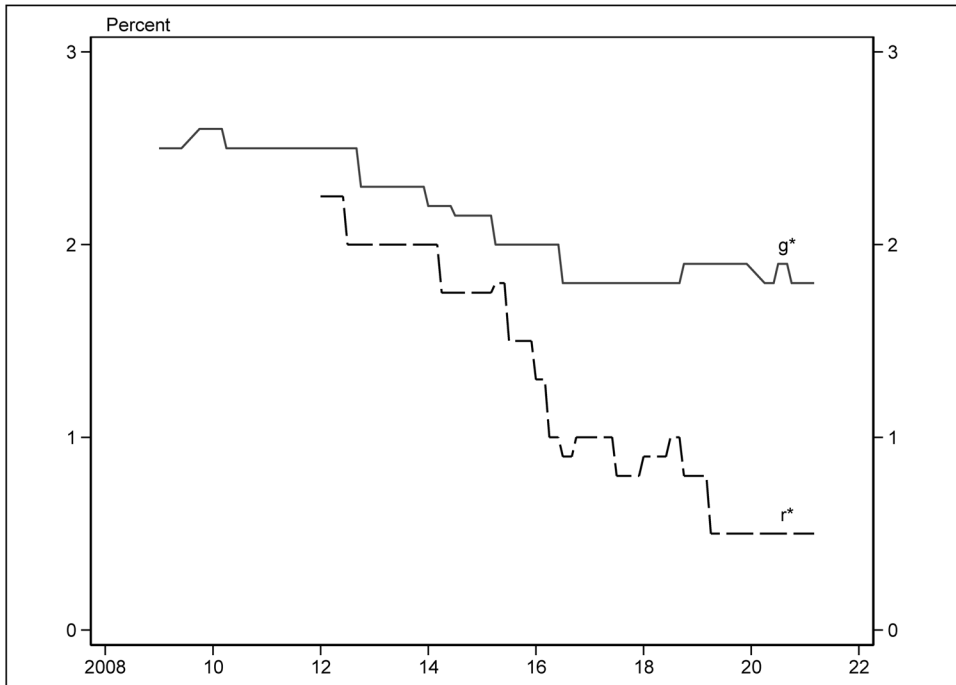
9. These are derived from medians of individual policymaker projections for the longer run. Similar policymaker estimates are not available for the BOJ and the ECB. In the case of the BOJ, policymaker projections are only provided for the short- and medium-term. The ECB has not yet adopted the practice of providing information about policymaker projections.

10. This reflects the imperfect substitutability of assets with different duration, cf. Modigliani and Sutch (1967), Tobin (1969), Andres, Lopez-Salido and Nelson (2004) and Vayanos and Vila (2021).

11. Studies with pertinent estimates of the effect of QE on the term premium and the economy include D’Amico *et al.* (2012), Li and Wei (2013), Ihrig *et al.* (2018), Sudo and Tanaka (2018), Rostagno *et al.* (2019) and Kawamoto *et al.* (2021).

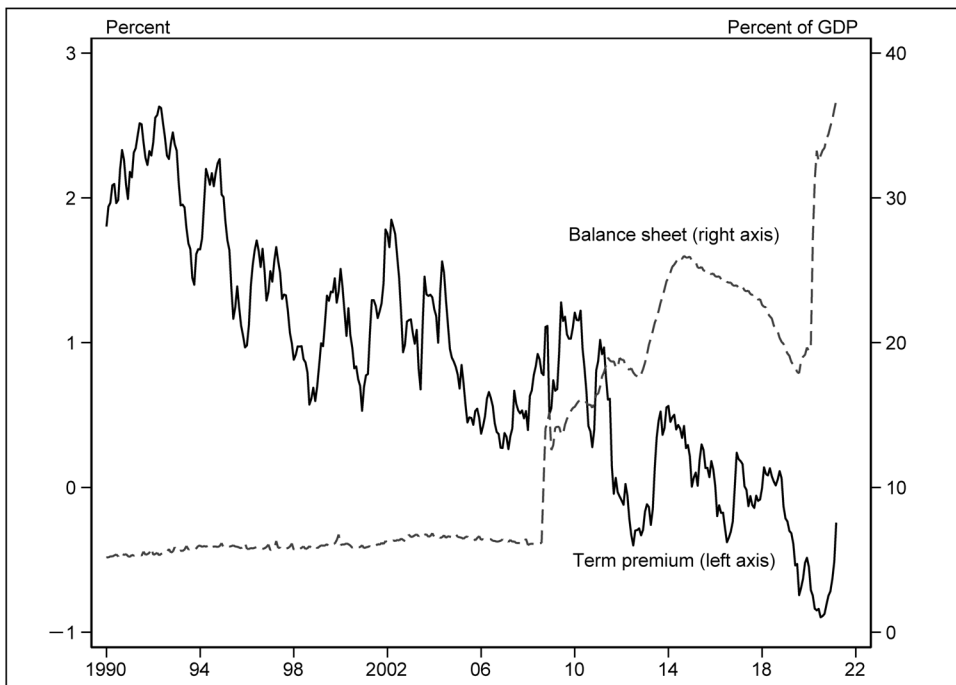
12. Term premia are not directly observed and their estimates are derived from empirical models. The estimates for the 10-year premium shown in Figure 13, are based on the Fed’s three-factor model (Kim and Orphanides [2012]).

Figure 12 FOMC-implied Estimates of “Stars”



Note: SEP median projections for long run. Real GDP growth for g^* . Federal funds rate minus inflation goal for r^* .

Figure 13 Federal Reserve Balance Sheet and 10-year Treasury Term Premium



Note: Monthly. Term-premium estimates reflect the Federal Reserve’s three-factor model.

some time, as central banks continue to operate with relatively large balance sheets to provide sufficient monetary accommodation to circumvent the ZLB. Policy rates will likely continue to be constrained during economic downturns as long as r^* remains low.

The effect of monetary policy on the term premium and the resulting fiscal-monetary interactions are critical for successful policy design in a low interest rate environment as we have experienced in the recent past. A low r^* limits interest rate policy easing—the ZLB challenge that has complicated the monetary policy response to the pandemic last year. At the ZLB, QE can partially substitute for interest rate easing by boosting prices of longer-term debt and other asset prices (including equities and real estate). This is the *direct* monetary easing from QE. By compressing the term premium, QE also reduces the cost of refinancing government debt and increases the fiscal space available to the government. QE thus provides *indirect* easing, through facilitating an extraordinary fiscal expansion that can be afforded because of the reduced cost of government finance.

When the equilibrium real interest rates is low, coordinating fiscal and monetary policy in this fashion is critical for protecting against debt-deflation and avoiding policy mistakes. Explicitly accounting for debt dynamics and monetary-fiscal interactions in otherwise standard policy models can avoid pitfalls that appear to have contributed to excessive fiscal austerity and insufficient monetary accommodation in some economies in the aftermath of the GFC. For example, such analysis shows that excessively debt averse fiscal policies are self-defeating.¹³

VI. Ongoing Challenges

Decisive use of central bank balance sheet policies at the onset of the pandemic in March 2020 resulted in a much better handling of the economic challenges compared to previous encounters with the ZLB during the past quarter century. It also revealed the incredible power independent central banks have available during a crisis.

In a low interest rate environment, central banks must be ready to activate the power of the balance sheet to respond to a crisis and recessionary threats. That said, balance sheet policies are more challenging for central banks than interest rate policies and raise difficult governance questions. Balance sheet policies are more uncertain and have more pronounced fiscal and distributional effects that can attract political scrutiny and criticism.

Whenever central banks demonstrate the extraordinary power of their balance sheets, they risk attracting unwanted attention and controversy, raising the risk of compromising their political independence. This is a risk, but one that cannot serve as an excuse for inaction. Reluctance to employ a central bank's balance sheet powers to avoid attracting criticism would constitute an abrogation of responsibility when these policies are needed for meeting the central bank's core mandate. Central banks must be ready to activate the power of their balance sheets when needed, regardless of the

13. See Hofmann *et al.* (2021) for pertinent stochastic simulation experiments that focus on the fiscal-monetary policy interactions and the role of QE at the ZLB. A related finding, presented in Billi and Walsh (2021) is that a seemingly irresponsible debt-financed fiscal expansion can be welfare improving at the ZLB.

prospect of political scrutiny and criticism and despite perceived risks to their political independence.

Nonetheless, this highlights a challenge: What is the best way to protect the independence and institutional integrity of a central bank after an impressive demonstration of the power of its balance sheet?

In my view, the answer is simple: Focus attention on the basic central banking principles that apply regardless of whether balance sheet tools or interest rates are employed. Strive to be apolitical, avoid overstepping the central bank's core responsibilities and apply the available tools to achieve the central bank's core objectives. Communicate clearly and adhere to a systematic policy framework that aims to achieve the central bank's inflation goal in the medium term.

These principles should be uncontroversial for interest rate policy when the complications associated with ZLB do not apply. The same principles apply to balance sheet policy, when interest rate policy is hampered by the ZLB. Similar to interest rate policy, balance sheet policy must be systematic to help ensure that the central bank is transparent, predictable and accountable. The same framework explaining the necessity of the balance sheet expansions observed in response to the pandemic should serve as a guide for the systematic withdrawal of accommodation that will be appropriate to maintain price stability once the economy normalizes.

The successful activation of the power of central bank balance sheets in response to the pandemic was instrumental for fulfilling the mandate of central banks as independent institutions. The demonstration of this power also attracted attention to it, highlighting the challenge of maintaining central bank independence. Pursuing a systematic policy that achieves a central bank's core mandate can protect the central bank's institutional integrity and address this challenge.

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