DEPARTMENT OF MANAGEMENT - DISA

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INTERNATIONAL MANAGEMENT

AVERTING PUBLIC DEBT SUSTAINABILITY CRISES: THE UNITED STATES CASE

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Abstract

In the aftermath of the pandemic crisis, inflation surged and central banks increased their target interest rates, raising concerns over the serviceability of public debts. Among the countries under observation, the United States saw its federal debt held by the public approach the size of the economy, reaching 94.55% of GDP. This paper investigates the implications of varying fiscal policies on American debt sustainability, employing scenario analysis to project potential future outcomes.

The study begins with an extensive review of the past two decades of monetary and fiscal policies, encompassing the history of the Great Financial Crisis and the subsequent pandemic-related crisis. It examines the respective monetary and fiscal responses during these periods and transitions to the post-pandemic scenario characterized by an inflation surge that led to interest rate levels not seen in the last twenty years. Finally, the paper transitions to the core scenario analysis using the Buiter model.

Three fiscal scenarios are examined: baseline, fiscal consolidation, and fiscal negligence. The baseline scenario presents the most likely situation, incorporating the Congressional Budget Office's forecasts for the primary balance. In contrast, the fiscal consolidation scenario explores the substantial fiscal efforts required to significantly reduce the debt-to-GDP ratio, highlighting the fiscal policies needed to ensure debt sustainability. The most critical findings emerge from the fiscal negligence scenario, which demonstrates that a lack of proactive debt management can lead to a long-term debt spiral, underscoring the urgency of timely fiscal intervention to prevent severe economic and social consequences.

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1 Introduction

Over the past fifteen years, the dynamics of global debt have experienced significant turbulence. Following a period of widespread growth in world GDP across both advanced economies (AEs) and emerging markets (EMs), the global economy faced two major crises within a decade: the Great Financial Crisis (GFC) and the Covid-19 pandemic. These crises differed greatly in nature and consequences, as we shall explore.

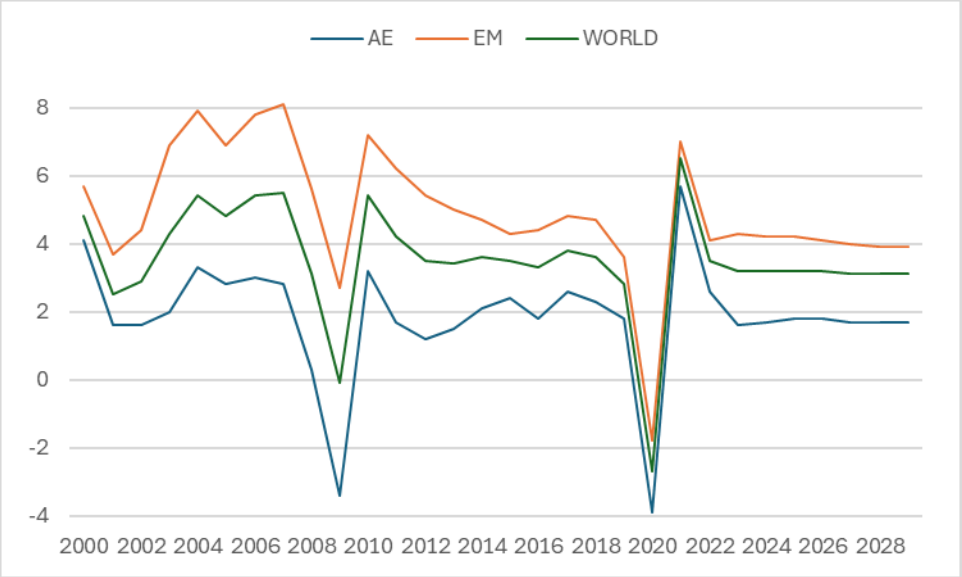


Figure 1. Real GDP Growth (annual % change). Source: IMF.

The GFC ushered in an era of accommodative monetary policy, further compounded by the Sovereign Debt Crisis in Europe, which allowed countries to borrow at unprecedentedly low rates. This led to an accumulation of debt that now weighs heavily on government finances.

This situation raises questions about the sustainability of public debt. Many governments have become accustomed to rolling over debt at rates near the Zero Lower Bound (ZLB). However, with inflation rising for the first time in decades, central banks may be compelled to maintain higher target interest rates, thereby increasing the cost of servicing government debt.

Through a Buiter model, we will investigate how these developments could impact the financial health of United States government finances, presenting the potential potential future scenarios and their effects on debt dynamics.

This thesis is structured as follows: Section 2 delves into the history of the GFC. Section 3 examines the monetary policies implemented in response to the GFC, with a particular focus on unconventional measures such as Quantitative Easing (QE). Section 4 analyzes the fiscal policies adopted after the financial crisis. Section 5 reviews the policies enacted in response to the Covid-19 crisis; given that many of these were modeled on measures used during the GFC, this section is shorter but no less critical to our analysis. Section 6 addresses the post-pandemic conjuncture, with a specific focus on the United States. In Chapter 7, we discuss the main theories behind debt sustainability analysis, relevant to

both academic and practical perspectives. Chapter 8 details the derivation of the Buiter model, and Chapter 9 applies this model to conduct a scenario analysis. The thesis concludes with final remarks and an appendix that provides a deeper examination of certain QE mechanisms that were too complex to be included in the main body of the text.

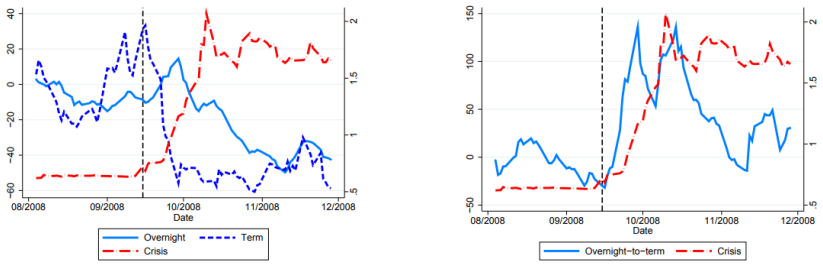
2 The Great Financial Crisis: a brief history

The first symptoms of a financial crisis emerged in the United States around 2007, stemming out of the real estate sector and fueled by various factors such as easy access to credit, reckless lending practices, and risky financial engineering. These factors led to significant levels of leverage within financial institutions, exploiting regulatory gaps that failed to address economic imbalances and oversee financial activities effectively.

The pivotal moment of the crisis came with the collapse of Lehman Brothers, which set off a chain reaction of panic and turmoil, ultimately causing financial markets to seize up. The paralysis in the U.S. financial sector plunged the American economy into its most severe recession in over six decades, with ripple effects felt across many advanced economies worldwide. The interconnectedness of international banks played a pivotal role, turning this into a "transatlantic" banking crisis (Shin, 2018), where financial institutions on both sides of the Atlantic faced similar challenges of undercapitalization and liquidity shortages.

In Europe, the recession commenced in the second quarter of 2008 and persisted for five consecutive quarters, with a return to growth only occurring in the latter half of 2009. The initial shock was the drying up of the interbank market, as banks sought to deleverage by closing credit lines, halting lending to the real economy and setting off a negative chain reaction.

This effect was particularly pronounced in cross-border interbank lending, where term-lending volumes plummeted by up to 60% immediately following Lehman's collapse compared to pre-Lehman levels. Approximately two weeks after Lehman's collapse, when the freeze on long-term liquidity subsided, total overnight lending activity also began to decline, showing a similar magnitude of decrease as observed in term-lending turnover (Abbassi, P, F Bräuning, F Fecht, and J-L Peydró, 2015).



(a) Overnight and term (b) Overnight-to-term ratio

Figure 2. Subfigure (a) shows the aggregate daily lending amount during the Lehman sample for both the overnight (solid blue line, left axis) and term (dashed blue line, left axis) segment for the period from August 1, 2008, to December 31, 2008. "Term" lending relates to transactions with maturity larger than one week. Subfigure (b) depicts the ratio of the aggregate daily lending amount in the overnight segment to the aggregate daily lending amount in the overnight segment. All three series are expressed as percentage deviations from the mean value of each respective series during pre-Lehman period from August 1, 2008 to September 12, 2008. "Crisis" denotes the three-month Euribor-OIS spread (long-dashed red line, in % on the right axis). All series (except "Crisis") are smoothed with 10-day moving

average. The vertical dashed line corresponds to September 15, 2008, when Lehman Brothers filed for bankruptcy. Source: Abbassi, Fecht, Brauning, and Peydro (2014).

The ripple effect initiated by the interbank market continued as households witnessed a depletion of their wealth, particularly due to declines in the real estate and stock markets. This led to a shift in consumer behavior towards saving rather than spending, dampening demand and consequently reducing investments by firms.

During recessions, consumers often postpone certain purchases, particularly discretionary and significant ones such as durable goods (e.g., cars, furniture), holidays, or new homes. However, demand for essential consumer goods such as food typically remains relatively stable, even in times of economic downturns (Newson B., 2009).

Figure 3 illustrates the impact of the recession on the breakdown of retail sales between food and non-food products. Prior to the recession, there was a more rapid growth in the volume of EU-27 non-food sales. The decline in food sales, beginning in September 2007, preceded any contraction in non-food sales by seven months. Nonetheless, starting from mid-2008, the decline in non-food sales generally surpassed the reductions noted in food sales.

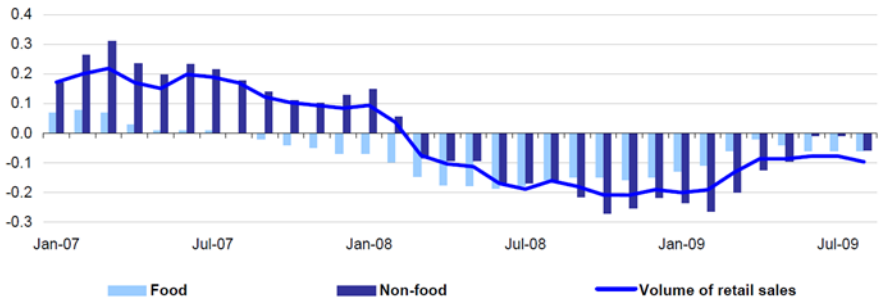


Figure 3.Evolution of the volume of retail sales - comparison of food and non-food items, EU-27 (seasonally adjusted, growth rates compared with the previous month, %). Source: Eurostat.

The contraction in consumers demand resulted in manufacturers experiencing involuntary stockpiling, leading to production cuts. Exporting was not a viable alternative due to the collapse of global trade, a phenomenon often referred to as the "Great Trade Collapse" by economists (Alessandria, G, JP Kaboski, and V Midrigan, 2010).

The economic downturn quickly translated into the labor market, with an increase in part-time employment in many countries and a decrease in the number of hours worked. European unemployment (at the EU28 level) experienced a dual acceleration, first with the global financial crisis and subsequently with the Eurozone crisis.

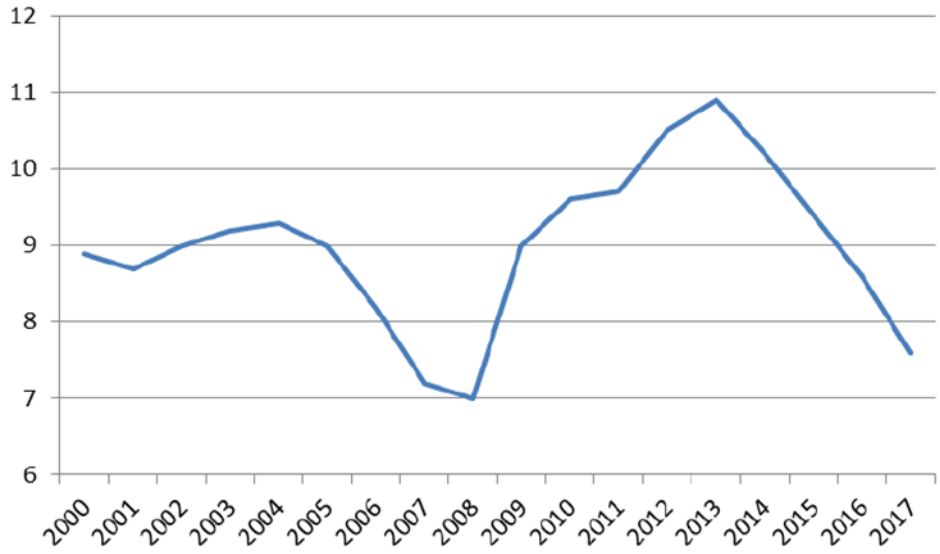


Figure 4. Unemployment rate. Source: Eurostat.

Figure 4 illustrates the trajectory of unemployment rates leading up to and following the financial crisis. Prior to the crisis, there was a notable decrease in unemployment, falling from 9.3% in 2004 to 7.0% in 2016, as per Eurostat's official figures. Post-crisis, unemployment rates reverted to their historical averages of between 9.0% and 9.6%. However, the situation worsened during the Eurozone crisis years, with unemployment peaking at 10.9% in 2013. Since then, a significant decline in unemployment rates has been observed, accelerating to 8.6% by 2016 and further to 7.6% in 2017 (Monastiriotis V., 2018).

This overall trend masks variations at the national level, where unemployment increases ranged from a minimal 0.2 percentage points in Germany to a substantial 9.8 percentage points in Latvia. Six years later, the disparity in outcomes had become even more pronounced. By mid-2013, the most affected countries saw dramatic increases in their national unemployment rates—up to approximately 19 percentage points in Greece and 16 percentage points in Spain, resulting in staggering unemployment rates of 27% and 26%, respectively (Cappiello, Hördahl, Kadareja & Manganelli, 2006).

Figure 5. Changes in unemployment rates across the euro area (percentages of the labor force, countries ordered according to their unemployment rate in 2008). Source: Cappiello, Hördahl, Kadareja & Manganelli (2006).

As previously observed, the crisis not only widened inequality among EU countries (Mazurek J., 2014) but also within individual economies, affecting various demographic groups, particularly young and unskilled workers. Data from the EU Labour Force Survey (Cappiello, Hördahl, Kadareja & Manganelli, 2006) offer detailed insights into employment and unemployment trends across different demographic categories, including gender, age, educational attainment, and employment status (refer to figure 6).

Overall, men, younger individuals, and those with lower levels of education bore the brunt of the crisis. The disproportionate impact on men compared to women can be attributed in part to the concentration of the crisis in sectors traditionally dominated by men, such as industry, construction, and transport. When considering age groups, both young workers (under 25) and prime-age workers (25-54) experienced significantly higher levels of unemployment compared to older workers (55 and over).

The continued increase in employment among older workers may be driven by various factors, including the need to replenish wealth lost during the financial crisis and ongoing adjustments to pension schemes and retirement ages in several euro area countries. However, it may also reflect institutional disparities within certain euro area economies, such as stringent employment protection laws for permanent workers, which tend to favor the retention of older workers at the expense of younger, potentially more flexible employees. Due to their shorter job tenure and higher prevalence of temporary contracts, younger and prime-age workers are often more susceptible to layoffs, particularly when companies adopt "last in, first out" dismissal policies.

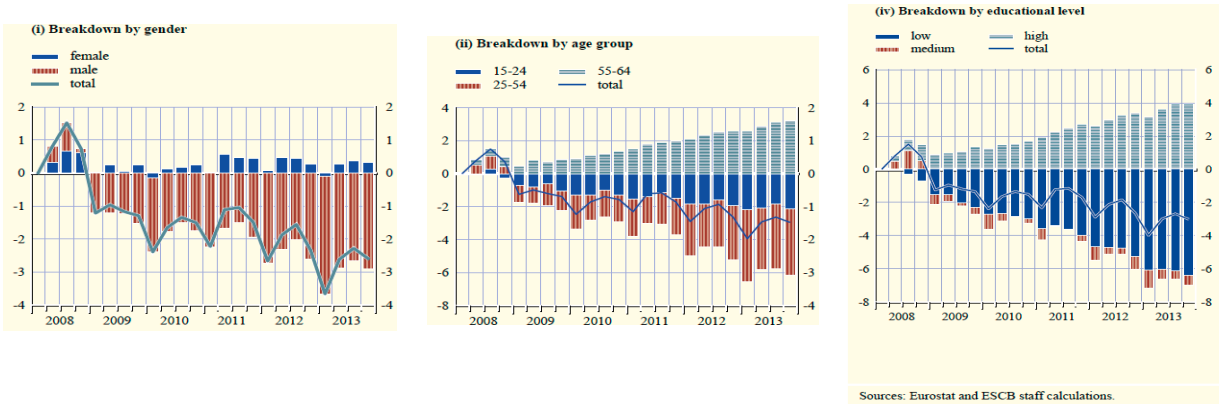


Figure 6. Employment and unemployment trends across different demographic categories, including gender, age, educational attainment, and employment status Source: Cappiello, Hördahl, Kadareja & Manganelli (2006).

2.1 The role of securitization and moral hazard

The issues of securitization and moral hazard became prominent early in the crisis. Securitization broadly refers to the process of bundling individual bank loans and other financial assets into tradable securities, which are then sold to investors (Kara, Marqués-Ibáñez, & Ongena, 2011).

In the United States, securitization techniques have been utilized for over fifty years. The market for asset-backed securities (ABS) began to develop through government-sponsored agencies such as the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac), established in 1938 and 1968, respectively. In contrast, the European securitization

market started much later and was not initiated by any governmental agency. It emerged cautiously in the late 1990s, experienced rapid growth from 2004 to 2007, and then sharply declined thereafter.

The rapid evolution of securitization markets transformed the role of banks. Traditionally, banks mitigated idiosyncratic risks primarily through portfolio diversification and monitoring on behalf of less-informed investors. However, securitization enabled banks to convert illiquid claims, mostly in the form of bank loans, into marketable securities. This facilitated the off-loading of a portion of their credit exposure to external investors, thereby alleviating regulatory pressures on capital requirements, raising new funds, and expanding lending activities. This model is commonly referred to as "originate-to-distribute," contrasting with the traditional "originate-to-hold" approach (Eubanks, 2010).

Before the recent global financial crisis, the prevailing perspective highlighted the positive role of securitization in spreading credit risk, thus bolstering the resilience of the financial system (Shin, 2009). By allowing the largest and most sophisticated banks to offload credit risk to institutions with lower leverage, securitization contributed to stabilizing the overall system by diversifying and distributing risk across the economy.

However, there were concurrent concerns regarding the screening and monitoring incentives of banks. As loans transferred off balance sheets were passed on to external investors, a phenomenon known as the "hot potato" dynamic emerged. This perspective expressed skepticism about the benefits of securitization, positing that it could incentivize banks to retain risky loans, heighten their risk appetite, and ultimately undermine both banks' monitoring incentives and the overall soundness of the financial system.

In fact, the scenario that unfolded was not akin to a "hot potato" game where banks simply passed on bad loans to entities outside the banking sector. Instead, risk became concentrated within the banking sector itself, ultimately resulting in significant losses for banks. There exists a critical distinction between selling a bad loan down the chain and using bad loans as collateral for borrowing: in the latter case, the bad loan remains on the balance sheet, whether it's within the bank itself or within a special purpose vehicle sponsored by the bank, thereby keeping the risk within the banking sector.

As banks sought to continually expand their balance sheets, they pursued new borrowers, eventually resorting to subprime borrowers once the pool of good borrowers was depleted. This expansion led to the proliferation of poor-quality loans, packaged into increasingly complex and opaque securities. Consequently, financial institutions found themselves unable to trust one another, as they struggled to grasp the underlying riskiness of the assets held by other banks. This lack of transparency and understanding ultimately contributed to the freezing of the banking sector.

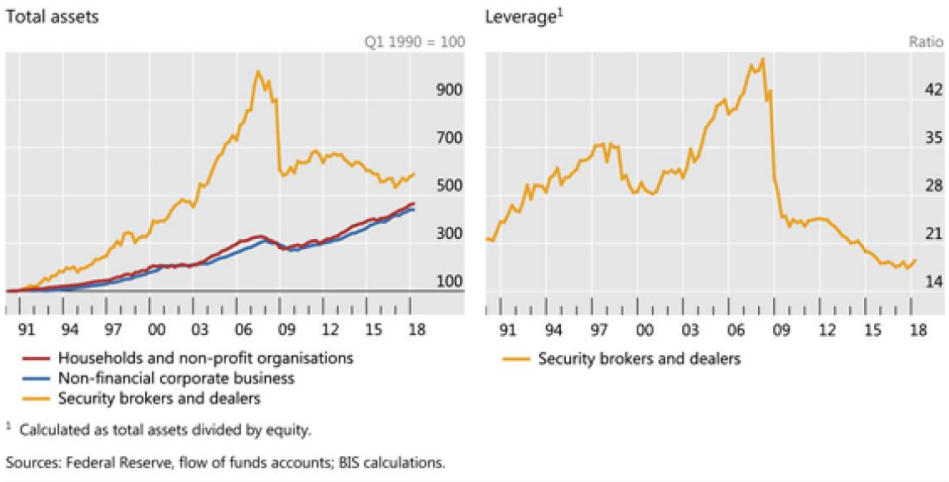


Figure 7. Total assets and leverage of the US securities broker-dealer sector. Source: Shin (2009).

2.2 The role of European financial institutions

The Global Financial Crisis (GFC) is frequently depicted as originating in the United States and subsequently spreading to other countries, including Europe. However, this narrative oversimplifies the complexities of the crisis.

In reality, European banks experienced losses nearly on par with those of their American counterparts during the initial phases of the crisis. By the conclusion of 2009, US banks had incurred losses totaling $708 billion, while European banks were not far behind, with losses amounting to $520 billion. Meanwhile, banks from other regions suffered comparatively minor losses in comparison (Shin, 2018).

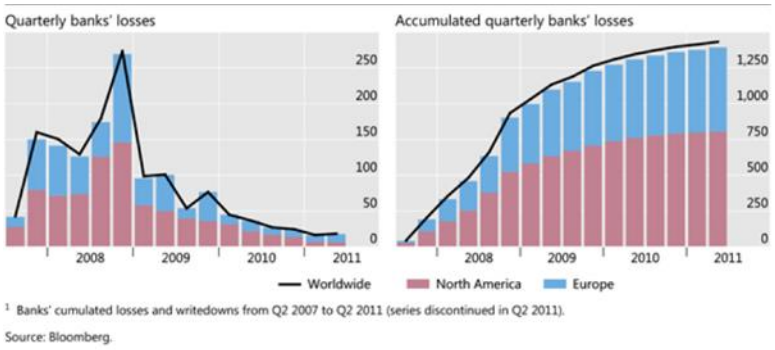


Figure 8. Losses suffered by banks worldwide, by region of headquarters[1] in billions of US dollars. Source: Shin (2009).

Furthermore, European banks were deeply intertwined with the American financial system, having embraced the originate-to-distribute model previously mentioned, and were key players in the subprime mortgage securitization market. They engaged in borrowing from US money markets and lending to US mortgage borrowers, mirroring the activities of American banks. In fact, more than half of the assets held by US money market funds that were lent to the private sector consisted of short-term obligations issued by European banks.

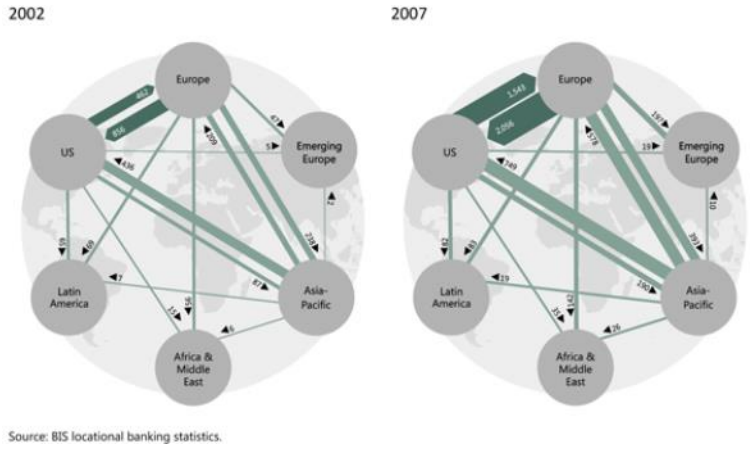


Figure 9. US dollar-denominated cross-border bank claims in billions of US dollars. Source: Shin (2009).

At the end, the significance of national boundaries was minimal, except when determining which taxpayers were responsible for rescuing banks in distress. This scenario is exemplified by European banks receiving bailouts from European taxpayers, reflecting Mervyn King's notable assertion that “banks are global in life but national in death”.

3 Monetary policy and the Great Financial Crisis

3.1 Introduction

Before the financial crisis of 2008, the Federal Reserve's main monetary policy was simply to achieve low and stable inflation, combined with sustainable growth. This was achieved by targeting short-term interest rates, with the impact being reliably quantifiable through the use of the Taylor rule and the calculation of the output and inflation gaps.

Conventional monetary policy could not prevent asset bubbles, it rather used to deal with them ex post, mopping up the consequences; after the Great Financial Crisis, this view of monetary policy was challenged, with great attention posed also to financial stability.

Another important challenge stressing conventional monetary policy was the zero lower bound, that questioned the ability of conventional monetary policy to stimulate the economic recovery once the interest level bottomed the zero level.

The Taylor rule would suggest decreasing the nominal interest rate below zero, but agents would have the incentive to hold non-interest-bearing short-term assets, such as cash, making the decrease ineffective.

Also, the financial system itself suffered disruptions, the solvency of banks and borrowers represented a central concern: the chain mechanism broke, and the classic transmission did not allow the central bank to affect market rate by modifying the official rates.

The consequence was that the conventional policy proved to be ineffective: the official rate could not be adjusted according to the Taylor rule, the impact of market rate was not as expected, and the transmission mechanism was not working.

This scenario led the number of monetary targets to increase, which in turn highlighted the need for additional monetary tools, as for the Tinbergen's law, thereby many of the most important central banks in the world started adopting unconventional instruments.

Among the most common forms, we find a massive expansion of the central banks' balance sheet, implemented to impact interest rates other than usual short-term ones.

Central banks started to buy not only Government bonds but also mortgage-backed securities, to provide liquidity in a market that dried up and exerting downward pressure directly on mortgage interest rates.

For sure, the most relevant unconventional tool was *Quantitative Easing.*

It was firstly applied by the Bank of Japan, then used also by the Bank of England, Federal Reserve (Fed) and European Central Bank (ECB), even if the ECB used it to tackle a different problem for BoE and Fed: whereas in England and US the focus was on affecting prices, Europe was worried by an important outflow of euros from banks, like in a bank run.

What usually happens is that central banks buy or sell securities from banks through Open Market Operations, affecting bank reserves, with the final aim of impacting target interest rates.

In the standard case, affecting bank reserves was an intermediate step, but now it has become a target: as the name suggests, the focus shifted toward *quantity* variables.

Targeting the reserves means that the central bank purchases securities from banks to increase reserves, in the hope that this will spill over into the broader economy through increase willingness to lend, stimulating consumption and driving prices up and removing deflationary pressures.

3.2 Unconventional monetary policy

In the aftermath of the Lehman Brothers' failure in September 2008, financial market tensions escalated dramatically, prompting immediate and decisive interventions by central banks. Credit spreads surged to unprecedented levels, market activity seized, and the efficacy of the monetary policy transmission mechanism seemed under threat.

With interest rates already at the Zero Lower Bound (ZLB), central banks found themselves unable to rely on conventional tools to stimulate the economy. As a result, they introduced unconventional tools, each taking different forms but sharing the common objective of supporting market functioning and preventing disruptions that could jeopardize macroeconomic stability in the medium term.

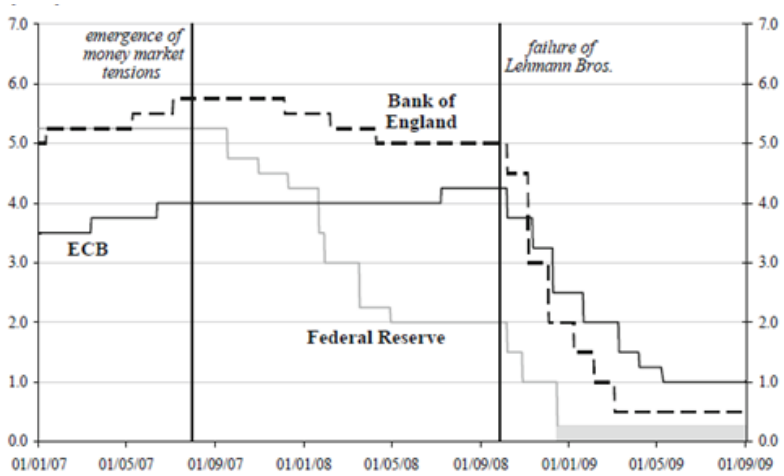


Figure 10. Evolution of key policy rates (percent per annum). Note: since 16 December 2008, the FED has expressed its target for the Fed Funds rate in the form of a range, from 0-0.25%. Source: Lenza, Phil & Reichlin (2010).

The variations in these unconventional tools primarily stem from differences in the design of pre-crisis operational frameworks for monetary policy - such as the size of the balance sheet - and the structure of the financial sector in the relevant region. For instance, the responses of the Federal Reserve (Fed) and the Bank of England (BoE) differ from that of the European Central Bank (ECB), reflecting the bank-centered structure of financing in Europe.

The ECB's existing framework allowed for relatively modest innovations to address the challenges at hand. In contrast, the Federal Reserve in the United States needed more substantial changes. The introduction of new measures by the Federal Reserve can be interpreted as an effort to replicate the possibilities for central bank intermediation and refinancing that were inherent in the ECB's regular operations.

The co-movement of money market spreads during the period from August 2007 to September 2008 supports the view that the various and seemingly diverse measures taken by central banks, including

the ECB and the Federal Reserve, were similar in substance. The alignment in the movement of money market spreads suggests a degree of convergence in the underlying challenges faced by central banks and their responses to address disruptions in financial markets (Lenza, Phil & Reichlin, 2010).

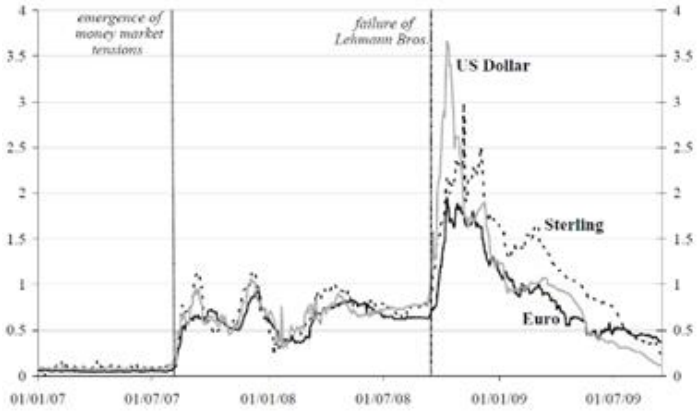


Figure 11. Spread between interbank and OIS rates at 3-month maturity (percent per annum). Note: The euro spread (labeled EUR) represents the difference between the 3-month EURIBOR fixing and the 3-month overnight interest swap (OIS) rate. For the US dollar (USD) and British pound (GBP), the interbank deposit rate used is the 3-month LIBOR fixing. Source: Lenza, Phil & Reichlin (2010).

Various unconventional monetary measures implemented during times of economic stress often involve adjustments to the procedures and tools used to implement monetary policy, resulting in a shift in the central bank's role.

In developing typologies for non-standard measures, Lenza, Pill, and Reichlin (2010) identify three key dimensions. The first dimension pertains to the immediate impact on the central bank's balance sheet, which reflects the specific transactions involved in implementing these measures. Such changes can arise from asset purchases, lending programs, or other unconventional operations. The second dimension is the choice of counterparty, which considers whether non-standard measures are designed to replace or reactivate private financial market activity. The selection of counterparties, such as banks or other financial institutions, can significantly influence the effectiveness of these measures in shaping market dynamics. Lastly, the third dimension is the intent of the measure, focusing on whether the aim is to re-establish or enhance conventional channels of monetary transmission, or to leverage typically neglected channels. This dimension highlights the broader objectives of the central bank when implementing unconventional measures. These three dimensions help to categorize and understand the diverse range of non-standard measures central banks may deploy in response to economic challenges.

3.2.1 Immediate impact on the central bank balance sheet

Textbooks often differentiate between quantitative easing (QE) and qualitative easing (or credit easing) based on the strategies used in managing the central bank's balance sheet.

Quantitative easing (QE) involves expanding the central bank's balance sheet by increasing the monetary base. This expansion occurs without changing the composition of the asset side of the balance sheet. The central bank simply acquires additional holdings of conventional assets, such as government securities, without introducing new asset classes.

In contrast, qualitative easing or credit easing keeps the overall size of the balance sheet unchanged but adjusts the composition of asset holdings. This strategy involves introducing unconventional assets

while reducing holdings of conventional assets. This shift in asset composition aims to influence specific sectors of the financial market more directly. However, the non-standard measures implemented by central banks after 2007 do not neatly fit into this textbook distinction. In practice, central banks have employed a mix of measures, often combining aspects of both quantitative and qualitative easing. For example, central banks have not only expanded their balance sheets by purchasing government securities but have also introduced new programs to purchase non-conventional assets, such as mortgage-backed securities or corporate bonds. The boundaries between quantitative and qualitative easing have become blurred as central banks adopt a more flexible approach to address specific economic challenges.

3.2.2 Choice of counterparty

Non-standard policy measures can be distinguished not only by the nature of the transactions conducted but also by the choice of counterparties involved. Traditionally, central banks primarily engaged with banks as counterparties. However, in response to crises, central banks faced the decision of whether to maintain dealings exclusively with regular counterparties or to expand their operations to involve a broader set of participants.

The decision to enlarge the set of counterparties reflects a crucial conceptual choice. It determines whether central banks aim to replace or bypass a market that is impaired or, alternatively, to reactivate private activity in that market.

In instances where the interbank market froze during times of crisis, many measures provided the central bank with the opportunity for greater intermediation. In such cases, the central bank aims at replacing private activity in a market gripped by panic, with the intention of safeguarding a pivotal component, like the money market, within the monetary policy transmission mechanism. However, this intervention could potentially lead to overreliance on the central bank's intervention (“moral hazard”), posing a downside risk.

Looking beyond the money market, the central bank's responses can vary widely. For instance, to support the credit creation process, the central bank may work through the banking system to bolster the supply of loans, reviving private activity. Alternatively, the central bank might act as a market maker to support the functioning of the private credit market, bypassing an impaired banking system. It could also provide credit directly to the non-financial sector, substituting for the malfunctioning financial sector. The choice of approach depends on the central bank's assessment of the most effective way to address the specific challenges facing the financial system.

3.2.3 Intent of the measure

Another important distinction in the design of non-standard measures is whether they are intended to complement or substitute for conventional monetary policy actions. Two principal cases can be identified: first, complementary measures are non-standard measures designed to enhance the effectiveness of conventional monetary policy. These measures are seen as supplements to interest rate cuts and other standard monetary policies. Many measures implemented following the onset of money market tensions in August 2007 fall into this category.

Second, substitutive measures are non-standard measures aimed at easing financing conditions further when the scope for conventional easing has been exhausted. This situation arises, for example, when

the ability to lower nominal short-term interest rates is limited by the lower bound. By nature, these measures serve as substitutes for conventional monetary policy.

In practice, however, it is challenging to neatly classify non-standard measures along this dimension. As a result, the clarity with which central banks communicate the monetary policy stance, which can no longer be captured solely by the level of a very short-term interest rate in the current environment, has been impaired. This complexity also introduces identification problems for scholars studying the impact of these measures. The boundaries between complementary and substitutive measures can become blurred in the dynamic and evolving landscape of central bank responses to economic challenges.

3.3 Chronology of Quantitative Easing

Quantitative Easing term was coined in February 1999, when the Japanese rates were stuck at the lower bound, one member of the BoJ asserted that Bank of Japan should "implement a quantitative easing by targeting the monetary base" (Bank of England, 2016). The bank implemented that plan two years after, purchasing government securities in exchange for reserves.

QE was then adopted in the United States and UK in 2008 and 2009, as they both reached the ZLB and were seeking to stimulate further the economy. In 2015, the European Central Bank started expanding its balance sheet for the same reason of Fed, BoE and BoJ.

Expansions of balance sheet are not new, central banks used to do it since the 18th and 19th centuries; what changed is the purpose: whereas in the past they were associated with financing of wars and tackling of distressed banks, since the GFC they became a monetary policy tool.

Historical balance sheet expansions were commonly backed by government securities and were often geared towards facilitating an increase in debt. This aligns with the original mandate of the Bank of England, which was established with the primary purpose of raising funds for the war against France.

This was particularly true for the world wars, when the balance sheet of a range of countries expanded up to 40% (Ferguson, Schaab and Schularick, 2015).

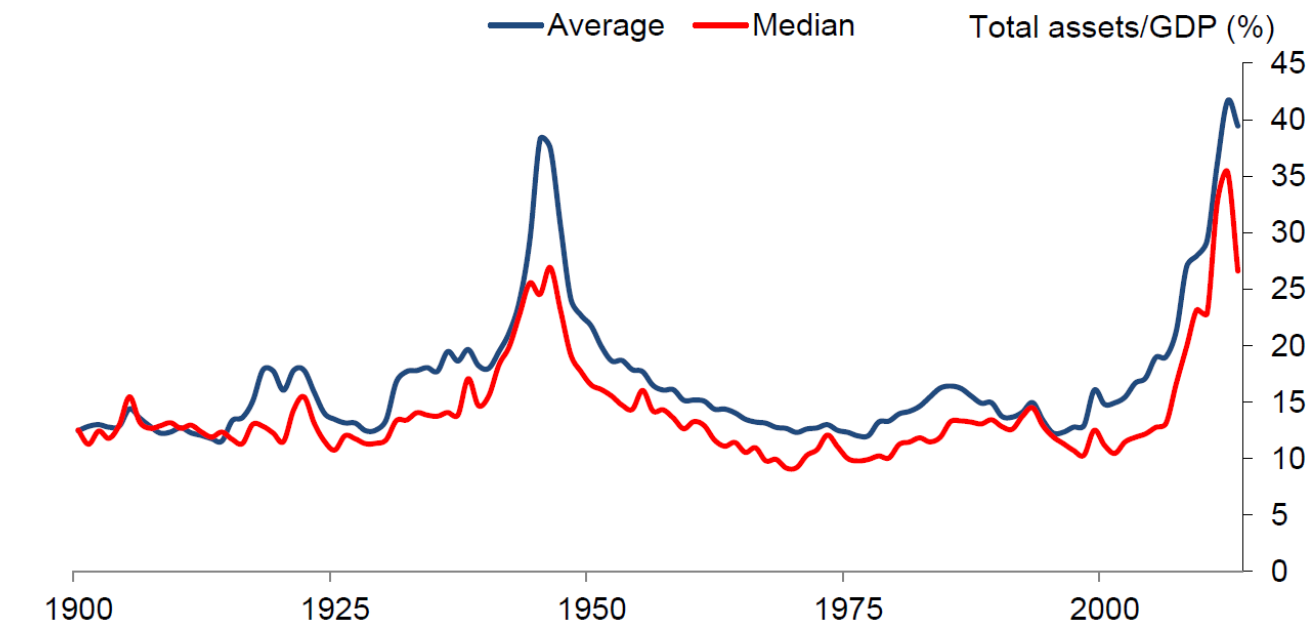


Figure 12. Note: Countries covered are: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. Source: Ferguson, Schaab and Schularick (2015).

As previously mentioned, QE as a monetary policy tool emerged in 1999 when Japan used the quantity of central bank reserves as the operating policy target, by purchasing government bonds in order to provide the liquidity until inflation returned to normal standards sustainably.
Central bank balance sheet expansions for monetary policy purposes became more prevalent following the global financial crisis.
Indeed, in response to the onset of the global financial crisis, central banks such as the Federal Reserve, Bank of England, and European Central Bank initiated balance sheet expansions through repo programs.
These large-scale repo operations were primarily aimed at providing liquidity support to the banking sector. Specifically, in the case of the European Central Bank (ECB), these operations played a crucial role in enhancing the functioning of the monetary policy transmission mechanism. It's noteworthy that for the ECB, repo operations remained the primary tool for balance sheet expansion until the commencement of its asset purchase program in 2015.
Instead, when employed as a tool of monetary policy, central bank balance sheet expansions typically involve outright asset purchases funded by the creation of central bank reserves.
As regards the asset purchased, ECB tended to buy government bonds of the 18 euro-area governments, Fed purchased MBS and agency bonds, whereas BoE aimed at gilts, the most basic form of government bonds.

3.4 The Fed case: Large-Scale Asset Purchase (LSAPs)

Also the Federal Reserve, as the other principal central banks, found itself looking for alternative instrument to ease the monetary policy once the official rate was at the zero lower bound.

As mentioned previously, as long as investors do not view these two assets as substitutes, the reduction in supply of the riskier longer-term assets reduces the risk premiums required to hold them and thus reduces their yields.

3.4.1 The transmission mechanism of LSAPs

The main channel through which LSAPs impact the economy is the already mentioned portfolio balance effect, by affecting the risk premium. The central bank buys a great amount of long-term assets, bidding up their price and reducing their yield. Long-term yields can be decomposed into two parts: the average level of short-term risk-free interest rates expected over the life of the asset, and the risk premium. The first is the expected return that investors could earn by rolling over short-term risk-free assets, and the risk premium is the additional return that investors expect to bear the risk associated with longer-term assets.

In principle, LSAPs can influence either of the two, but the Fed clarified simultaneously that it would have still been able to raise short-term interest rates at the appropriate time, so we can assume that expectations are unaffected and any reduction in the yield should be attributed to the risk premium component.

The markets have witnessed the withdrawal of a significant quantity of assets with extended durations by the LSAPs. With a reduced aggregate duration risk to maintain, the market is expected to demand a decreased premium for holding such risk. This phenomenon could be attributed to the fact that those investors who are most willing to shoulder the risk are the ones who remain in possession of it.

Beyond the impact on the risk premium effect, the acquisition of agency debt and agency MBS (mortgage-backed securities) by the Federal Reserve might exert an additional influence on the yield through other components of the risk premium, since these assets are perceived to carry a higher credit or liquidity premium compared to Treasury securities.

The portfolio balance effect brings an additional advantage by mitigating prepayment risk in the market. To comprehend this, it is essential to first explore what convexity is and the implications of having negative convexity.

Convexity serves as a gauge of the curvature of a bond's duration or the connection between bond prices and yields. It explains how a bond's duration changes in response to fluctuations in interest rates.

Negative convexity emerges from the capacity of mortgage borrowers to repay their loans anticipately. As interest rates decrease, the motivation to prepay rises, typically resulting in heightened prepayments to MBS holders. This phenomenon causes the duration of MBS to decrease with declining interest rates and increase with rising interest rates.

Having negative convexity signifies that MBS prices exhibit a less pronounced increase when rates fall and experience a more substantial decline when rates rise, in comparison to a non-callable bond with an equivalent coupon and maturity.

Given this unfavorable characteristic, investors commonly insist on an additional return to bear the negative convexity risk, thereby keeping MBS rates at higher levels.

LSAPs removed from the market a great number of assets with high convexity risk, reducing MBS yields.

The portfolio balance effects not only diminished the yield of the acquired assets but also extended their influence to the yields of other assets. This transpired because investors consider assets as interchangeable, and when the expected returns on agency debts, MBS, and Treasury securities dwindled, they redirected their focus towards alternative assets such as corporate bonds and equities.

Furthermore, the current valuations of assets should discount expectations regarding the future inventory of assets. Consequently, a trustworthy declaration that the Federal Reserve intends to acquire longer-term assets at a later date is anticipated to immediately lower longer-term interest rates.

The presence of the Fed in the market may also exert effects on the prices of longer-term assets, if it enhances market functioning and liquidity. Through serving as a consistent source of demand for longer-term assets, the LSAPs potentially facilitated dealers and other investors in taking larger positions in these securities or engaging in more active market-making activities.

The liquidity or market functioning channel, distinct from the portfolio balance channel, emerged as particularly significant in the initial phases of the LSAP programs for specific asset types. Notably, spreads between yields on agency-related securities and yields on Treasury securities remained considerably higher than historical norms, even after adjusting for the convexity risk in MBS, reflecting poor liquidity and heightened liquidity risk premiums associated with these securities.

Purchases from the Fed played a crucial role in restoring liquidity, leading to the narrowing of spreads between yields on agency debt and MBS compared to yields on Treasury securities. This, in turn, contributed to a reduction in the cost of financing agency-related securities.

In general, LSAPs have the potential to influence market interest rates through a blend of portfolio balance and market functioning effects. While the impact on market functioning seems to have held significance at the initiation of the LSAPs, particularly during a period of financial market stress, the enduring and primary effects are likely linked to the portfolio balance effect.

3.4.2 The implementation of LSAPs

The Federal Reserve maintains assets in the System Open Market Account (SOMA), historically consisting primarily of Treasury securities. Outright Open Market Operations (OMOs), which involve the purchases and sales of SOMA assets, along with repurchase agreements and reverse repurchase agreements, are utilized to adjust the stock of bank reserves and influence conditions in the federal funds market.

While OMOs aim to have a minimal impact on security prices, given that the assets exchanged constitute a small share of the Treasury bill market, Large-Scale Asset Purchases (LSAPs) are designed with a different objective. LSAPs are intended to directly affect interest rates through substantial transactions relative to the markets for the targeted assets.

Between December 2008 and March 2010, the Fed acquired over $1.7 trillion in assets, representing 22% of the $7.7 trillion stock of longer-term agency debt. Another metric to gauge the magnitude of the purchase is in terms of duration, measured in "ten-year equivalents." In this context, the Fed bought

$850 billion in ten-year equivalents, surpassing 20% of the $3.7 trillion stock of ten-year equivalents at the program's inception.

The scale of these acquisitions is unprecedented, with no investor, whether public or private, having ever procured such a substantial amount of assets within such a brief timeframe. The pace of purchases intensified from March 2009 through June 2009, after which, in the middle of 2009, the Fed announced the decision to taper purchases and slow down the pace.

3.5 The QE in Europe

The European Central Bank (ECB) implemented several measures within its existing framework to address the challenges in the financial markets:

First, the ECB adopted the Fixed Rate/Full Allotment (FRFA) tender procedure in its regular monetary policy operations. This approach allowed the ECB to forgo determining the quantity of liquidity provided to the market, leaving that decision to its counterparties. The aim was to ensure certainty regarding the availability of central bank liquidity in terms of both quantity and price.

Second, the ECB expanded its list of eligible collateral to include securities (other than Asset-Backed Securities) rated BBB or higher. Additionally, the ECB lengthened the average maturity of its outstanding operations, thereby enhancing the flexibility and reach of its liquidity provision.

Third, the ECB increased the number and variety of Euro system longer-term operations over time. This expansion was designed to provide more extensive and varied support to the financial markets, ensuring a more stable and predictable supply of liquidity. Together, these measures significantly expanded the scope for central bank intermediation, allowing it to substitute for a money market experiencing severe disruption. The full allotment procedure empowered the market to determine the volume of such intermediation itself, providing substantial support to the banking sector.

As a consequence of strong counterparty demand and the decision not to reabsorb excess liquidity through exceptional draining operations, a chronic situation of ample liquidity emerged in the euro money market. This led to the overnight money market interest rate (EONIA) systematically deviating from the rate at the main weekly tenders, known as the Main Refinancing Operations (MRO) rate, which is the ECB's target rate.

The MRO rate consequently became a less effective summary of the monetary policy stance, as the emergence of spreads in the money market diminished its effectiveness in assessing market rates and the starting point of the transmission mechanism. Recognizing this, it was acknowledged over time that the MRO rate alone no longer provided a complete indicator of the monetary policy stance. In exceptional times, the stance needed to be understood in terms of the level of market rates at various maturities, in addition to the MRO rate.

Certainly, the persistent situation where the Euro Overnight Index Average (EONIA) remained consistently below the Main Refinancing Operations (MRO) rate indicated the impact of the specific liquidity measures introduced by the ECB. This discrepancy led to adjustments in money market rates across various types and maturities, consistently pushing them downwards. As a result, the specific liquidity measures implemented by the ECB had a distinct and observable effect on the level of short-term interest rates, thereby influencing the monetary policy stance from the autumn of 2008 onward.

In May 2009, the ECB announced its intention to conduct three repurchase (repo) operations with a one-year maturity. This decision was part of the ongoing efforts to support banks' credit creation. As a consequence of these operations, there was a sustained downward pressure on the Euro Overnight Index Average (EONIA). Instead of the typical spread of 3-10 basis points above the Main Refinancing Operations (MRO) rate, characteristic of normal times, EONIA fluctuated at a lower level, approximately 60-70 basis points below the MRO rate (Lanza et al., 2010). This continued deviation reflected the persistent impact of the ECB's measures on short-term interest rates.

In conjunction with the announcement of the one-year repo operations, the ECB disclosed its plan to purchase EUR 60 billion worth of bank covered bonds over the following year. Although these purchases were relatively modest in comparison to the overall size of the covered bond market and the ECB's balance sheet, they were strategically aimed. The stated purpose of the covered bond purchase program was to serve as a catalyst for the recovery of private transactions in the market, rather than functioning as a direct replacement for such transactions. This approach differed from the strategy adopted in the money market interventions.

Despite the relatively modest amount, the ECB's purchases of bank covered bonds seem to have had a positive impact on the primary market issuance and contributed to narrowing credit spreads in this specific market segment. However, it's noted that secondary market trading remained low compared to normal standards.

Additionally, in response to the Lehman Brothers' failure, the ECB took steps to address liquidity concerns. The ECB opened swap lines with the Federal Reserve, aiming to ensure a smoother distribution of US dollar liquidity to European and Asian banks. This collaborative measure was implemented to enhance financial stability and alleviate liquidity pressures in the wake of the Lehman Brothers' collapse.

4 Fiscal Policy during the Great Recession

4.1 The crisis and fiscal policy

The Great Recession, marked by its onset in 2008, led to the most severe economic downturn since the Great Depression. The characteristics of this recession—its depth, the sharp increase in unemployment rates, and the slow recovery process—underscore the profound impact it had on the labor market and the broader economy. Job market data vividly highlight the crisis's depth during the Great Recession. The rise in the unemployment rate, a significant 5.5 percentage points from the first half of 2007 to October 2009, marked the most substantial increase in unemployment in the postwar period. Additionally, the enduring nature of elevated unemployment levels was notably severe. The unemployment rate consistently exceeded 8 percent over an extended span of 43 consecutive months. This prolonged phase of high unemployment underscores the crisis's intensity and the prolonged challenges for job seekers and the economy at large.

The impact of the Great Recession on those who lost jobs or were entering the job market was particularly severe. Prior to the Great Recession, across the entire postwar period, the longest median unemployment duration recorded was 12.3 weeks, observed in May 1983 as the economy was recovering from the recession during Reagan's presidency. However, in the recent downturn, the median duration of unemployment soared to more than double this figure, peaking at 25 weeks, and it persisted above 13 weeks for an extraordinary period of 67 consecutive months.

In response to this financial and economic crisis, the federal government took decisive action, particularly in stabilizing the financial sector. The swift intervention to rescue ailing financial institutions within a year post-crisis demonstrates a focused approach to preventing a complete financial meltdown. However, the broader economic recovery, especially in terms of employment and fiscal stability, presented more complex challenges.

The critique by scholars like Burtless (2017) towards fiscal policy, rather than monetary policy, during the Great Recession points to concerns about the adequacy, timing, and effectiveness of government spending and tax policy measures aimed at stimulating economic recovery. Fiscal policy tools, such as government spending and tax adjustments, are critical for managing economic downturns by influencing demand, investing in infrastructure, and providing social safety nets. However, the effectiveness of these tools can be hampered by delays in implementation, political constraints, and the magnitude of the economic challenges at hand.

Since monetary policy has been addressed in preceding sections, the subsequent pages will primarily concentrate on fiscal policy.

4.2 The fiscal policy in the United States

In response to the challenges confronting the American economy, Congress approved a range of fiscal policy initiatives aimed at bolstering consumer incomes, incentivizing business investment, and safeguarding state-level expenditures on vital areas such as healthcare, education, and public infrastructure.

The majority of these government measures implemented in response to the Great Recession followed conventional approaches. These included temporary tax cuts designed to stimulate consumer spending and foster business investment, extensions of unemployment benefits, and relaxation of other

government assistance programs such as food stamps and social support. Additionally, there were increases in federal funding allocated towards new government initiatives targeting infrastructure development, including investments in buildings, transportation infrastructure, and projects focused on science and technology.

The fiscal response also encompassed some exceptional measures. For the first time, generous insurance subsidies for laid-off workers who were stripped of health insurance upon job loss were financed by the federal government. Additionally, it allocated unusually generous grants to state governments, motivating them to sustain or augment expenditures on fundamental state responsibilities, including K–12 education and healthcare for the poor. Utilizing funds from the Troubled Asset Relief Program (TARP), President Obama facilitated emergency loans and expedited bankruptcy support to safeguard General Motors, Chrysler, and numerous companies supplying the auto industry. A minor portion of the emergency stimulus funds was directed towards financing or providing loans for initiatives aimed at boosting energy efficiency and minimizing carbon emissions.

It's important to highlight that a significant majority of the stimulus expenditures were allocated to programs that would have been recognizable to policymakers and economists in any recession since the early 1960s, regardless of whether the administration in power was Democratic or Republican, liberal or conservative.

The distinguishing factor with respect to previous crises was the unprecedented scale and rapidity of the increases to peacetime deficits during 2008–2009. This was largely due to the alarming prospect of a financial market collapse following the bankruptcy of Lehman Brothers.

However, despite the necessity of these measures, certain well-known policies faced significant public backlash. Particularly, the financial rescue efforts for the nation's largest banks and automakers provoked widespread public outrage. The federal bailout of major banks seemed to reward firms whose irresponsible and potentially reckless actions had contributed to the crisis. Many voters may have erroneously believed that a vast majority of public funds used for economic recovery were allocated to these bailouts for big banks and automakers. In reality, a much larger portion of resources were directed towards temporary tax cuts for middle-income families, emergency assistance for laid-off workers and their families, and substantial grants to state and local governments.

The confusion is understandable. Following the Democratic takeover of both the White House and Congress in January 2009, Republican adversaries of fiscal stimulus persistently criticized certain elements of the countercyclical program. Surprisingly, many liberal Democrats also joined in vehemently opposing the assistance provided to major financial institutions.

The uncompromising and relentless hostility from political opponents towards the fiscal measures has had tangible repercussions. It has shifted the focus of public discourse towards the sustainability of debt rather than addressing the issue of unemployment, prompting Congress to adopt a more conservative fiscal policy post-2009 than would have seemed warranted based on the historical record from 1929 to 2007.

4.2.1 The characteristics of the crisis and the social safety nets enacted

The impact on the labor market during the 2008–2009 recession was exceptionally severe compared to any other postwar downturn. Furthermore, the subsequent recovery was notably sluggish. A particularly informative comparison can be made with the recession that commenced in 1981, which was considered the most severe postwar downturn prior to the Great Recession. Figure 13 illustrates the trajectory of the unemployment rate before and after the onset of these two recessions.

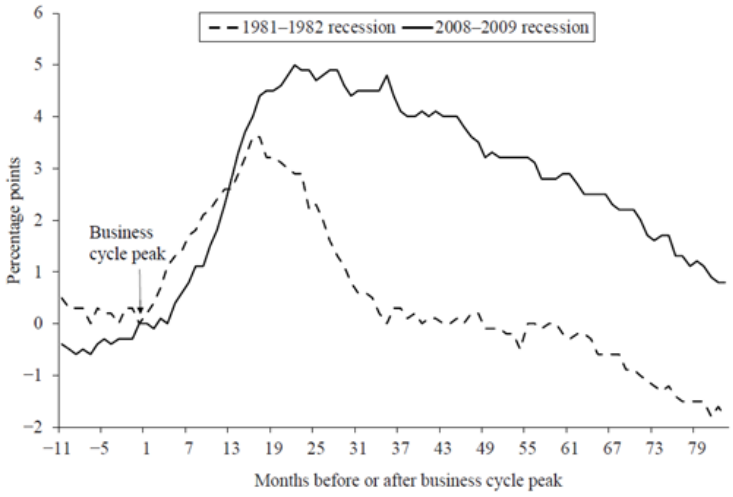


Figure 13. Change in unemployment rate in two postwar recessions. Source: Burtless (2017).

The recession of 1981–1982 initially experienced a more rapid increase in the unemployment rate. However, a little over a year following the recession's start, the escalation in joblessness seen during the Great Recession surpassed that seen in the Reagan recession, with the unemployment rate continuing to ascend for 22 months instead of merely 16. Importantly, the reduction in unemployment has been significantly more gradual in the latest economic cycle.

The precipitous downturn in the economy in 2008 was primarily sparked by the critical financial distress faced by major U.S. financial entities. The foundational issue behind the frailty of these financial institutions was linked to the surge and subsequent sharp fall in housing and apartment values across various regions. Initially, the increase in property values prompted households to take on more debt and elevate their spending. However, the rapid depreciation in housing prices post-2006 eradicated a significant portion of this newfound wealth and, at the same time, severely impaired the creditworthiness of numerous households.

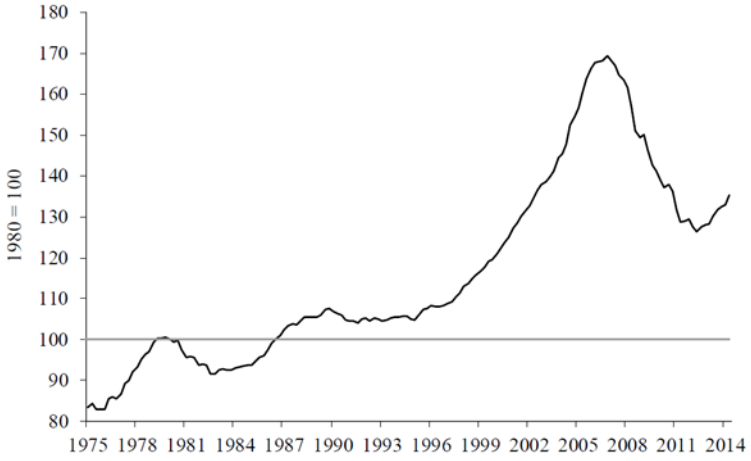


Figure 14. Surge in house prices. Source: Burtless (2017).

The surge in house prices from 2003 to 2006 coincided with a robust increase in stock prices, which contributed to heightened consumption among households. However, equity prices experienced a significant decline of about half between the fall of 2007 and 2009 Q1. This collapse in stock prices impacted the net worth of a distinct group of households compared to those affected by the housing market downturn. Typically, stockholders possess higher average wealth compared to the average homeowner.

A comprehensive gauge of Americans' wealth is the ratio of their household net worth to their disposable income. This ratio peaked at 6.5-to-1 in 2006 before receding to 5-to-1 by early 2009.

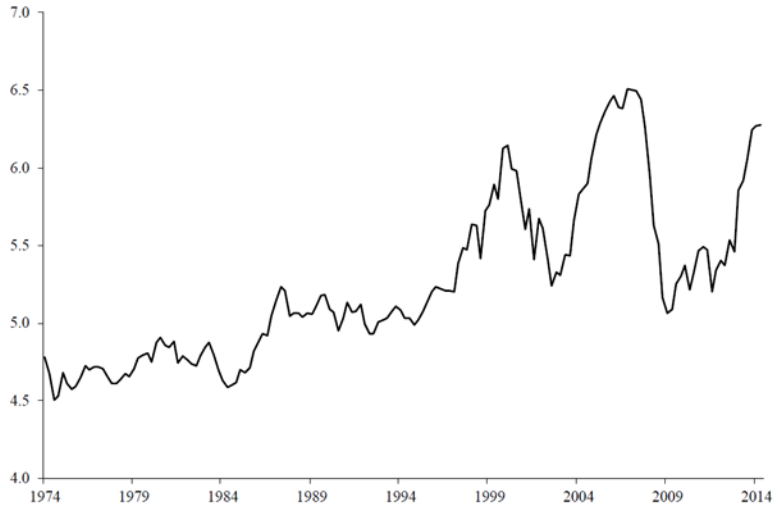


Figure 15. US households' net worth-to-disposable income ratio. Source: Burtless (2017).

Many large nonfinancial corporations entered the downturn with relatively healthy balance sheets, lacking immediate credit needs to sustain operations. However, for investment to occur, firms need confidence that there will be demand for the increased production new investments would bring. Following the collapse of Lehman Brothers, business leaders were confronted with the daunting likelihood of consumer pullback.

The decline in home values eliminated the possibility for many families to secure additional loans. Yet, even wealthier households recognized that their net worth was not just stagnant but rapidly decreasing. This situation led to reduced consumer spending, diminished business sales, and prudent business managers forecasting continued low household expenditure, nullifying the incentives for fresh investment. The situation began to look up as stock markets rebounded and housing prices started to climb once more.

It might be puzzling to some why per capita consumption only dropped by 4 percent from its peak before the recession to its lowest point during the Great Recession. A key reason is the effective performance of the U.S. social safety net during this period of economic turmoil.

Even in the absence of active economic stimulus measures during a recession, the United States' tax and transfer system inherently provides stabilizers that mitigate income losses for those out of work. The primary stabilizer comes from federal tax payments, including payroll, personal, and corporate income taxes, which decrease more rapidly than private incomes as recessions reduce pre-tax earnings.

The next significant support mechanism is unemployment benefits, which assist eligible workers who are unemployed through no fault of their own, typically for up to six months. During downturns, the duration of these benefits can be extended, contingent on the unemployment level in the individual's home state.

During the 2007 to 2010 period, Congress enacted a temporary increase in the amount of weekly unemployment benefits and lowered the taxes on these benefits. Consequently, yearly spending on unemployment benefits surged by over four and a half times, escalating from $35 billion to $160 billion.

Beyond these temporary enhancements to unemployment benefits, the federal government also approved increases in food stamp benefits, additional funding for state child welfare programs, and a doubling of the budget for training programs aimed at the unemployed and those difficult to employ.

The combination of automatic income stabilization mechanisms along with substantial temporary measures effectively cushioned household income from the full brunt of the downturn. This strategic approach ensured that the decline in household net income was significantly less severe than the reduction in private income. This effectiveness is depicted in Figure 16, highlighting the trends from 2007 to 2014 in both gross market income and disposable personal income.

Figure 16. Impact of the Great Recession on pretax market income and disposable income, 2007Q1-2014Q3. Source: Burtless (2017).

Market income is comprised of employee gross labor compensation, business owner self-employment income, along with interest, dividends, rent payments, and other pre-tax capital income flows. Disposable personal income experienced a significantly lesser decline, as the uplift in government transfers and reduced personal taxes buffered the loss of household income.

When we dissect disposable personal income into its three constituents as displayed in figure 17: pre-tax market income (encompassing wages, fringe benefits, earnings from self-employment, rent, interest, and dividends); direct government tax payments (primarily social insurance and personal income taxes); and government transfer payments, the chart's trend lines, based on data relative to the end of 2007, reveal the shifts in per capita values through to 2014 Q3.

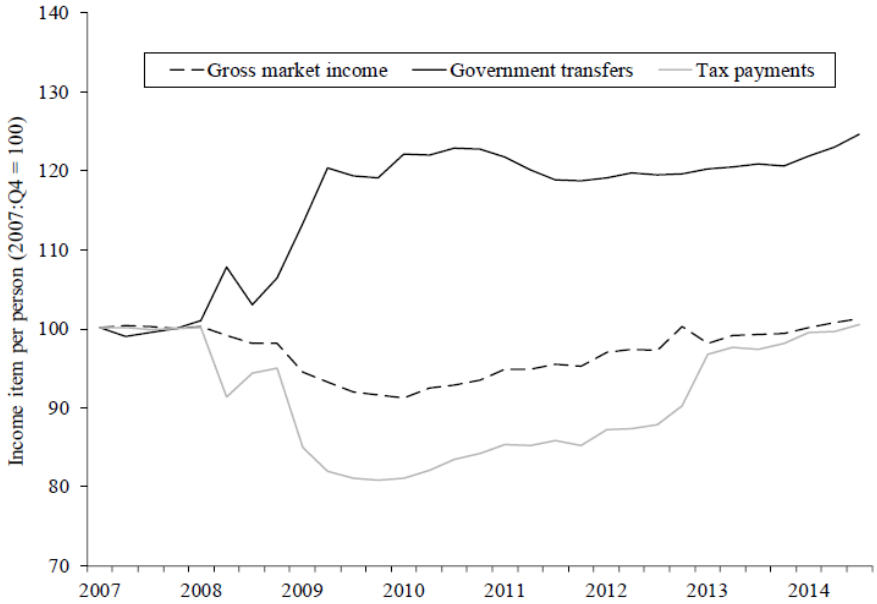


Figure 17. Components of real disposable personal income per person, 2007Q1-2014Q3. Source: Burtless (2017).

Owing to progressive income taxation alongside temporary tax reductions active between 2008 and 2012, individuals' tax contributions decreased both in absolute terms and as a share of pretax income. By 2009 Q3, per capita tax payments had reduced nearly 20 percent, a figure approximately double the proportional fall in pre-tax market income.

Given the marked rise in transfer income and significant temporary reductions in personal taxes, the lesser decline in personal consumption compared to market income during the Great Recession, as illustrated in figure 18, is logical. This figure shows the trend in real per person consumption expenditures, expressed as a percentage of the personal consumption level in the quarter immediately preceding the recession.

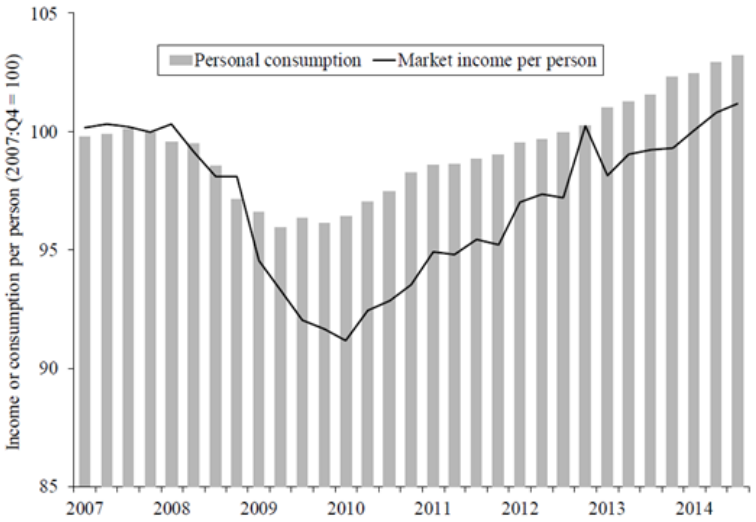


Figure 18. Trends in pretax market income and personal consumption expenditure per person, 2007Q1-2014Q3. Source: Burtless (2017).

Even at the nadir of the recession in 2009 Q2, personal consumption experienced only a 4 percent decline, significantly less than the contraction in pretax market income. The combined impact of the stimulus program and automatic stabilizers undoubtedly played a role. By bolstering disposable income, they mitigated the decline in consumer spending, particularly benefiting low- and middle-income families, especially those affected by job losses.

Data from the Congressional Budget Office (CBO) spanning from 1979 to 2011 shed light on income disparities across the household income spectrum and over time. The accompanying bar chart illustrates that the most substantial income losses were incurred by households in the top 1 percent of the income distribution, experiencing a 27 percent decline in both pre- and post-tax incomes. Conversely, other income groups witnessed a notably smaller proportional decline in post-tax, post-transfer income compared to the reduction in gross market income. Lower tax burdens and increased transfer payments effectively offset market income losses for households in the bottom two-fifths of the income distribution, with those in the bottom quintile even experiencing a marginal rise in after-tax income, despite the 8% dip in average market income.

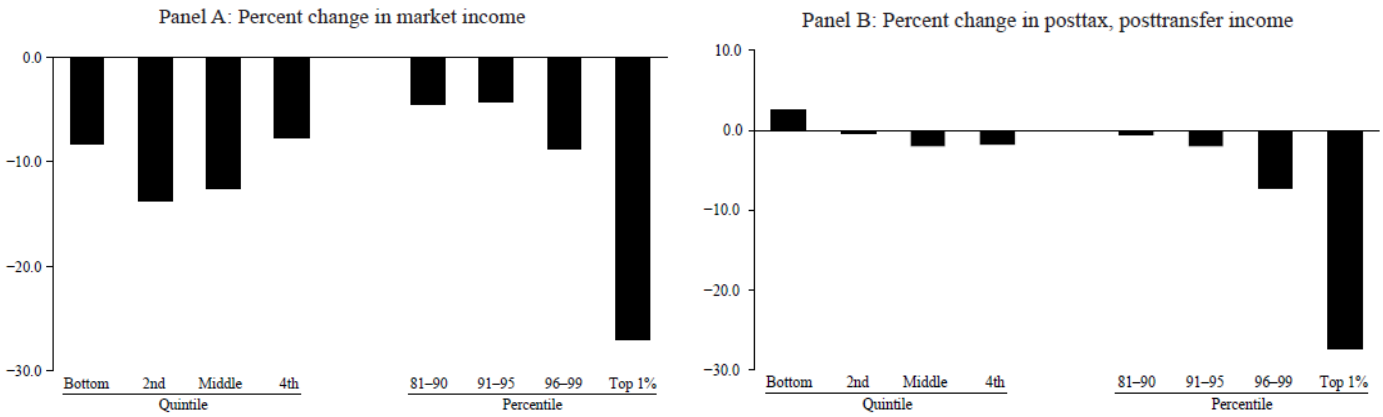


Figure 19. estimates of changes in market income and post-tax, post-transfer income by position in household income distribution, 2007-2011. Source: Burtless (2017).

Despite the positive impact of the stimulus program, many voters seemed unaware of its beneficial effects. In the subsequent section, we will dig deeper into how public discourse influenced the trajectory of fiscal policy in the aftermath of the Global Financial Crisis.

4.2.2 The deficiencies of GFC fiscal policy and the role of public debate

While fiscal policy managed to mitigate much of the income loss experienced by lower- and middle-income Americans, it fell short of generating robust demand for domestically produced goods and services. This failure may be attributed to the unexpected severity of the Great Recession, which caught policymakers and forecasters off guard, resulting in a painfully slow recovery unprecedented in the postwar era.

These forecasting inaccuracies had unfortunate repercussions, as some critics, either naively or disingenuously, attributed the disappointing outcome to the policies enacted by Congress and the Obama administration. Although critics rightfully highlighted that actual output and employment trends were worse than initially forecasted, they erroneously concluded that countercyclical fiscal and monetary measures contributed to the shortfall.

By the summer of 2009, as the financial system showed signs of stabilization, the sense of crisis waned, leading economists within the administration and among Republican policymakers to shift focus towards deficit reduction, believing the worst of the crisis had passed.

Furthermore, many voters may have misconstrued the allocation of stimulus spending, assuming it was primarily directed towards infrastructure projects. However, as illustrated in the following figure, this was not the case.

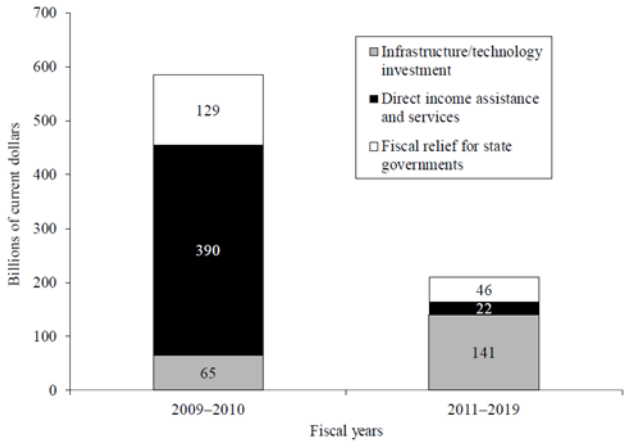


Figure 20. Anticipated stimulus spending under the American Recovery and Reinvestment Act of 2009, 2009-2019. Source: Burtless (2017).

The allocation of stimulus funds during the Great Recession, as outlined, underscores a strategic decision to prioritize immediate economic relief over long-term investments in public capital projects. This strategy was encapsulated in the America Recovery and Reinvestment Act (ARRA) and other non-ARRA spending measures, which focused heavily on providing temporary tax cuts and expanding unemployment benefits. The emphasis on these measures was driven by a desire for rapid disbursement of funds to counteract the economic downturn as quickly as possible.

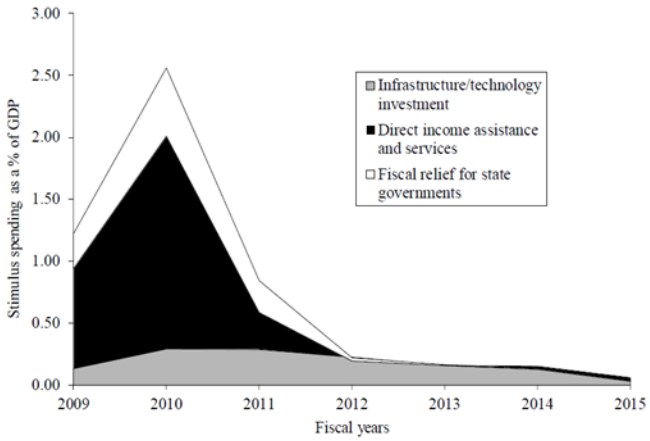


Figure 21. Anticipated stimulus spending under the ARRA of 2009, 2009-2015. Source: Burtless (2017).

The choice to allocate a substantial portion of stimulus funding to tax cuts and direct transfers to individuals, rather than to public capital projects, was based on the urgency of stimulating economic activity in the short term. Public capital projects, despite their potential for long-lasting economic benefits and strong multiplier effects, typically require more time for planning, approval, and implementation. In the context of the Great Recession, the administration deemed it more critical to

inject liquidity directly into the hands of consumers and the unemployed to stimulate demand immediately.

The long timing of initiating and selecting projects for capital investment can lead to a delay in the deployment of funds allocated for these projects. As a result, the actual spending of federal stimulus funds may occur after the economic crisis has subsided. At this later stage, these federal funds may end up competing with private-sector investment for resources, leading to delays in project completion. Instead of stimulating the economy when it is significantly below its full employment capacity, the expenditure may happen when the economy is approaching full employment. This timing mismatch means that the funds could be spent too late to aid in a swift recovery, potentially contributing to inflation in an economy that is already operating at full capacity. On the other hand, tax cuts and increases in transfers can be designed to be temporary and directed towards those groups most in need of financial support.

The previously mentioned perception of inefficient resource use may have contributed to the public debate, pressuring the government to consider the sustainability of its debt. This resulted in a contraction in public spending and investment shortly after 2009, despite the persistence of high unemployment rates and underutilized capital. By 2013, the real government expenditure on these fronts was even lower than at the onset of the recession.

Critics of the stimulus were concerned that the burden of financing the public budget through borrowing would lead to exorbitantly high interest rates for current and future taxpayers. This concern appears unfounded when considering the actual interest rates on U.S. government debt, which, for most of the period between 2011 and 2014, saw the yield on five-year indexed bonds dip below zero percent. This indicates a continued confidence among investors in the government's ability to manage its debts.

Contrastingly, the period following the financial crisis presented an optimal opportunity for such investments. With borrowing costs at historically low levels, and the availability of labor and capital resources that were not being utilized by the private sector, the conditions were ripe for public investment. The lack of aggressive fiscal policy use, especially in public investment to drive the economy towards full employment post-2009, stands out as a significant oversight in the policy response to the Great Recession.

4.3 European fiscal responses to the GFC

To counteract the repercussions of the crisis and forestall its recurrence, the EU undertook three categories of actions: on the EU level, at the central bank level, and at the governmental level.

As delineated in preceding sections, the ECB enacted measures to bolster liquidity in the banking sector and accommodate banks' funding requirements. Concurrently, governments bolstered the financial system by augmenting deposit insurance limits, furnishing guarantees for bank obligations, and injecting capital into rescued banks.

Furthermore, individual nations implemented fiscal policies to mitigate the crisis's adverse effects on the broader economy. This entailed a combination of automatic stabilizers and targeted discretionary fiscal policies. Among the former, we observe actions such as reducing tax revenues and augmenting government welfare disbursements, akin to measures adopted by the United States. As for discretionary fiscal policies, they encompassed increased public investment, tax breaks, and subsidies for part-time

employment. These endeavors contributed to a marked escalation in the public debt of European nations, prompting market scrutiny regarding debt sustainability and the cohesion of the Union (Szczepanski, 2019).

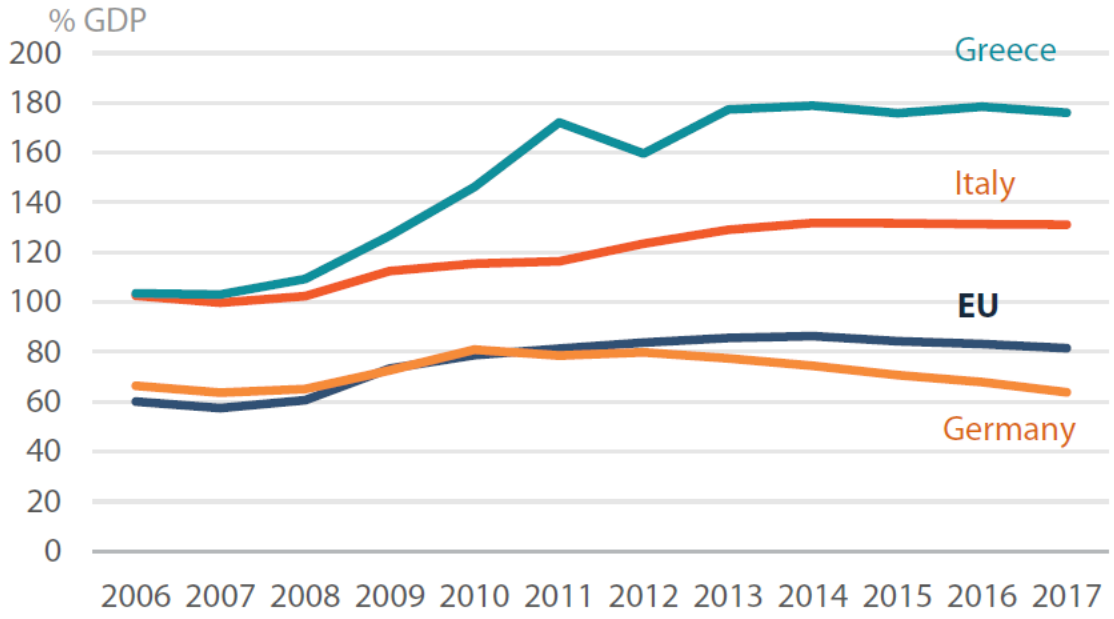


Figure 22. Debt as a percentage of gross domestic product (GDP). Source: Szczepanski (2019).

Shifting focus to initiatives implemented at the Union level, the European Commission launched a substantial stimulus initiative, the European Economic Recovery Plan (EERP), on November 26, 2008, which received endorsement from the European Council on December 11-12. This stimulus, augmenting the effect of automatic fiscal stabilizers, signified the Commission's commitment to coordinated action in addressing the economic downturn. It aimed at synergizing policy tools at both EU and national levels to rejuvenate consumer and business trust, ensuring that immediate measures align with the EU's strategic long-term goals without causing unintended negative impacts or compromising fiscal health over the longer term (Commission of the European Communities, 2008).

This comprehensive approach enables national policies to simultaneously pursue multiple objectives; they offer immediate relief from the recessionary impacts while fostering structural reforms vital for the EU's robust recovery and sustainable fiscal health.

Specifically, the EERP is built on two main supports and a fundamental principle. The first pillar involves a significant boost to the economy's purchasing power, intended to elevate demand and restore confidence. The second pillar focuses on channeling short-term efforts towards boosting Europe's long-term competitiveness through a detailed investment agenda. This agenda is geared towards preparing Europe for future challenges through investments in energy efficiency, clean technologies, and infrastructure.

The fundamental principle of the Plan is solidarity and social justice, emphasizing Europe's collective responsibility to assist the most vulnerable, especially in safeguarding employment and preventing the scourge of long-term unemployment (Commission of the European Communities, 2008).

In more detailed fiscal terms, the EERP comprises a budgetary impulse of €200 billion, equivalent to 1.5% of the EU's GDP. This includes €170 billion (about 1.2% of EU GDP) from Member States and an additional €30 billion (around 0.3% of EU GDP) from EU and European Investment Bank (EIB) contributions aimed at supporting immediate initiatives. Furthermore, the plan outlines several priority actions for adapting the European economy to meet future challenges, incorporating structural reforms to enhance potential growth, in harmony with the objectives of the Lisbon strategy.

4.3.1 The fiscal impulse in Europe

The fiscal impulse can be broadly categorized into three components:

1. Automatic Fiscal Stabilizers: These are mechanisms inherent in the tax and transfer systems that automatically adjust government revenues and expenditures in response to fluctuations in economic activity. For instance, during a recession, tax revenues tend to decrease while spending on unemployment benefits increases, providing a natural stabilizing effect on the economy.

2. Fiscal Stance: This encompasses discretionary fiscal policy measures undertaken by the government, as well as various non-policy factors reflected in changes to the cyclically adjusted (or structural) primary balance. The fiscal stance is a key metric for assessing the impact of government policies on the economy. However, it is influenced not only by deliberate policy decisions but also by external factors beyond the government's control.

3. Interest Payments: These represent financial flows between the government and other sectors of the economy and are considered part of the fiscal impulse. While interest payments are not typically viewed as discretionary policy measures, they nevertheless have an impact on government finances and overall economic conditions.

The fiscal stance is commonly used to gauge the effects of discretionary fiscal policies, but accurately assessing it requires distinguishing between cyclical and policy-related budget changes. This can be challenging due to difficulties in estimating the output gap in real-time. During a recession, for example, automatic stabilizers may lead to increased government spending on unemployment benefits, reflecting cyclical changes. However, policymakers may also implement additional stimulus measures, such as infrastructure projects, which constitute policy-related budget changes.

The accurate delineation of these two types of changes is crucial for understanding the true impact of government fiscal policy. Inaccurate estimation of the output gap can lead to misinterpretation of the economic situation, potentially resulting in inappropriate policy responses. Therefore, addressing challenges in real-time estimation of the output gap is essential for ensuring effective fiscal policy implementation.

Addressing the effects of automatic stabilizers and enacting discretionary fiscal policies during the economic crisis has incurred significant costs for public finances in the euro area, as illustrated in figure 23.

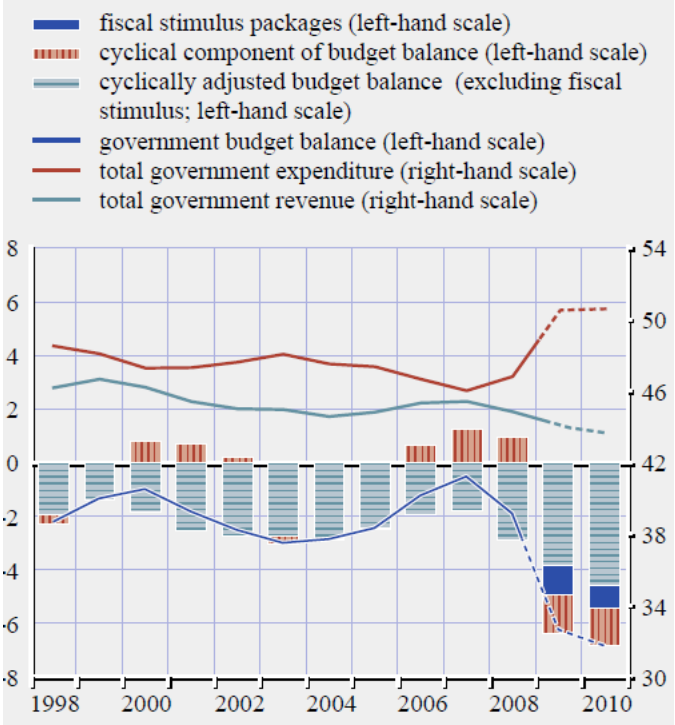


Figure 23. Euro area budget and its components over the period 1998.2010. Note: data for 2009 and 2010 are projections (indicated by dashed lines). Source: ECB (2010).

Following a period of near balance in 2007, the general government budget in the euro area exhibited a deficit of 6.3% of GDP in 2010, as indicated in Table 1. This deficit stemmed from an increase in the spending ratio and a concurrent decline in revenue relative to GDP.

Table 1. Government deficit/surplus. Source: Eurostat.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Euro area	-0.6	-2.2	-6.2	-6.3	-4.2	-3.8	-3.1	-2.5	-2.0	-1.5	-0.9	-0.4
Germany	0.3	-0.1	-3.2	-4.4	-0.9	0.0	0.0	0.6	1.0	1.2	1.3	1.9
Ireland	0.3	-7.0	-13.9	-32.1	-13.6	-8.5	-6.4	-3.6	-2.0	-0.8	-0.3	0.1
Greece	-6.7	-10.2	-15.2	-11.4	-10.5	-9.2	-13.5	-3.7	-5.9	0.2	0.8	0.9
Spain	1.9	-4.6	-11.3	-9.5	-9.7	-11.6	-7.5	-6.1	-5.3	-4.3	-3.1	-2.6
France	-2.6	-3.3	-7.2	-6.9	-5.2	-5.0	-4.1	-3.9	-3.6	-3.6	-3.0	-2.3
Italy	-1.3	-2.6	-5.1	-4.2	-3.6	-2.9	-2.9	-3.0	-2.6	-2.4	-2.4	-2.2
Portugal	-2.9	-3.7	-9.9	-11.4	-7.7	-6.2	-5.1	-7.4	-4.4	-1.9	-3.0	-0.3

Table 2 presents the data supporting the magnitude of the fiscal impulse and its constituents for the euro area.

Table 2. The fiscal impulse and its component for the euro area. Source: ECB (2010).

Fiscal impulse (annual changes, p.p. of GDP)	**2008**	**2009**	**2010**
Change in government budget balance	-1.4	-4.4	-0.5
Fiscal impulse (annual changes, p.p. of GDP)	1.4	4.4	0.5
o/w cyclical component - automatic stabilizers	0.3	2.4	0
o/w cyclically adjusted primary balance - fiscal stance	1	2.1	0.2
o/w interest expenditures	0.1	0	0.2
Change in fiscal stimulus package	-	1.1	-0.3

Over the two-year period spanning 2009-2010, out of the total fiscal impulse amounting to 4.9% of GDP, approximately half of this can be attributed to the effects of automatic stabilizers. The remaining half primarily represents the relaxation of the fiscal stance, with a smaller portion attributed to the rise in interest expenditures. The fiscal stance reflects the impact of various fiscal stimulus packages, as well as substantial additional revenue shortfalls and structural spending growth surpassing the (lower) trend growth rate of the economy.

When examining the distribution of fiscal stimulus across countries, a notable degree of variation is observed. This discrepancy generally mirrors differences in available fiscal flexibility and perceptions regarding the deterioration of economic conditions. Countries with limited room for fiscal maneuver, notably Greece and Italy, refrained from implementing discretionary fiscal measures that would exacerbate their budget deficits in response to the crisis.

Table 3. Fiscal variables measurements by country for 2008, 2009, 2010. Source: ECB.

Fiscal variable	Fiscal impulse			Automatic stabilizers			Fiscal stance and change in interest expenditure			Fiscal stimulus packages	
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2009	2010
Belgium	1	4.7	-0.1	0.4	2.2	0.2	0.6	2.5	-0.3	0.4	0.4
Germany	0.2	3.4	1.6	-0.2	3	-0.1	0.3	0.4	1.7	1.4	1.9
Ireland	7.4	5.3	2.2	2	2.9	0.2	5.4	2.5	1.9	0.5	0.5
Greece	4.1	4.9	-0.4	0.3	1.3	0.8	3.8	3.6	-1.3	0	0
Spain	6	7.2	-1.1	0.3	1.6	0.3	5.7	5.6	-1.5	2.3	0.6
France	0.7	4.9	0	0.5	1.7	0	0.1	3.2	0	1	0.1
Italy	1.2	2.5	0	0.8	2.5	-0.2	0.5	0.1	0.2	0	0
Cyprus	2.5	4.4	2.2	-0.4	1.2	0.4	2.8	3.2	1.8	0.1	0
Luxembourg	1.2	4.7	2.1	1.8	2.8	0.3	-0.5	1.9	1.7	1.2	1.4
Malta	2.5	-0.1	-0.1	-0.3	1.1	0	2.8	-1.2	-0.1	1.6	1.6
Netherlands	-0.5	5.4	1.5	-0.2	3.2	0.2	-0.4	2.2	1.2	0.9	1
Austria	-0.1	3.9	1.1	-0.2	2.4	0.2	0.1	1.5	1	1.8	1.8
Portugal	0.1	5.3	0.1	0.3	1.3	0	-0.2	4	0.1	0.9	0.1
Slovenia	1.8	4.5	0.7	-0.1	4.2	0	1.9	0.3	0.7	0.6	0.5
Slovakia	0.4	4	-0.2	-0.5	2.9	0.4	0.9	1	-0.6	0.1	0
Finland	0.8	7.3	1.7	0.6	4.1	-0.1	0.2	3.2	1.8	1.7	1.7
Euro Area	1.4	4.4	0.5	0.3	2.4	0	1.1	2.1	0.4	1.1	0.8

When examining the composition of the fiscal stimulus package in greater detail, euro area countries implemented four main categories of measures to bolster their economies during 2009-2010.

Firstly, most governments opted to enhance households' purchasing power, primarily through reductions in direct taxes, social security contributions, and value-added tax (VAT), alongside direct financial assistance such as income support and aid for housing or property markets. This category alone represents half of the total stimulus by euro area countries during this period, equating to 0.9% of GDP.

Secondly, over half of the countries pursued significant stimulus measures in the realm of public investment, including infrastructure projects and investments in green industries and energy efficiency enhancements. This category accounted for approximately 28% of the total stimulus in 2009-2010.

Thirdly, about half of the countries also implemented substantial measures to bolster businesses, encompassing tax reductions, social security contribution cuts, direct financial assistance such as expedited VAT refunds, subsidies, and intensified export promotion efforts. This category constituted 17% of the total stimulus during the period.

Lastly, increased spending on labor market initiatives, such as wage subsidies and active labor market policies, were initially adopted by only a few countries and represented just 5% of the total stimulus volume.

It's worth noting that many countries also supported demand through extra-budgetary actions, such as capital injections, loans, and guarantees to non-financial firms, as well as additional investments by public corporations. The combined size of these supplementary measures is estimated at 0.5% of GDP for the euro area during 2009-2010 (ECB, 2010).

5 Policies and Covid-19

5.1 Overview of the policies implemented in 2020

Governments and central banks have responded to the pandemic and the ensuing economic crisis by deploying fiscal and monetary tools on an unprecedented scale, unparalleled in history. Throughout 2020, a staggering 5,462 policies were announced by governments worldwide (Kirti, Liu, Peria, Mishra & Strasky, 2022). Notably, both advanced economies (AEs) and emerging market and developing economies (EMDEs) saw a concentrated surge of policies in March and April 2020. A significant observation gleaned from our data is the tendency of countries to implement a variety of policies concurrently. Consequently, isolating the individual impact of specific measures enacted in response to Covid-19 is likely to pose considerable challenges.

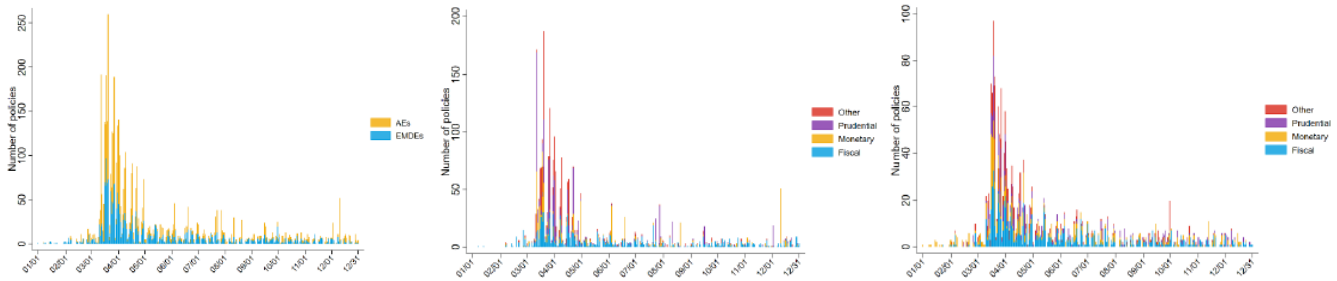


Figure 24. Fiscal Policies during Covid-19. Source: Kirti, Liu, Peria, Mishra & Strasky (2022).

5.2 Fiscal policies and Covid-19

In both advanced economies (AEs) and emerging markets (EMs), grants emerged as the most common fiscal policy measure adopted in 2020. Following grants, public loans and guarantees to support households and businesses were the next most utilized instruments in AEs, while EMs tended to prioritize tax reliefs. Notably, the scale of fiscal interventions was significantly larger in AEs compared to emerging market and developing economies (EMDEs); specifically, the median size of all combined fiscal measures in AEs amounted to 15.2% of GDP, whereas in EMs it was just 4.1%. This discrepancy is underscored by a wide variance in the figures for both groups (Kirti, Liu, Peria, Mishra & Strasky, 2022).

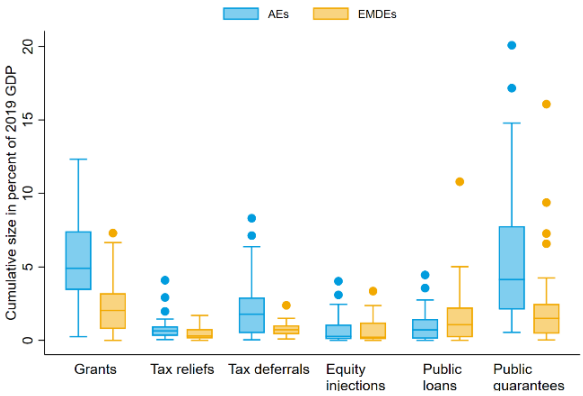


Figure 25. Magnitued of fiscal policies. Note: each box ranges from the 25th percentile to the 75th percentile with the median in between. The whiskers outside of the box show the adjacent values, and the dots, if any, are potential outliers. Source: Kirti, Liu, Peria, Mishra & Strasky (2022).

Furthermore, Benmelech & Tzur-Ilan (2020) discovered that a country's credit rating is the primary determinant of its fiscal spending during the pandemic. Surprisingly, they did not find a negative correlation between the debt-to-GDP ratio and the size of a country's fiscal programs relative to its GDP. Instead, they observed a positive or near-zero correlation. This finding is contrary to the traditional belief that countries with lower debt-to-GDP ratios tend to employ fiscal policy more aggressively during crises.

5.3 Monetary policy and Covid-19

5.3.1 What role should monetary policy play?

Before delving into the responses of major central banks worldwide to address the economic setbacks caused by the pandemic, it's imperative to tackle a seemingly straightforward question that harbors complexities: what role should monetary policy play in a pandemic crisis? Should it adhere to conventional recessionary measures? Far from being obvious, the appropriate course of action for monetary policy extends beyond efforts to preserve financial stability and possibly support appropriately calibrated fiscal packages (Brzoza-Brzezina, Kolasa & Makarski, 2021).

Treating the observed output contraction as a typical recession often leads to an overly expansionary policy stance. While falling inflation and output traditionally call for monetary easing, implementing an aggregate demand expansion during a pandemic can prove counterproductive. This is because the recession largely stems from intentional and desired reductions in economic activity—actions taken by individuals aiming to mitigate the risk of contracting the disease, as well as policymakers implementing lockdowns and other containment measures to curb the spread of the virus.

Optimal management of aggregate demand must navigate a delicate balance between addressing externalities arising from nominal rigidities (such as price stickiness), which typically warrant policy stimulus during recessions, and acknowledging agents' failure to internalize the impact of their actions on pandemics, which means that monetary policy should consider the repercussions of its actions on the number of interactions and fatalities - that carry significant economic costs - potentially necessitating an alternative approach.

Brzoza-Brzezina, Kolasa & Makarski (2021) assert that monetary policy need not adhere to conventional norms when responding to a pandemic. If monetary policy aggressively counters the economic slowdown, it risks reinforcing social interactions and accelerating the spread of the virus, undermining efforts by other authorities to contain it.

The pivotal questions then emerge: under such exceptional circumstances, how should the central bank behave? The answer is multifaceted and contingent upon the containment measures implemented by the government. In the absence of administrative restrictions, monetary policy should adopt a contractionary stance, aiming to cool down the economy and flatten the inflation curve. Moreover, the more suboptimal the lockdown policy, the more pronounced the need for contractionary measures (Lepetit & Fuentes-Albero, 2022). However, once authorities impose sufficiently stringent lockdowns, considerations pertaining to aggregate demand management resurface, prompting an expansionary tilt in optimized monetary policy.

5.3.2 The use of monetary policy during Covid-19

By 2020, the global financial and banking systems had undergone substantial fortification owing to the implementation of financial reforms and updated standards throughout the preceding decade (e.g., Dodd-Frank, Basel III & IV, etc.). However, the prolonged period of economic expansion came to an abrupt and unforeseen halt in early 2020 with the onset of the COVID-19 pandemic.

Unlike the Global Financial Crisis (GFC) in 2008, where the global recession stemmed from endogenous issues within financial systems and markets, COVID-19 emerged as an exogenous shock primarily characterized as a public health crisis. Nonetheless, despite the disparities in the underlying nature of these crises, the monetary policy responses of influential central banks to the COVID-19 pandemic largely drew upon the groundwork laid a decade earlier during the GFC. The Federal Reserve (Fed), Bank of England (BoE), and European Central Bank (ECB) all significantly expanded their emergency liquidity and quantitative easing programs in response to the economic downturns induced by COVID-19. Thus far, their actions have been widely acknowledged for helping avert even more severe recessionary downturns.

As anticipated, given that policy rates in many advanced economies were already at or near the effective lower bound, these economies leaned more heavily on asset purchases. In contrast, emerging markets and developing economies (EMDEs) opted for adjustments in interest rates and reserve requirements. Credit and liquidity injections were extensively utilized by both groups of countries.

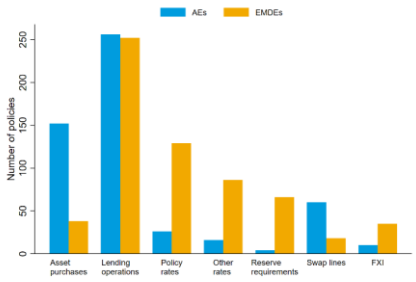


Figure 26. Frequency of monetary policies. Source: Kirti, Liu, Peria, Mishra & Strasky (2022).

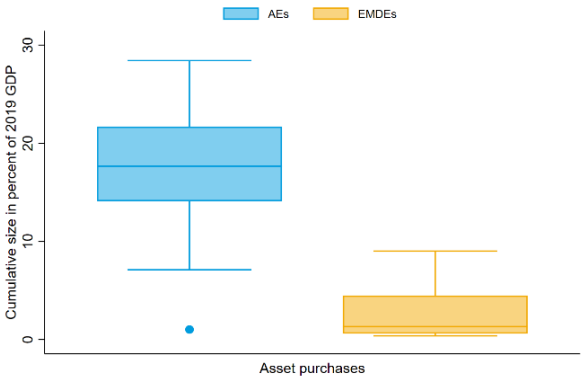


Figure 27. Magnitude of asset purchases. Source: Kirti, Liu, Peria, Mishra & Strasky (2022).

Entering the crisis, many high-income countries were already grappling with historically low interest rates, averaging around 0.78% (Benmelech & Tzur-Ilan, 2020), coupled with elevated levels of public debt. According to the OECD, by the end of 2019, central government gross marketable debt stood at an estimated 72.6% of GDP across OECD nations. Due to these already low interest rates, high-income countries made smaller rate cuts compared to their low-income counterparts. The average interest rate reduction in high-income countries was -0.43%, while it was -0.84% in low-income countries.

Despite smaller rate cuts, high-income countries significantly expanded their repertoire of unconventional monetary policy tools, notably asset purchases. The median size of cumulative asset purchases among advanced economies (AEs) reached 7.7% of GDP, with a standard deviation of 6.5%, compared to just 1.3% of GDP in emerging markets (EMs), which had a standard deviation of 2.7%. Given that the mechanisms underlying asset purchase programs have been discussed in previous chapters, they will not be further elaborated here.

5.3.3 Federal Reserve's response

The Federal Reserve's (Fed) monetary policy decisions during the COVID-19 crisis were heavily influenced by their experiences during the Global Financial Crisis (GFC), albeit with several significant differences. Mirroring actions taken during the GFC, the Fed swiftly responded to the economic fallout from COVID-19 by reducing interest rates. In March 2020, the Fed lowered the upper limit of the Fed Funds Target Rate from 1.75% to 0.25% (FED, 2024). In contrast, other major central banks, already operating with zero or negative interest rates, lacked the capacity to further reduce rates at the onset of the crisis (Fischer, 2021).

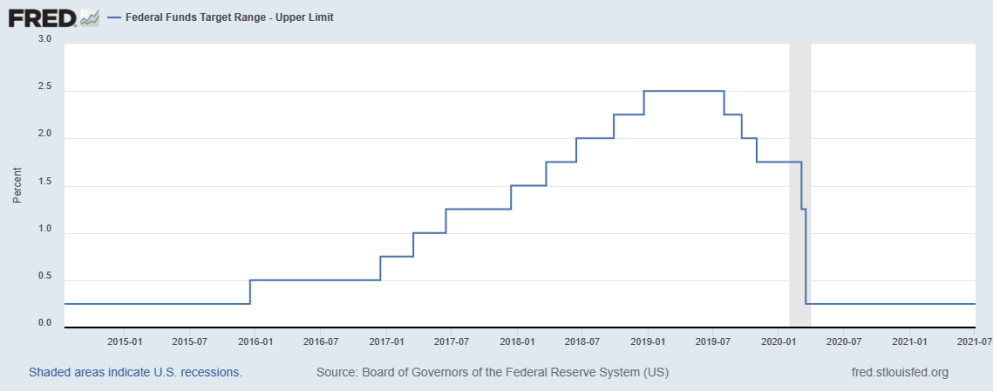


Figure 28. Federal Fund Target Range - Upper Limit. Source: Fed (2024a).

Another aspect of the Fed's COVID-19 response reminiscent of their actions during the GFC was forward guidance. The Fed continued to provide guidance to the markets regarding its future interest rate decisions, affirming that rates would remain low until US unemployment and inflation levels returned to the target levels sought by the central bank.

A pivotal element of the Fed's response to the COVID-19 pandemic was the revival of their GFC-era liquidity and credit programs, offering emergency lending to securities firms, money market funds, and the banking system. Notably, the Fed extended its lending beyond the financial system for the first time, launching programs to provide emergency financing to large corporations, small and medium-sized businesses, state and municipal governments, among others. Specifically, the Fed established two new facilities to facilitate financing for corporations: the Primary Market Corporate Credit Facility

(PMCCF) and the Secondary Market Corporate Credit Facility (SMCCF). Through the PMCCF, the Fed extended direct loans to corporations, while the SMCCF allowed the Fed to purchase existing corporate bonds and exchange-traded funds (ETFs) of investment-grade corporate bonds. The Fed announced that these facilities could purchase up to $750 billion of corporate debt, with any potential losses backstopped by $75 billion from the U.S. Treasury's Exchange Stabilization Fund.

However, the Fed's holdings of corporate bonds amounted to only a fraction of the funds allocated to these facilities, with the SMCCF reaching a peak value of around $14.2 billion. Approximately one year after the launch of these initiatives, the Fed announced in June 2021 its intention to begin selling its SMCCF purchases, with the central bank holding $5.2 billion in corporate bonds and $8.6 billion in corporate bond ETFs at that time. Despite the relatively small scale of its interventions, the Fed's commitment to supporting the corporate bond market signaled to investors that it would not allow market failure, which effectively stabilized the corporate bond market.

Quantitative easing (QE) once again played a pivotal role in the Fed's response to COVID-19, akin to its role during the GFC. Following the conclusion of the GFC-related QE program in 2014 (QE3), the Fed initiated "QE4" in response to the COVID-19 outbreak, engaging in large-scale purchases of treasury securities and agency mortgage-backed securities. From March 2020 to October 2021, the Fed's portfolio of securities expanded from $3.9 trillion to $8.0 trillion.

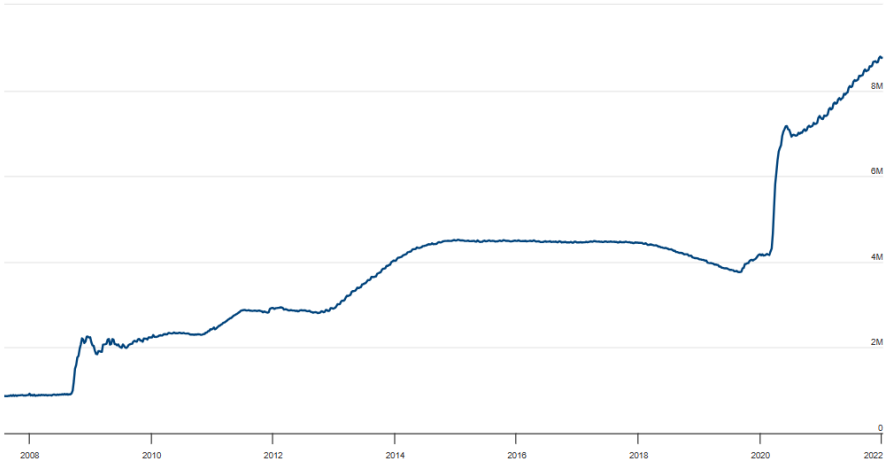


Figure 29. Fed's balance sheet trend. Source: Fed (2024b).

5.3.4 ECB's response

During the COVID-19 pandemic, the European Central Bank (ECB) adopted a markedly different approach to monetary policy compared to previous crises, reflecting the lessons learned from the Eurozone's prolonged struggles to recover from the Global Financial Crisis (GFC). In contrast to its response to the GFC, the ECB swiftly and significantly ramped up its policy actions in 2020, recognizing the imperative to avert a more severe economic crisis. Even before the pandemic, concerns about the "Japanification" of the European economy (Pelagidis & Haralambides, 2020), with the specter of another challenging decade ahead, underscored the ECB's resolve to take decisive monetary policy measures.

By the onset of the COVID-19 pandemic, the ECB had maintained a negative deposit rate since June 2014, further reducing it to -0.50% in September 2019 (ECB, 2024). Consequently, the ECB refrained

from making any changes to interest rates in 2020, given the already deeply negative deposit rate. This strategic decision reflected the ECB's acknowledgment of the limitations of traditional monetary tools and its readiness to explore alternative avenues to support the economy amidst the pandemic-induced downturn.

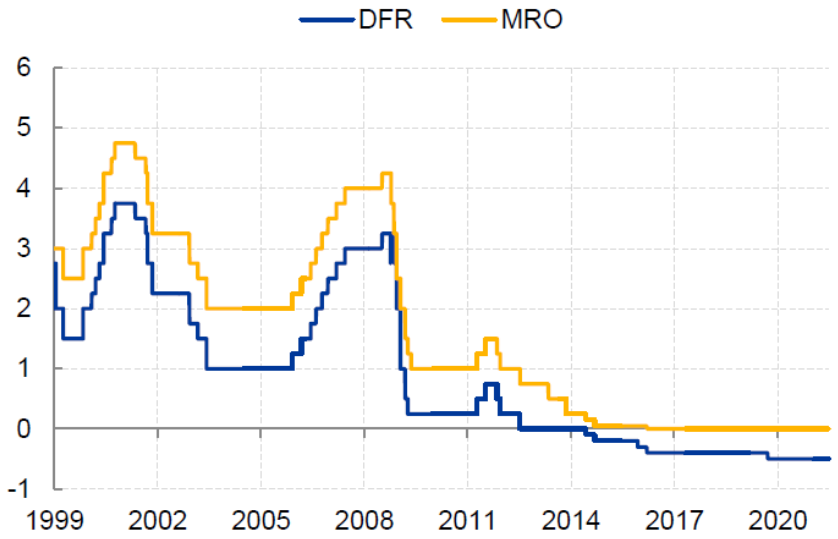


Figure 30. Policy rates in the Euro area (%). Source: ECB (2021).

The European Central Bank (ECB) effectively adapted and expanded its monetary policy toolkit in response to the COVID-19 pandemic, emphasizing the urgency and magnitude of the crisis. Like the Federal Reserve, the ECB used forward guidance as a key tool, reassuring markets that interest rates would remain low—or potentially lower—until inflation projections consistently aligned with their target of 2%. This policy was aimed at maintaining economic stability and encouraging investment by setting clear, predictable monetary conditions.

The ECB significantly ramped up its targeted long-term refinancing operations (TLTROs), which are designed to provide low-cost funding to banks on the condition that these funds are used to support loans to households and businesses. This program was crucial during the pandemic as it facilitated continued lending, especially to small and medium-sized enterprises that were disproportionately affected by the economic downturn. By June 2021, the uptake of these operations had soared to €2.2 trillion, highlighting the high demand for liquidity and the central role of the ECB in supplying it.

In addition to domestic measures, the ECB reinstated its international swap lines, which are crucial for providing liquidity in global funding markets, particularly addressing shortages in US dollars which are critical for international trade and finance. This step was especially significant at the start of the crisis when market tensions heightened.

Moreover, the ECB's quantitative easing (QE) measures were already in place before the pandemic, with ongoing purchases of €20 billion per month in various securities. The onset of COVID-19 led to a substantial augmentation of these efforts. In March 2020, the ECB announced an additional €120 billion under the existing Asset Purchase Programme (APP). More notably, it introduced the Pandemic Emergency Purchase Programme (PEPP) with an initial allocation of €750 billion, later expanded to

€1,850 billion. The PEPP was a flexible tool designed to stabilize the economy by purchasing government and corporate bonds and commercial paper from non-financial corporations.

These extensive measures, which brought the ECB's total asset purchases to about €7 trillion or roughly 60% of Eurozone GDP, underscored the ECB's aggressive and proactive stance in mitigating the economic impact of the pandemic. By expanding the monetary base and ensuring liquidity, the ECB aimed not only to support economic recovery but also to prevent a deeper financial crisis similar to the one experienced during the GFC. This strategic expansion of monetary policy tools was vital in preserving financial stability and fostering a conducive environment for economic recovery within the Eurozone.

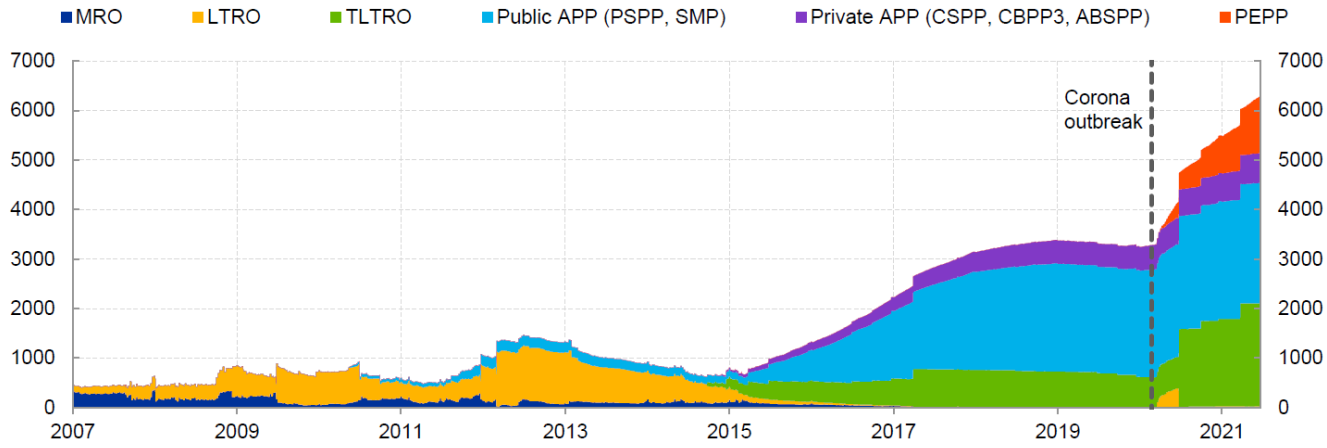


Figure 31. Evolution of ECB balance sheet (€ billions). Source: ECB (2021).

6 The post-pandemic conjuncture: the United States

Following over two decades of low and stable inflation in advanced economies, inflation spiked dramatically after the onset of the COVID-19 pandemic, catching many macroeconomists by surprise. Several factors likely contributed to this surge: a rebound in demand after pandemic lockdowns, supply chain disruptions, pandemic-related fiscal and monetary stimuli, and the Russian invasion of Ukraine.

Central bankers and the majority of economists failed to foresee the sharp rise in inflation that began in 2021. As a result, policymakers in the US and other advanced economies were slow to react, influenced by the belief that the inflation surge would be temporary.

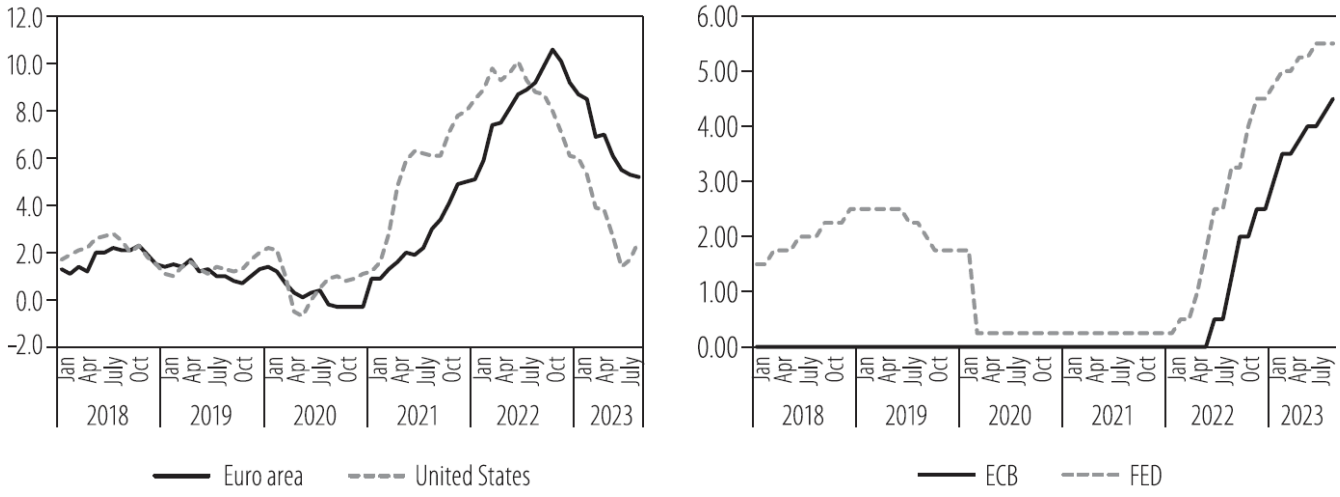


Figure 32. Inflation (left-side panel) and benchmark interest rates (right-side panel) in euro area and the US. Source: Fabris (2024).

One potential explanation for the failure to forecast inflation may be the misjudgment of the impact of COVID-era fiscal programs. These programs are also increasingly likely to have contributed to the ongoing rise in buybacks and, consequently, stock prices. The Federal Open Market Committee (FOMC) anticipated that inflation would change little between September 2020 and June 2021, as stated in the Survey of Economic Projections, and expected it to return close to the 2% target rate by 2023. This was despite the congressional approval of a bill in December 2020 that included $900 billion for COVID relief and the $1.9 trillion American Rescue Plan signed by President Biden. These two programs were in addition to the $2.2 trillion CARES Act passed in March 2020 and signed by President Trump. The combined cost of these three COVID-era packages was about 4.5 times the size of the American Recovery and Reinvestment Act (ARRA) enacted in response to the Global Financial Crisis (GFC).

Conventional economic theory suggests that expansionary fiscal policies can drive inflation if they lead to overheated labor markets and output surpassing the economy's potential. Some early analyses, such as Blanchard (2021), indicated that this might be the case, although there was some uncertainty regarding the exact magnitudes.

Inflation optimists maintained that a significant increase in inflation was improbable because the Phillips curve was flat, meaning inflation was unresponsive to labor market tightness. As a result, and considering the past decades of low inflation, they believed inflation expectations would remain stable.

On the other hand, pessimists argued that wage and price inflation could rise more than the Phillips curve suggested. They attributed this potential rise to the unprecedentedly large fiscal transfers and the Fed's interest rate cuts starting in March 2020. They also warned that the Phillips curve could steepen due to the very low unemployment rate.

Contrary to both views, the initial source of inflation was different than anticipated. Although the labor market tightened in 2021 and 2022, wage trends followed the Fed's expectations. In the end, while labor market overheating did contribute to persistent inflation, as the critics had predicted, it was not the primary cause in the early stages.

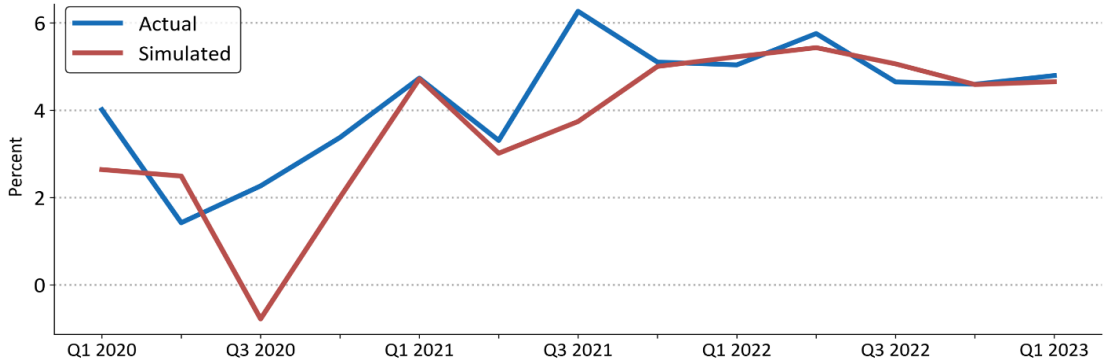


Figure 33. Wage growth 2020Q1-2023Q1 compared to predictions. Source: Bernanke & Blanchard (2023).

Initially, the primary inflationary pressure stemmed from the goods market, with price increases occurring independently of wages. The pandemic led to various distortions, such as rising commodity and food prices, as well as more unusual spikes in prices for both used and new vehicles. This created a perfect storm, driven by a combination of increased aggregate demand, shifts in consumer spending, supply constraints (most notably the microchip shortage), and subsequent sector-specific price increases that were not balanced by price decreases in other sectors (Bernanke & Blanchard, 2023).

6.1 Is Post-pandemic Wage Growth Fueling Inflation?

The surge in inflation was driven by a combination of factors: supply chain disruptions, extraordinary fiscal support for households, labor market shortages, and public health measures such as lockdowns. Nominal wage growth also saw a significant rise, maintaining levels above pre-pandemic averages and raising concerns about a potential wage-price spiral that could extend the current high inflation period.

Research by Andrade, Bräuning, Fillat, and Joaquim (2024) identified that post-pandemic inflation and wage growth were largely due to abnormal price shocks, following transmission patterns consistent with historical trends. They determined that wage growth played a minor role in driving additional inflation in 2023, contributing less than 15% at the peak of the current inflationary episode. Furthermore, since inflation has generally outpaced productivity-adjusted wages over the past three years, there is potential for wage growth to exceed inflation temporarily to realign with historical relationships among price, wage, and productivity growth rates. They specifically suggest that year-

over-year Employment Cost Index (ECI) growth could reach between 3.8% and 4.3% in Q4 2023 without causing additional price pressures.

In practice, ECI year-over-year growth was 4.8% in March 2023, and 4.2% in both December 2023 and March 2024, thus staying within the upper bounds of the interval suggested by Andrade et al. This situation leaves some uncertainty regarding the impact of wage increases on inflation.

Table 4. Civilian workers includes private industry and state and local government. Compensation includes wages and salaries and benefits. Source: US Bureau of Labor Statistics.

12-month, not seasonally adjusted, current dollar			
	Mar. 2023	Dec. 2023	Mar. 2024
Civilian workers			
Compensation	4.8	4.2	4.2
Wages and salaries	5.0	4.3	4.2
Benefits	4.5	3.8	3.7
Private industry			
Compensation	4.8	4.1	4.1
Wages and salaries	5.1	4.3	4.3
Benefits	4.3	3.6	3.6
State and local government			
Compensation	4.9	4.6	4.8
Wages and salaries	4.7	4.7	5.0
Benefits	5.0	4.6	4.5

6.2 Demand dynamics

In the midst of global challenges, consumers have displayed remarkable resilience, although they may be on the brink of a collective turning point, as highlighted by Deloitte's Financial Well-Being Index[1] (FWBI) (Deloitte, 2023). Despite the significant hurdles faced in 2020 and 2021, consumers' perceptions of their financial health remained relatively intact, largely attributed to the extensive government stimulus programs. Furthermore, with limited opportunities for expenditure, the savings rate experienced a notable surge.

[1] Deloitte's Financial Well-Being Index (FWBI) tracks shifts in consumers' perceptions of both their current financial status and their future financial stability. Unlike consumer confidence indices, which typically gauge sentiment regarding economic conditions such as the overall health of the economy or the labor market, financial well-being centers on individuals' personal financial experiences.

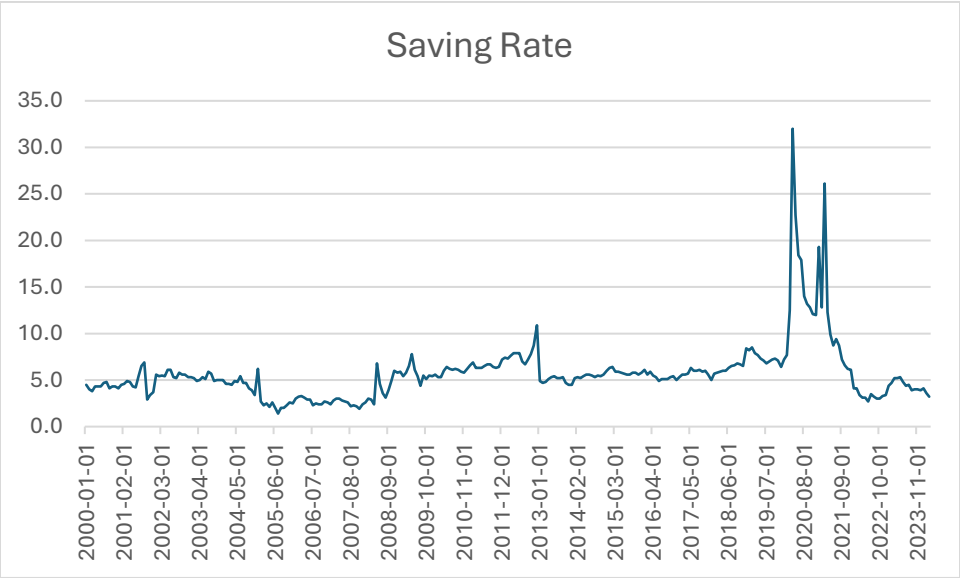


Figure 34. Saving rate in the United States. Source: Fed.

The trend swiftly reversed as the stimulus programs came to an end and inflation surged, causing the savings rate to plummet to historically low levels (see figure 35). While consumer sentiment initially rebounded as inflation began to ease, cautionary signals resurfaced in March 2023 when the momentum of the index began to falter. Looking at the most recent data, the FWBI for the U.S. dropped to 97.5 in April, down from 98.7 the previous month but still higher than the 95.7 recorded a year ago.

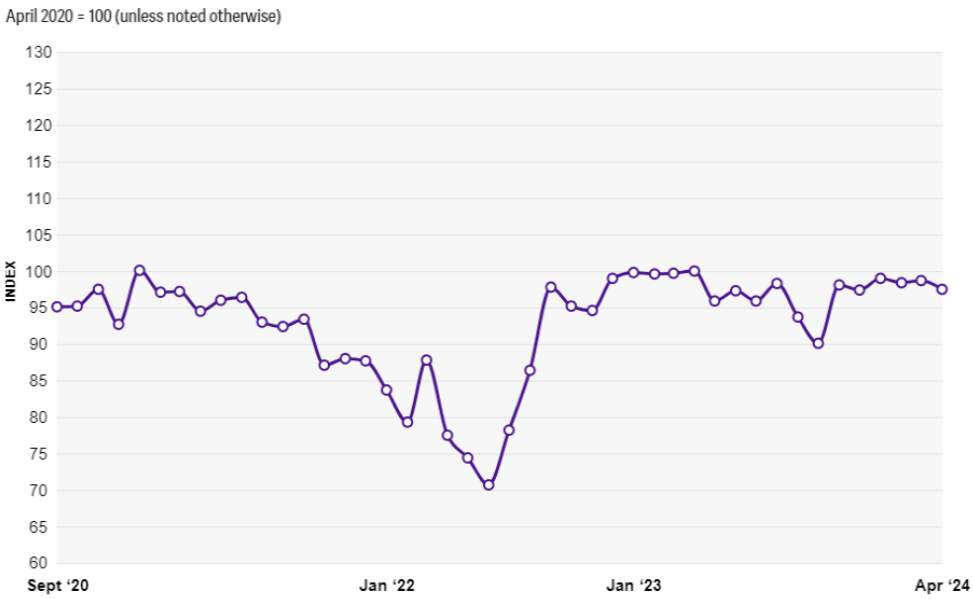


Figure 35. Deloitte Financial Well-Being Index for the U.S.. Source: Deloitte.

With the anticipated boost from easing inflation likely already incorporated into the index, further improvements may prove to be a challenging uphill battle. Consequently, many consumers may have reached their limits concerning price increases, depleting their pandemic savings, and stretching their

budgets. In such a scenario, certain consumer product companies may need to reconsider their pricing strategies or risk facing declining sales volumes. The automotive market, for instance, may encounter affordability challenges, as evidenced by the current decline in sales (see figure 37). Additionally, while many consumers still engage in travel, it remains a significant discretionary expense that they may scale back on if necessary.

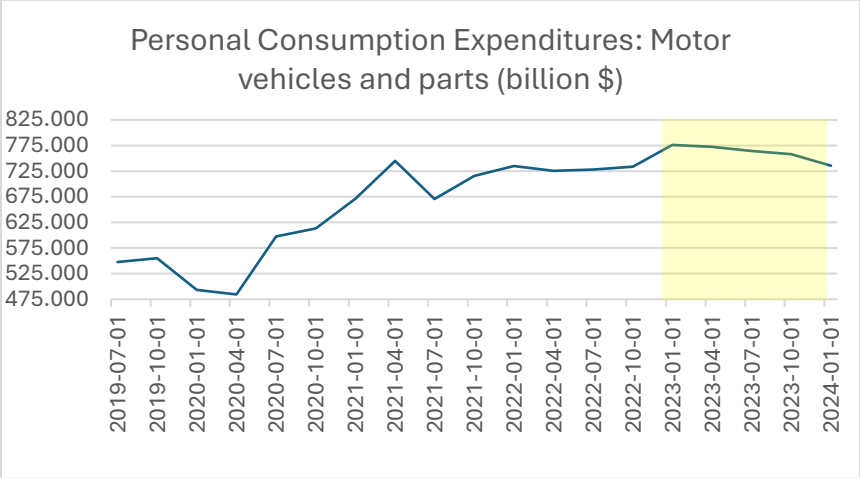


Figure 36. Source: Fed.

The worrying scenario is further underscored by the Spending Intention Index[2] (Deloitte, 2024), which indicates an 18% decrease in spending compared to the average of September, October, and November 2021, and an 8% decrease in saving and investment from the same period.

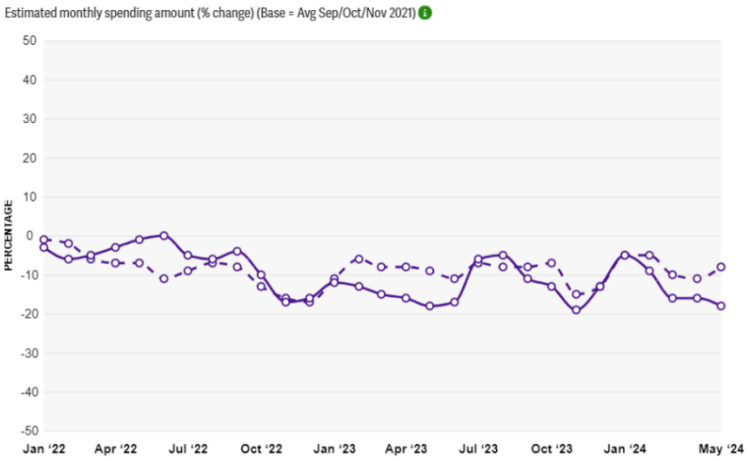


Figure 37. Spending Intention Index in the United States. Source: Deloitte.

[2] Spending intentions are depicted through a three-month exponential moving average (EMA). An exponential moving average (EMA) is a specific type of moving average that assigns greater importance to recent data points, thus making it more sensitive to recent price fluctuations when compared to a simple moving average (SMA). EMA serves as a useful tool for smoothing out data and facilitating the visualization of long-term trends. Non-discretionary categories have been reclassified to encompass housing, transportation, groceries, and healthcare.

Regarding real disposable income, households are experiencing a drain on liquidity due to measures taken to combat inflation and have exhausted all the cash received from covid-related fiscal stimulus, returning them to pre-pandemic levels (see Figure 39).

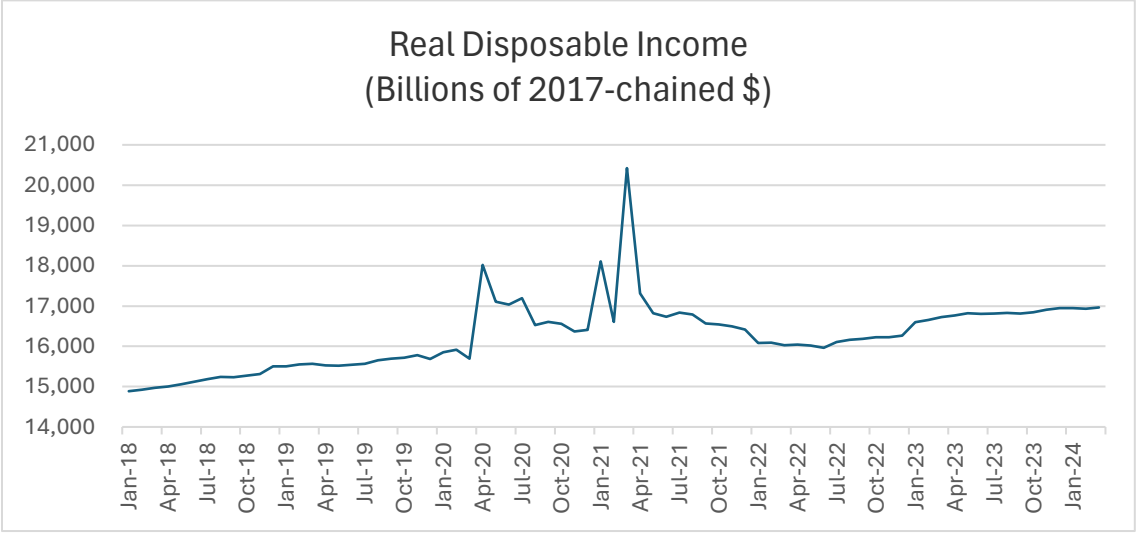


Figure 38. Real Disposable Personal Income, Billions of Chained 2017 Dollars, Monthly, Seasonally Adjusted Annual Rate.

Source: Fed.

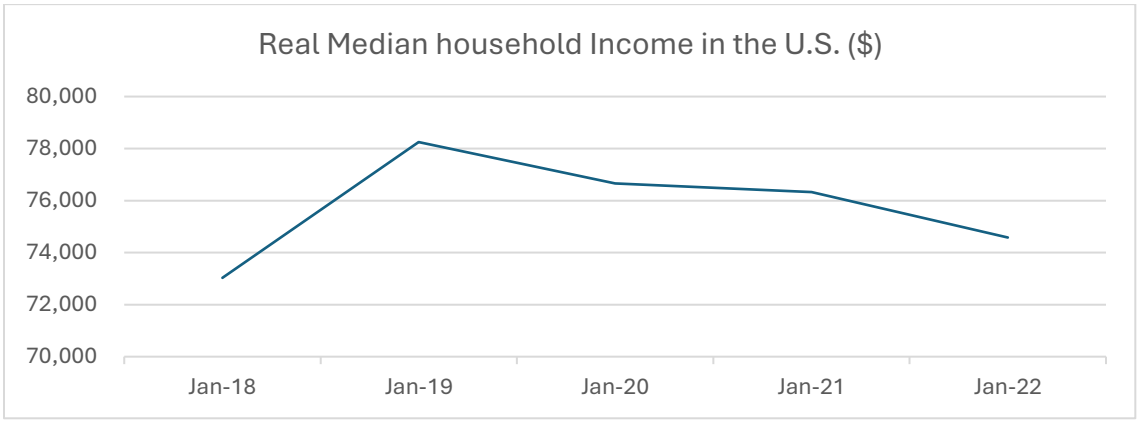


Figure 39. Real Median Household Income in the United States, 2022 CPI-U-RS Adjusted Dollars, Annual, Not Seasonally Adjusted. Source: Fed.

On the investment front, firms have enjoyed elevated prices and margins, resulting in an accumulation of cash. This surplus cash, as mentioned earlier, has facilitated buybacks, contributing to a surge in the stock market that has propelled it to historically high levels. Additionally, despite the presence of high interest rates, firms have increased their capital expenditure, both in aggregate and within the non-financial sector (figures 41 and 42) in the latter case, high interest rates may have actually stimulated investment growth). Furthermore, gross domestic private investment has experienced significant growth following the pandemic (figure 43).

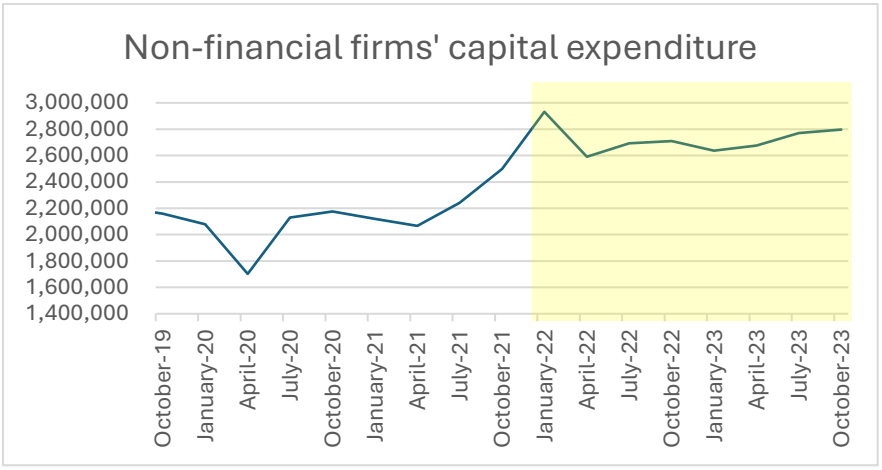


Figure 40. Nonfinancial Corporate Business; Total Capital Expenditures, Transactions, Millions of Dollars, Quarterly, Seasonally Adjusted Annual Rate. Source: Fed.

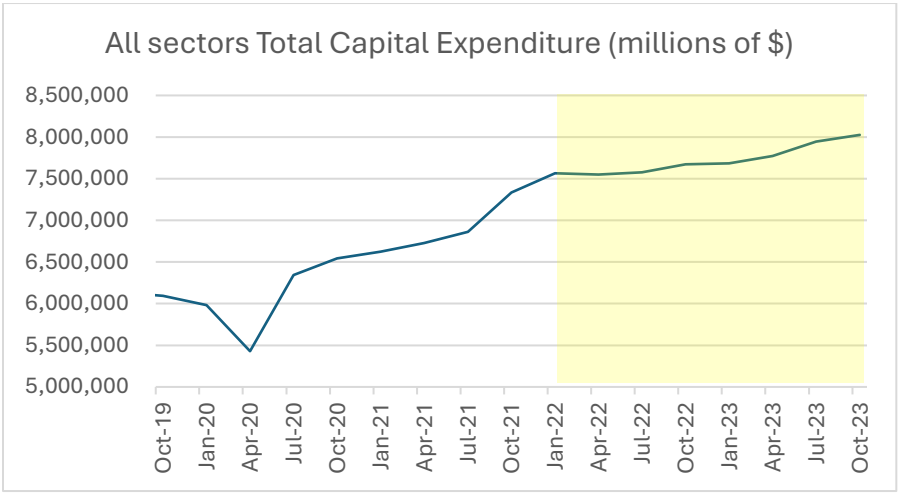


Figure 41. All Sectors; Total Capital Expenditures, Transactions, Millions of Dollars, Quarterly, Seasonally Adjusted Annual Rate. Source: Fed.

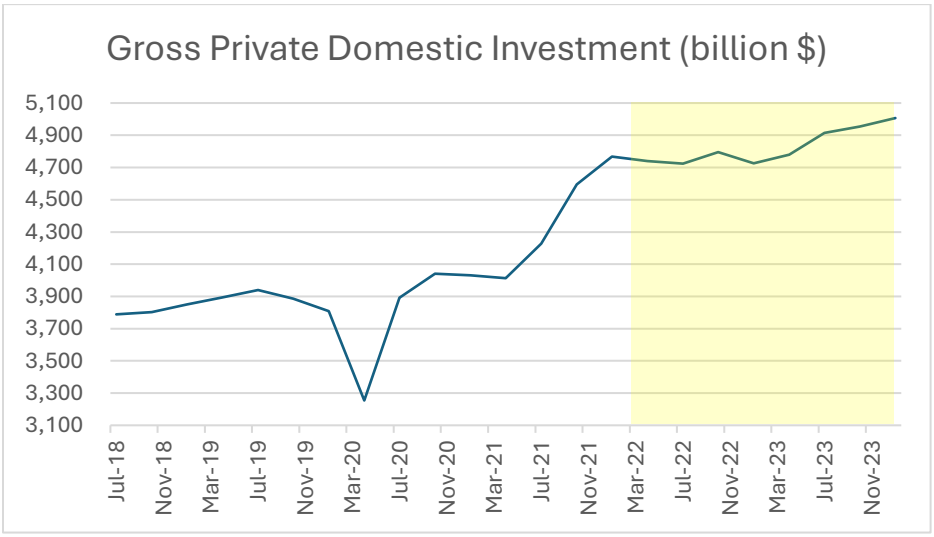


Figure 42. Gross Private Domestic Investment, Billions of Dollars, Quarterly, Seasonally Adjusted Annual Rate. Source: Fed.

However, it should be noted that all three measures of investment have exhibited a slowdown since 2022, signaling that the post-pandemic momentum may have dissipated. Moreover, some sectors are displaying signals of weakening, such as the housing and construction sectors (figure 44 and 45). In general, if we exclude defense expenditure, the overall durable goods sector displays a downward trend (figure 46 and 47).

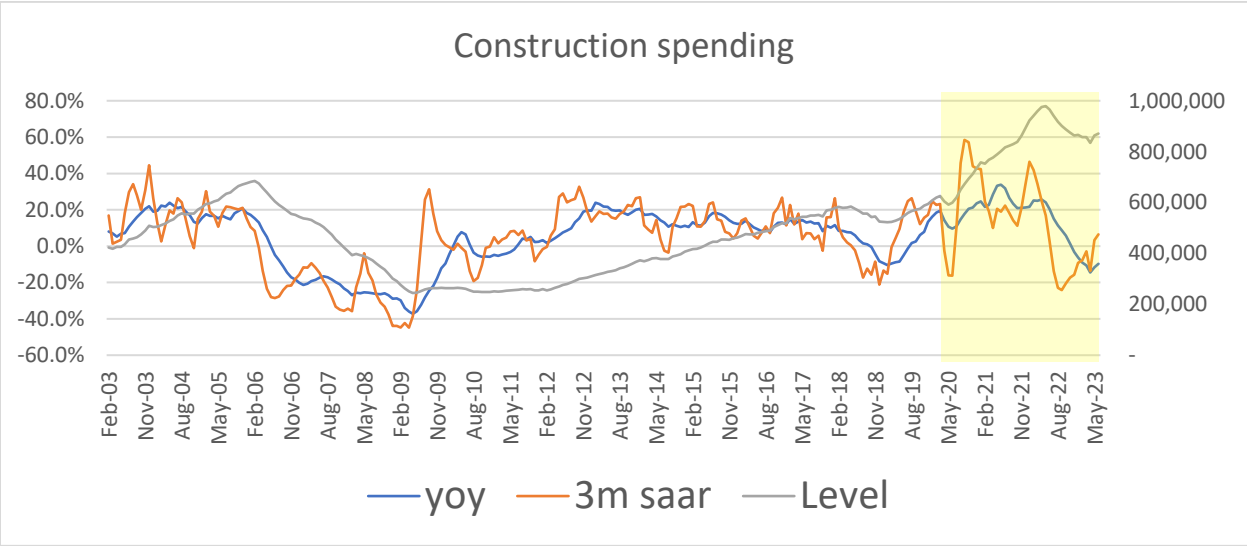


Figure 43. Construction spending. Source: FRED.

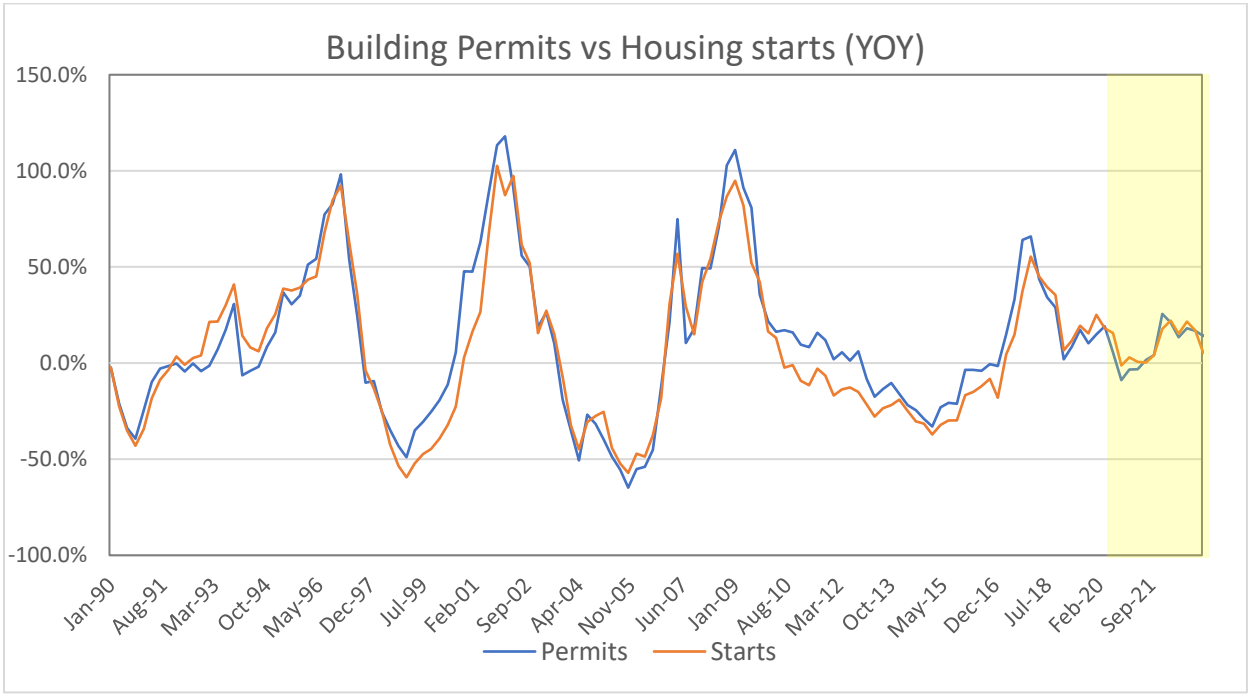


Figure 44. Housing market: building permits vs housing starts (growth rate, year-on-year). Source: FRED.

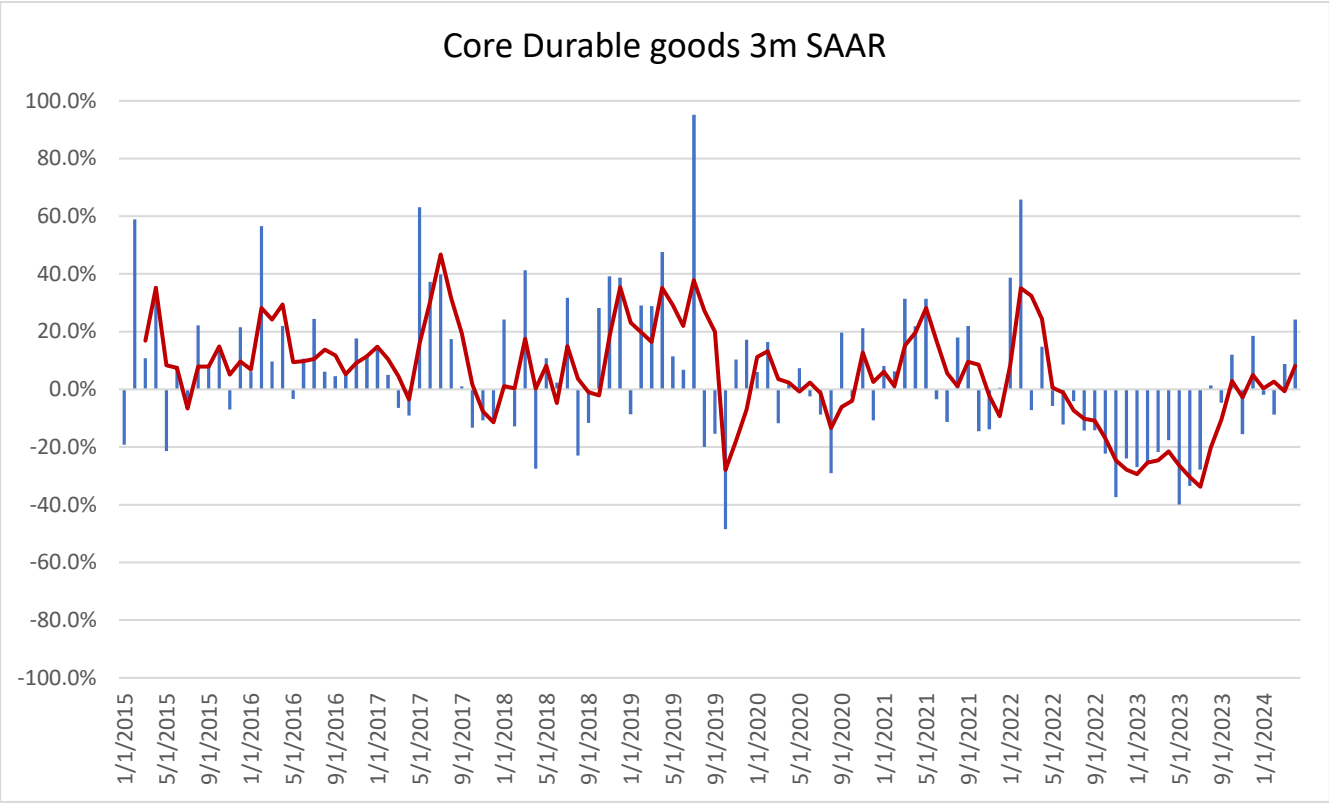


Figure 45. Core Durable Goods 3-month Seasonally Adjusted Annual Rate. Source: FRED.

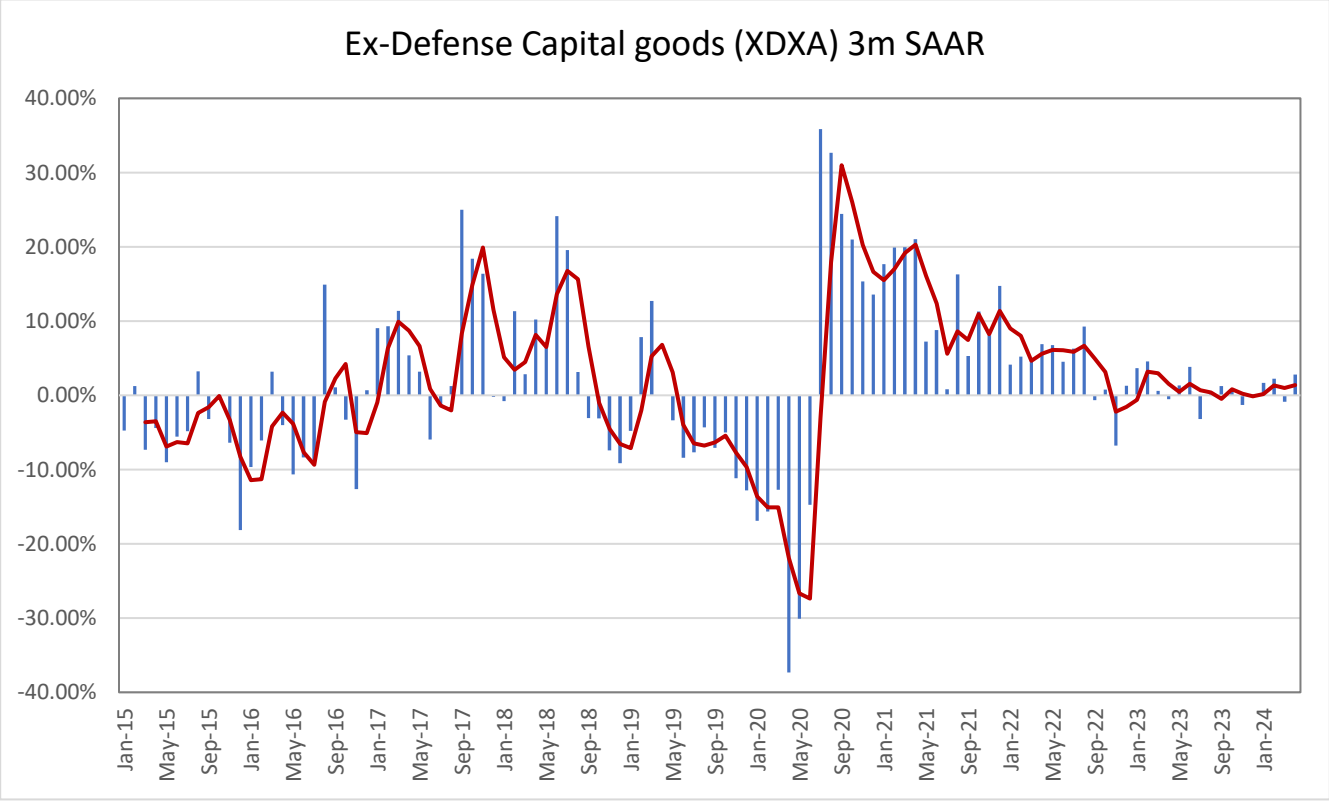


Figure 46.Capital Goods expenditures excluding defense(XD) and aircrafts (XA). Source: FRED.

Examining the Purchasing Managers' Index (PMI), an anticipatory metric that surveys the purchasing managers' intentions and provides insights into business sentiment, we observe a notable increase in the US PMI Composite Output Index. It surged from 51.3 in April to 54.4 in May, marking its highest level since April 2022 (values above 50 indicate expansion, while those below 50 suggest a potential recession). This rise has been sustained for 16 consecutive months, with May's acceleration contrasting with the slowdown observed in March and April.

The improved performance in May was primarily driven by the service sector, where business activity surged, reaching its fastest growth rate in a year at 54.8 points (compared to April's 51.1), reversing the slowdown witnessed over the preceding three months. Additionally, the manufacturing sector saw an increase in output pace in May, reaching 50.9 (compared to April 2024's 50.0).

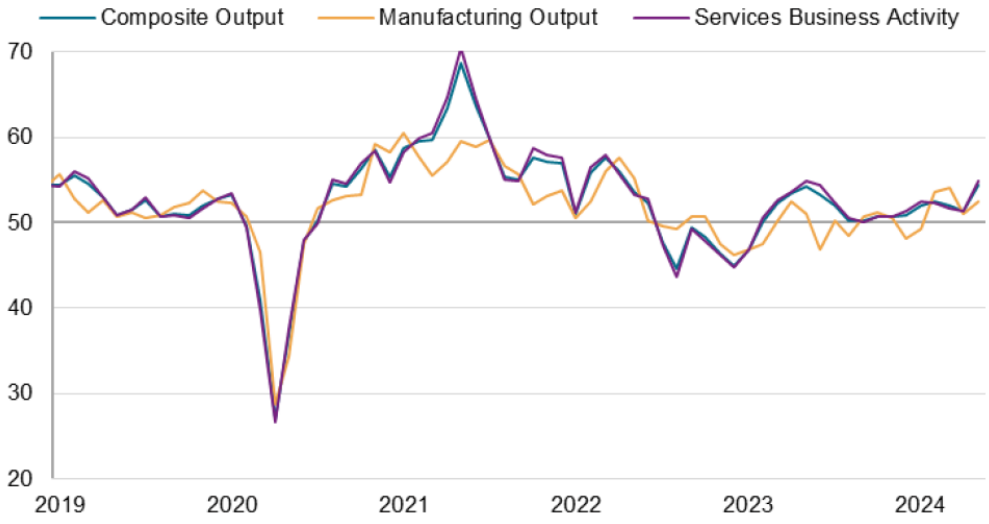


Figure 47. S&P Global Flash PMI. Note: Data compiled May 23, 2024. Source: S&P Global PMI (2024).

As a result, optimism regarding output in the upcoming year increased in both manufacturing and services sectors from April's five-month low, driven by brighter business prospects. However, confidence levels remained below long-term averages in both sectors. Companies continued to express uncertainty regarding the economic outlook due to factors such as the potential for persistently high interest rates, upcoming elections, and broader geopolitical uncertainties (S&P Global, 2024).

7 Debt Sustainability Analysis

7.1 Introduction

Interest in debt sustainability emerged in response to significant events. Initially, the Latin American debt crisis of the 1980s compelled economists, particularly in policy institutions, to develop methodologies for determining whether sovereigns were insolvent or facing temporary illiquidity. This crisis introduced concepts such as debt overhang and self-fulfilling debt crises into public economic discourse.

A second pivotal moment was the widening fiscal deficits in the United States during the 1980s, which raised concerns about the sustainability of U.S. fiscal policy. Renewed interest in debt sustainability has since been fueled by high deficits and markedly increased debts over recent decades, including during events like the Global Financial Crisis and the Covid-19 pandemic.

The current debate echoes that of the 1980s, with renewed attention on the United States, but the economic landscape differs. Many countries now experience real interest rates lower than real growth rates, a trend expected to persist. This scenario suggests that debt could decrease even without governments achieving primary fiscal surpluses, potentially creating a "free lunch" scenario.

Debt sustainability can be conceptualized in two ways. Firstly, it involves adhering to an "intertemporal government budget constraint" (IGBC), derived from the "no-Ponzi-game condition" (NPGC). Secondly, it entails government debt not spiraling out of control relative to GDP. The former is extensively studied in empirical literature, while the latter is the typical focus of policy institution analyses (Willems & Zettelmeyer, 2022).

Central to any discussion of debt sustainability are the government budget constraint and the dynamics of relative debt. In the simplest scenarios, where foreign currency-denominated debt is disregarded, we can assume:

$$B_{t+1} = (1 + r_t)B_t - S_{t+1}$$

Where B_t refers to debt at time t, measured at the end of the period, r_t to the government borrowing rate, and $S_t$to the primary balance (government revenues, including seignorage, minus non-interest rate); so the debt at time t+1 is equal to old debt B_t plus the interest on that debt $r_t B_t$.

There are two ways to interpret this equation. The first approach assumes that all debt matures after one period. Here, B_t represents the (nominal or real) level of outstanding debt, and r_t is the contractual interest rate on one-period debt, which is the government's borrowing cost.

Alternatively, B_t can be interpreted as the market value of the outstanding debt. This interpretation eliminates the need to assume that debt has a one-period maturity and changes r_t from being the contractual rate to the holding return on debt. This includes the coupon payments plus any capital gains or losses.

The latter interpretation is more commonly adopted because it offers greater flexibility. Debt is not assumed to have uniform one-period maturity, and the market value aggregates debts with different maturities into a single figure. Furthermore, it provides the government's opportunity cost of holding that debt, which is crucial when considering alternative policies.

In policy discussions, debt is typically expressed as a percentage of GDP, serving as an indicator of the government's capacity to generate revenue. To convert figures into GDP shares, both sides of the equation are divided by GDP, Y_{t+1}

$$\frac{B_{t+1}}{Y_{t+1}} = \frac{(1+r_t)B_t}{Y_{t+1}} - \frac{S_{t+1}}{Y_{t+1}} \quad (1)$$

Defining $1+g = \frac{Y_{t+1}}{Y_t}$, and multiplying $\frac{(1+r_t)B_t}{Y_{t+1}}$ by $\frac{Y_t}{Y_t}$, we obtain $(1+r_t)\frac{Y_t}{Y_{t+1}}\frac{B_t}{Y_t}$. Using lower case letters to denote shares of GDP, we obtain then:

$$b_{t+1} = \frac{1+r_t}{1+g_t}b_t - s_{t+1} \quad (2)$$

In which the denominator can be either seen as 1+g, or broken down into (1+π)(1+n), where π represents the inflation rate and *n* represents the growth rate of real gross domestic product.

Iterating this equation forward *n* times (for t+2, t+3, …, t+n), we get:

$$b_{t+2} = \frac{1+r_{t+1}}{1+g_{t+1}}b_{t+1} - s_{t+2}$$

$$b_{t+3} = \frac{1+r_{t+2}}{1+g_{t+2}}b_{t+2} - s_{t+3}$$

$$\vdots$$

$$b_{t+n} = \frac{1+r_{t+n-1}}{1+g_{t+n-1}}b_{t+n-1} - s_{t+n}$$

Substituting each b_{t+i} into the next equation, we obtain the general form (equation 3):

$$b_{t+n} = \left(\prod_{j=0}^{n-1}\frac{1+r_{t+j}}{1+g_{t+j}}\right)b_t - \sum_{j=1}^{n}\left(\prod_{h=j}^{n-1}\frac{1+r_{t+h}}{1+g_{t+h}}\right)s_{t+j} \quad (3)$$

To simplify, we define the growth-adjusted discount factor as

$$q_{t,t+j} = \prod_{h=t}^{t+j-1}\frac{1+g_n}{1+t_h}$$

That allows us to rewrite the equation 3 as:

$$b_{t+n} = \frac{1}{q_{t,t+n}} b_t - \frac{1}{q_{t,t+n}} \sum_{j=1}^{n} q_{t,t+j} s_{t+j}$$

Solving for b_t we get equation 4

$$b_t = q_{t,t+n} b_{t+n} + \sum_{j=1}^{n} q_{t,t+j} s_{t+j} \quad (4)$$

Further analysis necessitates considering the sign of r - g. When debt sustainability literature emerged in the 1980s, interest rates were higher than growth rates. However, today in most advanced economies, the opposite is often the case. The implication of $r > g$ for each period is that $q < 1$.

Regarding the relationship between r and g, the United States occupies a unique position, often referred to as the "exorbitant privilege," due to the dollar's status as a safe haven. This status ensures a consistently high demand for US Treasury securities, enabling the US to issue debt at lower interest rates and providing exceptional fiscal flexibility (Goldman Sachs, 2023). Although concerns about de-dollarization have emerged, they appear unfounded in the short to medium term. The reduction of dollar reserves in foreign central banks reflects a domestic re-orientation of the US economy, leading to decreased imports, particularly from China, and consequently lower outflows of US dollars. This results in reduced dollar reserves held by other countries' central banks, with no viable alternative currency or basket of currencies available to serve as a safe haven.

Additionally, the US capital market is the most liquid and deepest in the world, making it the preferred venue for raising capital through debt issuance or other securities. Furthermore, concerns about the safety of US debt and the consequent decline in trust from foreign investors are based on a flawed premise. American debt does not necessarily need to be financed by foreign investors. The retiring baby boomer generation holds approximately $82 trillion (Russo, 2024), which can be used to finance the national debt, especially considering the stock market's high valuation with a price-to-earnings ratio of 28.

In this context, the literature has proposed two approaches to operationalize the broad definitions of policy and debt sustainability mentioned earlier.

7.2 No-Ponzi-Game Condition

The first definition of debt sustainability necessitates that the "intertemporal government budget constraint" (IGBC), also known as the "present value budget constraint," is satisfied:

$$b_t = \lim_{n \to \infty} \sum_{j=1}^{n} q_{t,t+j} s_{t+j}$$

From equation 4, this requires:

$$\lim_{n \to \infty} q_{t,t+j} s_{t+j} = 0$$

This principle is referred to as the "transversality condition" (TVC) or "no-Ponzi-game condition" (NPGC). It stipulates that government debt must grow asymptotically at a rate below the growth-adjusted asymptotic rate of interest.

The NPGC serves to prevent a scenario where the government indefinitely rolls over its debt without ever reducing it, which would resemble a Ponzi scheme. Essentially, it ensures that the government cannot sustainably finance its debt without eventually reducing the principal.

Mathematically, the condition ensures that the present value of government debt does not grow faster than the economy's capacity to repay it. This involves considering asymptotic growth, which examines how a function behaves as time approaches infinity. For the NPGC, this means analyzing the behavior of the debt-to-GDP b_{t+n} approaches infinity, reflecting long-term dynamics.

The underlying rationale behind the NPGC is that continual issuance of new debt to service existing debt without principal reduction would lead to exponential growth in total debt (a debt bubble). The NPGC prevents this by mandating that the present value of debt, discounted by the economy's real growth rate and real interest rate, converges to zero:

$$\lim_{n\to\infty} q_{t,t+j} s_{t+j} = 0$$

For debt to be considered sustainable, the economy must be capable of servicing it indefinitely without relying on continuously increasing borrowing. The NPGC ensures that the economy's growth rate is sufficient to manage the debt burden over the long term. This implies that governments must shape fiscal policies to adhere to the NPGC. This can be achieved through various measures, such as implementing higher taxes, reducing primary spending, enacting growth-promoting reforms, increasing seigniorage revenues (with associated inflation risks), or adjusting policies to reduce the debt burden, such as through less desirable actions like default, hyperinflation, or debt restructuring.

8 Non-explosive debt ratio

A second definition considers fiscal policy sustainable when current and projected future policies do not cause the debt ratio to skyrocket. The rationale is that if the debt ratio were to explode, eventually the resources needed to service the debt would exceed the government's ability to raise revenue through taxation.

(5) $$\lim_{n\to\infty} b_{t+n} = b, \text{ where b is a constant}$$

Notice that condition (5) is stronger than the NPGC because the former encompasses the latter but not vice versa.

During the 1980s and early 1990s, researchers employed these dual criteria to assess the sustainability of debt by examining the stationarity and cointegration properties of fiscal time series. Stationarity refers to a characteristic of time series where statistical attributes like mean, variance, and autocorrelation remain stable over time, indicating consistent behavior regardless of observation time. Cointegration, on the other hand, pertains to a statistical feature of a set of time series variables where, while individually non-stationary, they exhibit a stable, long-term equilibrium relationship. If two or

more time series are cointegrated, it means there exists a linear combination of them that is stationary despite their individual non-stationarity.

When analyzing fiscal time series such as government debt and revenue, tests for stationarity and cointegration help elucidate the dynamics and interdependencies between these variables. A stationary fiscal series, like government debt, suggests it maintains a constant mean over time, reflecting a stable fiscal environment. Cointegration between government debt and revenue signals a sustained equilibrium relationship, implying that despite short-term deviations, they co-move in the long run, underpinning the sustainability of government debt tied to revenue generation capacity.

In the 1980s and early 1990s, these concepts were pivotal in empirically evaluating the sustainability of fiscal policies by examining the stationarity of debt and deficit series, and the cointegration between government revenues and expenditures. Sustainable fiscal policies typically demonstrate such relationships, indicating governments effectively manage debt and revenue in a balanced and stable manner.

8.1 The Buiter Model

Among the researchers who utilized these concepts in the 1980s and 1990s is Willem Buiter, who applied the concept of a non-explosive debt ratio to assess the sustainability of India's finances during a precarious period (Buiter & Patel, 1992).

Buiter conducted a systematic analysis to determine whether the current and recent behavior of key budgetary and related time series could be sustained. This involved examining the non-stationarity of fiscal variables, as the non-stationarity of discounted public debt implies that continuing the historical pattern of behavior reflected in the discounted debt process indefinitely would jeopardize solvency.

The analysis begins with the definition of total public debt (TPB), which is defined as

$$TPB = TDD + TFD - R^*$$

TDD refers to internal (domestic) debt, comprising domestic private sector holdings of central government debt (CDD), state government debt (SDD), and public enterprise debt. Intrapublic sector assets and liabilities are adjusted to avoid double-counting. Liabilities of public enterprises are included as they fall under Treasury responsibility, whereas the banking sector (excluding the Reserve Bank) is excluded. *TFD* represents external (foreign) debt, which includes public and publicly-guaranteed long-term debt, IMF credit, and estimates of public and publicly guaranteed short-term debt. *R** denotes official foreign exchange reserves.

To assess whether the continuation of past and current policies aligns with government solvency, we begin with the consolidated public sector budget identity, which integrates the general government with public enterprises and the central bank.

$$\frac{M_t - M_{t-1}}{P_t} + \frac{B_t - B_{t-1}}{P_t} + \frac{V_t(\tilde{B}_t^* - \tilde{B}_{t-1}^*)}{P_t} - \frac{V_t(F_t^* - F_{t-1}^*)}{P_t} = C_t + A_t - T_t + i_{t-1}\frac{B_{t-1}}{P_t} + i_{t-}^*\frac{V_t}{P_t}\left(\tilde{B}_{t-1} - F_{t-1}^*\right) - \rho_{t-1}K_{t-1} \quad (6)$$

In equation (6), M is the nominal stock of base money; B is the stock of domestic currency denominated public debt; $\tilde{B}_t^*$ is the stock of foreign currency denominated public debt; $F^*$is the stock of foreign exchange reserves; V is the foreign exchange rate; P is the domestic price level; C is government consumption; A is public sector gross domestic capital formation; T is net current revenue; i is the domestic nominal interest rate; i^* is the foreign nominal interest rate; ρ is the cash rate of return on public sector capital; K is the public sector capital stock valued at current reproduction cost.

It can be useful (though it lacks behavioral significance) to rephrase this identity in terms of the evolution over time of stocks and flows per unit of GDP.

$$\begin{aligned}(7)\qquad &\frac{M_t - M_{t-1}}{P_t Y_t} + \frac{B_t - B_{t-1}}{P_t Y_t} + V_t\left(\frac{\tilde{B}_t^* - \tilde{B}_{t-1}^*}{P_t Y_t} - \frac{F_t^* - F_{t-1}^*}{P_t Y_t}\right) \\ &\qquad = \frac{C_t}{Y_t} + \frac{A_t}{Y_t} - \frac{T_t}{Y_t} + i_{t-1}\frac{B_{t-1}}{P_t Y_t} + i_{t-1}^*\frac{V_t}{P_t Y_t}\left(\tilde{B}_{t-1} - F_{t-1}^*\right) - \rho_{t-1}\frac{K_{t-1}}{Y_t}\end{aligned}$$

Express the lowercase variables as the corresponding uppercase variables divided by GDP (Y).

$$b_t = \frac{B_t}{Y_t} \qquad m_t = \frac{M_t}{Y_t} \qquad c_t = \frac{C_t}{Y_t} \qquad a_t = \frac{A_t}{Y_t} \qquad \tau_t = \frac{T_t}{Y_t}$$

Define inflation rate $\pi_{t-1} = \frac{P_t - P_{t-1}}{P_t}$; the growth rate of real GDP $n_{t-1} = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$; the proportional depreciation rate of the real exchange rate $\epsilon_{t-1} = \frac{V_t - V_{-1}}{V_{t-1}}$ and seigniorage $\sigma_t = \frac{M_t - M_{t-1}}{P_t Y_t}$ and let $B^* = \tilde{B}^* - F^*$ be net foreign debt. We obtain:

$$\sigma_t + \frac{B_t - B_{t-1}}{P_t Y_t} + V_t\left(\frac{B_t^* - B_{t-1}^*}{P_t Y_t}\right) = \frac{C_t}{Y_t} + \frac{A_t}{Y_t} - \frac{T_t}{Y_t} + i_{t-1}\frac{B_{t-1}}{P_t Y_t} + i_{t-1}^*\frac{V_t}{P_t Y_t}(B_{t-1}^*) - \rho_{t-1}\frac{K_{t-1}}{Y_t}$$

In the next steps, we express then equation (7) in terms of these variables normalized by GDP. In order to do so, we need to first recognize that $Y_t = Y_{t-1}(1 + n_{t-1})$ and $P_t = P_{t-1}(1 + \pi_{t-1})$.

This implies that $\frac{B_t - B_{t-1}}{P_t Y_t} = \frac{B_t}{P_t Y_t} - \frac{B_{t-1}}{P_{t-1} Y_{t-1}}\frac{P_{t-1} Y_{t-1}}{P_t Y_t} = b_t - b_{t-1}\frac{1}{(1+n_t)(1+\pi_t)}$.

Similarly, $V_t\left(\frac{B_t^* - B_{t-1}^*}{P_t Y_t}\right) = b_t^* - b_{t-1}^*\frac{(1+\epsilon_{t-1})}{(1+n_t)(1+\pi_t)}$, $i_{t-1}\frac{B_{t-1}}{P_t Y_t} = b_{t-1}\frac{i_{t-1}}{(1+n_t)(1+\pi_t)}$, $i_{t-1}^* V_{t-1}\frac{B_{t-1}}{P_t Y_t} = b_{t-1}\frac{i_{t-1}(1+\epsilon_{t-1})}{(1+n_t)(1+\pi_t)}$, and $\rho_{t-1}\frac{k_{t-1}}{Y_t} = \rho_{t-1}\frac{k_{t-1}}{(1+n_t)}$.

Equation (7) therefore becomes:

$$\begin{aligned}&\sigma_t + b_t - b_{t-1}\frac{1}{(1+n_t)(1+\pi_t)} + b_t^* - b_{t-1}^*\frac{(1+\epsilon_{t-1})}{(1+n_t)(1+\pi_t)} \\ &\qquad = c_t + a_t - \tau_t + b_{t-1}\frac{i_{t-1}}{(1+n_t)(1+\pi_t)} + b_{t-1}\frac{i_{t-1}(1+\epsilon_{t-1})}{(1+n_t)(1+\pi_t)} - \rho_{t-1}\frac{k_{t-1}}{(1+n_t)}\end{aligned}$$

We leave only b_t and b_t^* on the left-hand side, obtaining:

$$b_t + b_t^* = b_{t-1}\frac{1}{(1+n_t)(1+\pi_t)} + b_{t-1}\frac{i_{t-1}}{(1+n_t)(1+\pi_t)} + b_{t-1}^*\frac{(1+\epsilon_{t-1})}{(1+n_t)(1+\pi_t)} + b_{t-1}^*\frac{i_{t-1}(1+\epsilon_{t-1})}{(1+n_t)(1+\pi_t)} + c_t + a_t - \tau_t - \rho_{t-1}\frac{k_{t-1}}{(1+n_t)} - \sigma_t$$

By factoring out the common factors appropriately, we obtain:

$$b_t + b_t^* = b_{t-1}\frac{(1+i_{t-1})}{(1+\pi_{t-1})(1+n_{t-1})} + b_{t-1}^*\frac{(1+i_{t-1}^*)(1+\epsilon_{t-1})}{(1+\pi_{t-1})(1+n_{t-1})} + c_t + a_t - \tau_t - \frac{\rho_{t-1}}{1+n_{t-1}}k_{t-1} - \sigma_t \quad (8)$$

Let's denote $c_t + a_t - \tau_t - \rho_{t-1}k_{t-1} = \delta_t$ as the primary public sector deficit per unit of GDP, this represents the conventionally measured consolidated public sector deficit net of any interest payments or interest income. The total public debt as a fraction of GDP will be denoted by $d = b + b^*$. The increase in the nominal stock of base money as a fraction of GDP (σ_t) is referred to as seigniorage.

We use the definitions of the domestic real interest rate $1 + r = \frac{1+i}{1+\pi}$ and the foreign real interest rate $1 + r^* = \frac{1+i^*}{1+\pi}$, to rewrite equation (8) as:

$$d_t = b_{t-1}\frac{(1+r_{t-1})(1+\pi_{t-1})}{(1+n_{t-1})(1+\pi_{t-1})} + b_{t-1}^*\frac{(1+r_{t-1}^*)(1+\pi_{t-1})(1+\epsilon_{t-1})}{(1+n_{t-1})(1+\pi_{t-1})} + \delta_t - \sigma_t$$

By simplifying $(1 + \pi_{t-1})$, we find

$$d_t = b_{t-1}\frac{(1+r_{t-1})}{(1+n_{t-1})} + b_{t-1}^*\frac{(1+r_{t-1}^*)(1+\epsilon_{t-1})}{(1+n_{t-1})} + \delta_t - \sigma_t$$

Given that $d = b + b^*$, we can say that $d_{t-1} = b_{t-1} + b_{t-1}^*$.

We therefore can say that $b_{t-1} = b_{t-1} + b_{t-1}^* - b_{t-1}^*$ becomes $b_{t-1} = d_{t-1} - b_{t-1}^*$, we multiply then both sides by $\frac{1+r_{t-1}}{1+n_{t-1}}$, finding $\frac{1+r_{t-1}}{1+n_{t-1}}b_{t-1} = \frac{1+r_{t-1}}{1+n_{t-1}}(d_{t-1} - b_{t-1}^*)$. We then substitute into the main equation to find:

$$d_t = \frac{1+r_{t-1}}{1+n_{t-1}}(d_{t-1} - b_{t-1}^*) + b_{t-1}^*\frac{(1+r_{t-1}^*)(1+\epsilon_{t-1})}{(1+n_{t-1})} + \delta_t - \sigma_t$$

By factoring out $\frac{b_{t-1}^*}{(1+n_{t-1})}$, we find

$$d_t = \frac{1+r_{t-1}}{1+n_{t-1}}d_{t-1} + \delta_t + \frac{b_{t-1}^*}{1+n_{t-1}}[(1+r_{t-1}^*)(1+\gamma_{t-1}) - (1+r_{t-1})] - \sigma_t$$

Acknowledging that $(1 + \epsilon_{t-1}) = (1 + \gamma_{t-1})$, where γ is the proportional depreciation rate of the real exchange rate, and $\tilde{r} = r - n$, we finally find equation (9):

(9) $$d_t = (1 + \tilde{r}_{t-1})d_{t-1} + \delta_t + \frac{b^*_{t-1}}{1 + n_{t-1}}[(1 + r^*_{t-1})(1 + \gamma_{t-1}) - (1 + r_{t-1})] - \sigma_t$$

Ultimately, defining the augmented primary deficit $\overline{\delta}_t = +\delta_t + \frac{b^*_{t-1}}{1+n_{t-1}}[(1 + r^*_{t-1})(1 + \gamma_{t-1}) - (1 + r_{t-1})]$ we get equation (10):

(10) $$d_t = (1 + \tilde{r}_{t-1})d_{t-1} + \overline{\delta}_t - \sigma_t$$

By iterating equation (10) forward in time and letting E_t denote the expectation operator conditional on information at time *i* we get equation (11):

(11) $$d_t = \sum_{i=0}^{\infty} E_t \prod_{j=0}^{i} \frac{1}{1 + r_{t+j}}\left[-\bar{\delta}_{t+1+i} + \sigma_{t+1+i}\right] + \lim_{i\to\infty} E_t \prod_{j=0}^{i} \frac{1}{1 + r_{t+j}} d_{t+1+i}$$

The first term sums the discounted future values of the augmented primary deficit (δ) and seigniorage (σ). In particular, $\prod_{j=0}^{i} \frac{1}{1+r_{t+j}}$ is the discount factor applied to future values; it adjusts future values to their present value at time t, taking into account the real interest rates r_{t+j} over the periods. $E_t\left(-\bar{\delta}_{t+1+i} + \sigma_{t+1+i}\right)$ represents the expected value of the augmented primary deficit and seigniorage at time t+1+i, based on information available at time t.

The second term, $\lim_{i\to\infty} E_t \prod_{j=0}^{i} \frac{1}{1+r_{t+j}} d_{t+1+i}$ represents the expected value of the debt-to-GDP ratio at an infinite future time, discounted to the present; if the debt is to remain solvent in the long run, this term should approach zero, ensuring that the present value of future debt does not explode.

Therefore, equation (11) can be interpreted as stating that the current debt-to-GDP ratio d_t is the sum of the present values of all expected future primary deficits and seigniorage, plus the present value of the debt-to-GDP ratio in the infinite future. By solving equation (10) recursively forward and incorporating expectations, equation (11) ensures that all future values are accounted for, reflecting both deterministic trends and stochastic elements influenced by the information available at time.

Buiter then continues by letting $q_i = \prod_{j=0}^{i}\left(1 + \tilde{r}_j\right)^{-1}$, $q_{-1} = 1$ be the discount factor from period zero to period *t*+*i*, and then rewrites equation (11) in the more compact form:

(11') $$d_t = \sum_{i=0}^{\infty} E_t \frac{q_{t+i}}{q_{t-1}}\left[-\bar{\delta}_{t+1+i} + \sigma_{t+1+i}\right] + \lim_{i\to\infty} E_t \frac{q_{t+i}}{q_{t-1}} d_{t+1+i}$$

To obtain the government solvency constraint, Buiter imposes the following condition on equation (11):

(12) $$\lim_{i\to\infty} \frac{1}{q_{t-1}} E_t q_{t+i} d_{t+1+i} \leq 0$$

Where we consider the behavior of the term as i goes to infinity, which implies looking at the very long-term future. The discount factor q is defined as $\prod_{j=0}^{i} \frac{1}{1+r_j}$ and discounts future values to their present values, taking into account the real interest rate r_j over time, and d_{t+1+i} represents the debt-to-GDP ratio at a future time $t+1+i$.

Hence, equation (12) states that the present value of future public debt, when discounted appropriately and considering expectations, should not exceed zero in the limit. In other words, it ensures that the expected present value of government debt in the infinite future is non-positive. This condition prevents the debt from growing indefinitely without bounds, which would imply that the government would not be able to meet its debt obligations. In essence, this implies that future primary surpluses and seigniorage should be sufficient to meet the debt obligations.

8.2 The application of the Buiter model to the United States

At this point, it is important to note that in the case of the United States, the augmented primary deficit $\overline{\delta}_t$ coincides with the primary deficit δ_t because the debt denominated in foreign currency b^*_{t-1} is zero, as the United States issue the entirety of its debt in US dollars, and therefore there is no debt denominated in foreign currencies. For the same reason, also the exchange rate is irrelevant in the case of the United States; it is however interesting to see how it affects debt: when a currency appreciates, it happens that the country issuing securities denominated in that currency will have to pay more to service that debt; in this kind of scenario, for the same dynamic, reserves of that currencies enter the equation negatively, i.e. as the currency strengthen, the value of reserves increases, having a positive effect on debt (i.e. decreasing debt).

The final adjustment we made, compared to Buiter's version, is to keep $(1+\tilde{r}_{t-1})$ in the form of $\frac{1+r_{t-1}}{1+n_{t-1}}$, which is a purely formal adjustment.

Therefore, the final equation we will use in the scenarios that we are going to simulate will be:

$$d_t = \frac{1+r_{t-1}}{1+n_{t-1}} d_{t-1} + \delta_t - \sigma_t$$

8.3 The state of affairs

Years of substantial budget deficits, intensified by significant federal expenditures during the COVID-19 pandemic, have driven the debt to unprecedented levels: exceeding $26 trillion in 2023, U.S. federal government debt now stands at its highest percentage of gross domestic product (GDP) since World War II. Equally concerning for many experts is the debt's unsustainable path, as current laws predict spending will continue to surpass revenues.

At present, the national debt nearly matches the size of the entire U.S. economy and is expected to double within the next thirty years. Some economists warn this could lead to numerous risks, including a budget crisis, rising interest rates, increased economic instability, and a reduced role in global leadership. Reducing the debt will necessitate Congress to make politically challenging choices to either cut spending, increase taxes, or both. Conversely, some experts argue that the United States can

continue to borrow safely at current levels because it pays relatively low interest due to its unique position in the global economy.

The United States has experienced annual deficits—where government spending exceeds tax revenue—almost every year since its inception. Post-World War II, when the U.S. emerged as a global superpower, serves as a useful starting point for analyzing modern debt levels. Defense expenditures during the war led to unprecedented borrowing, with debt surging to over 100 percent of GDP by 1946.

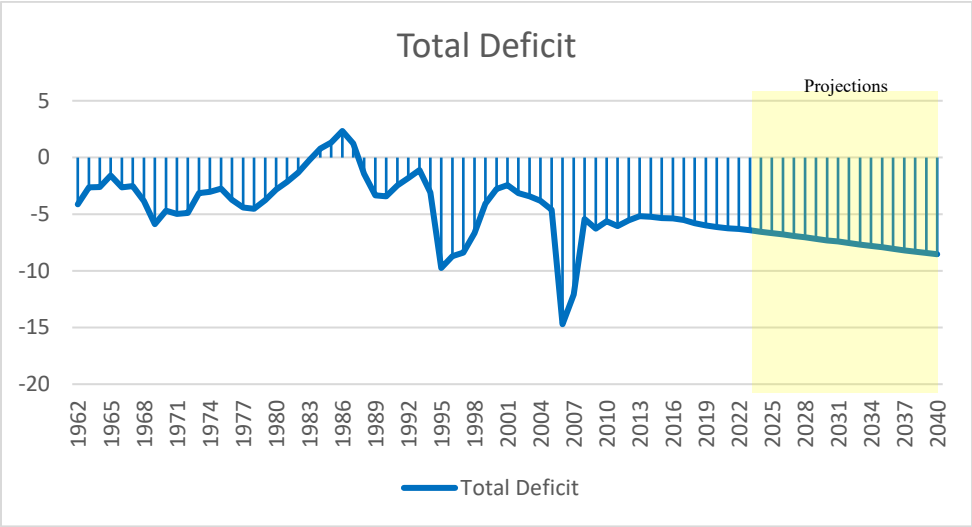


Figure 48. Surplus or Deficit as a percentage of gross domestic product (GDP). Source: Congressional Budget Office.

Over the following three decades, continuous economic growth gradually reduced the debt-to-GDP ratio, despite costly conflicts in Korea and Vietnam and the creation of major entitlement programs such as Medicare and Medicaid. Debt as a percentage of GDP reached its lowest point in 1974 at 24 percent (McBride, Berman and Siripurapu, 2023).

In the 1980s, the Reagan administration significantly increased defense spending and implemented major tax cuts, initiating a period of rising debt. The 1990s saw a reduction in the debt-to-GDP ratio due to tax hikes, defense spending cuts, and an economic boom. In 1998, President Bill Clinton, alongside a Republican-controlled Congress, achieved the first of four consecutive budget surpluses—the longest streak in forty years.

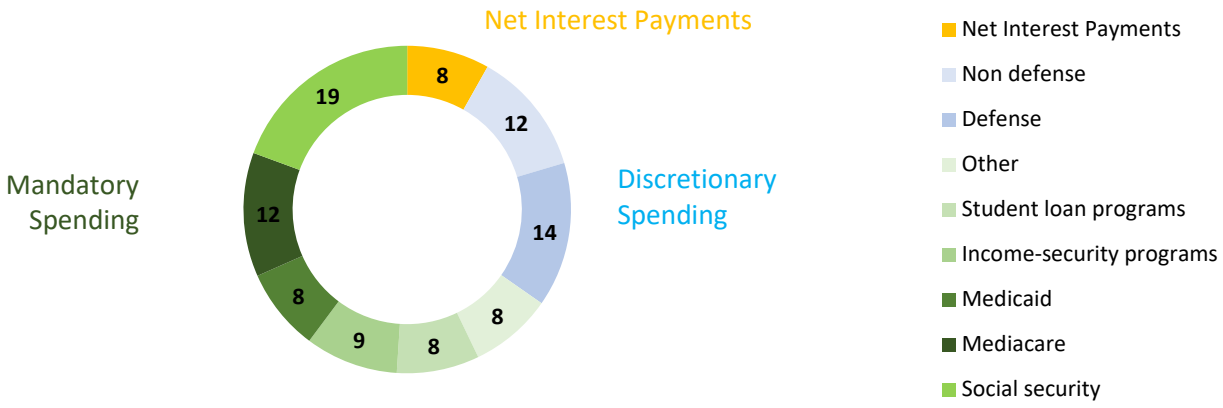
Deficits reappeared during President George W. Bush's tenure, marked by tax cuts, war expenditures in Afghanistan and Iraq, and substantial new entitlements like Medicare Part D, which added prescription drug coverage. Under President Barack Obama, annual deficits exceeded $1 trillion, driven by responses to the Great Recession, including the continuation of the Bush administration’s bank bailout program and significant fiscal stimulus measures.

8.3.1 How does the government spend the money?

The federal budget is allocated among mandatory spending, discretionary spending, and interest payments on the debt. The majority of the budget is devoted to mandatory spending, which occurs automatically unless Congress changes the authorizing legislation. This category primarily includes entitlement programs like Social Security, Medicare, and Medicaid. The remaining portion is allocated

to discretionary spending, which Congress must approve annually through the appropriations process, and to servicing the debt.

In fiscal year 2022, discretionary programs accounted for only 27 percent of federal spending. Of this, defense-related agencies and programs received the largest share, about $750 billion. Other significant discretionary expenditures, including health, education, veterans' benefits, and transportation, each received less than $150 billion.



The nonpartisan Congressional Budget Office (CBO) projects that the primary drivers of spending will be mandatory programs, particularly Social Security—the largest U.S. government program—alongside Medicare and Medicaid. These projections are based on the assumption that existing federal revenue and spending laws remain unchanged. The costs of these programs are expected to increase as a percentage of GDP due to an aging population and rising health care expenses without a corresponding increase in revenue.

Additionally, interest payments on the debt are anticipated to rise sharply relative to GDP in the near future. These payments have recently climbed to their highest levels in over two decades as the Federal Reserve raised interest rates to counteract inflation triggered by the pandemic and the Russian invasion of Ukraine. In fiscal year 2023, net interest payments on the national debt amounted to $659 billion, or about 2.5 percent of GDP, and are projected to nearly triple to 7.5 percent over the next thirty years.

Conversely, discretionary spending, which includes expenditures on defense and transportation, is expected to remain constant as a share of GDP.

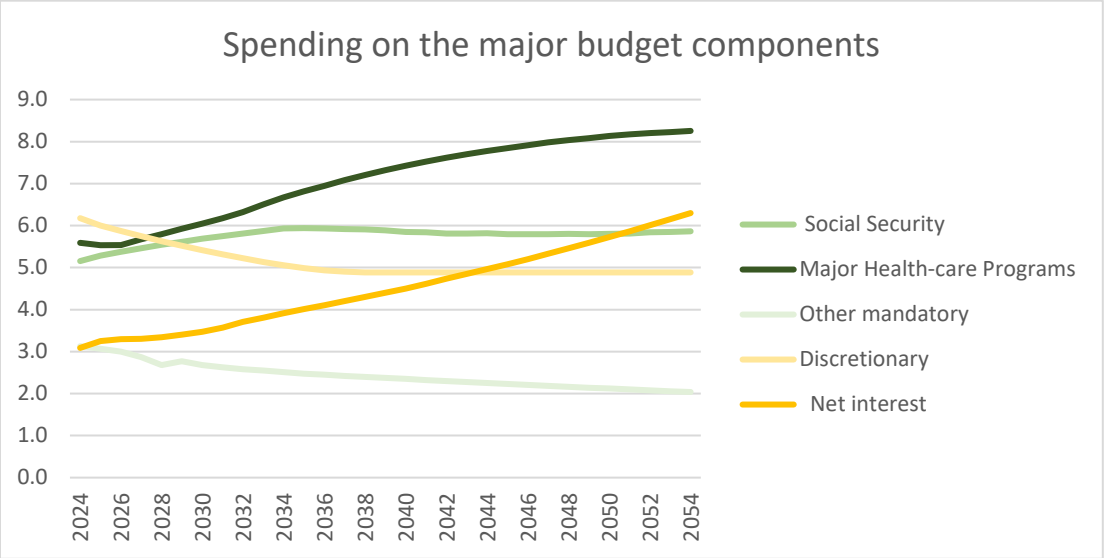


Figure 49. Spending on major budget components as a percentage of gross domestic product (GDP).

Source: Congressional Budget Office.

8.3.2 How important is the rising U.S. debt?

The substantial and accumulating deficits, coupled with a persistent lack of political will to either raise revenue or cut spending, have reignited the debate over the dangers posed by the national debt. Some economists are concerned that the continued expansion of national debt could undermine U.S. global leadership by reducing the funds available for military, diplomatic, and humanitarian operations worldwide. Other experts worry that large debts could hamper economic growth or trigger a fiscal crisis, suggesting that there is a threshold beyond which substantial government debt accumulation begins to slow economic progress. In this scenario, investors might lose confidence in Washington's ability to manage its finances and become unwilling to finance U.S. borrowing without demanding much higher interest rates. This could lead to significantly increased borrowing costs, or what is sometimes referred to as a debt spiral. Such a fiscal crisis could force abrupt and economically painful spending cuts or tax increases.

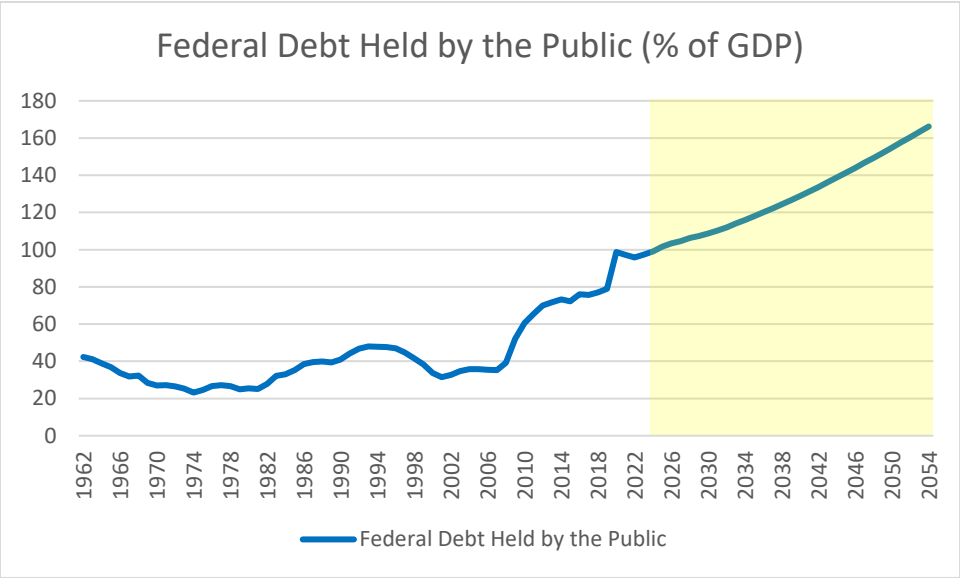


Figure 50. The U.S. Debt is projected to soar. Source: Congressional Budget Office.

As regards how to deal with this issue, over the years, politicians and policy experts have proposed numerous plans to balance the federal budget and reduce the debt. These plans typically involve a combination of significant spending cuts and tax increases to curb the debt's growth.

To cut spending, many comprehensive proposals focus on major reductions in entitlement programs and defense spending. For example, the 2010 Simpson-Bowles plan, a notable bipartisan deficit-reduction proposal that ultimately failed to gain congressional support, aimed to set the debt on a downward trajectory by reducing overall spending, including military expenditures. It also sought to lower Medicare and Medicaid payments and place Social Security on a sustainable path by cutting certain benefits and raising the retirement age (McBride, Berman and Siripurapu, 2023).

On the revenue side, most budget reform plans aim to increase tax revenue by eliminating deductions and other tax subsidies, raising rates for higher earners and corporations, or introducing new taxes, such as a carbon tax. The Simpson-Bowles plan, for instance, proposed raising over $1 trillion in new tax revenue. However, over 80 percent of Republicans in Congress have pledged never to raise taxes, limiting the potential for compromise on revenue generation.

While some optimists believe that the federal government can continue expanding the debt for many years without significant consequences, relying on the trust the U.S. economy has garnered from investors, many experts argue that this approach is too risky. They contend that time is running out to control the debt. Economists at the Penn Wharton Budget Model estimate that financial markets cannot sustain more than twenty additional years of deficits. Beyond that point, they argue, no amount of tax increases or spending cuts would be sufficient to prevent a devastating default.

8.4 The scenarios

Based on the previously outlined circumstances, we carried out a scenario analysis applying the Buiter model to assess the United States' debt. This analysis distinguishes between three: the baseline, the fiscal consolidation, and the fiscal negligence scenario.

In the baseline scenario, we use the primary budget forecasts of the Congressional Budget Office to carry out the most likely scenario.

In the fiscal consolidation scenario, political leaders demonstrate a clear commitment to addressing the debt issue. This commitment translates into effective measures to control and reduce the deficit, thereby stabilizing the debt-to-GDP ratio and preventing it from spiraling out of control. Policies in this scenario may include spending cuts, tax reforms – in particular, an higher tax rate for wealthy individuals and corporations - and measures to boost economic growth, ensuring that debt remains at a manageable level relative to the size of the economy.

On the other hand, in the fiscal negligence scenario, there is a lack of political will to confront the debt challenge. Consequently, the deficit continues to widen without any substantial interventions, leading to an unchecked increase in the debt-to-GDP ratio. This scenario envisions a situation where the government fails to implement necessary fiscal reforms, resulting in the debt escalating without restraint. Over time, this could lead to severe economic repercussions, including a potential loss of investor confidence, higher borrowing costs, and an increased risk of a fiscal crisis.

By comparing these three scenarios, our analysis highlights the critical importance of political will and proactive fiscal management in ensuring debt sustainability. It underscores that without decisive actions to curb the deficit and manage debt levels, the United States could face significant economic instability and potential threats to its financial sovereignty.

8.4.1 Variable descriptions

In every scenario, the main variable under consideration is the primary deficit as a share of GDP. This is defined as the fiscal balance excluding net interest payments on general government liabilities (i.e., interest payments minus interest receipts). The fiscal balance, also known as net lending or net borrowing of general government, is calculated as total government revenues minus total government expenditures. The primary deficit or surplus is particularly significant because it is the variable over which the government has the most control, despite a substantial portion being non-discretionary and thus requiring significant time and bipartisan effort to alter.

The nominal interest rate is also taken into account. Since it is controlled by the Federal Reserve, which operates independently of the government, the interest rate cannot be used as a tool by the government to address debt issues directly. However, it will be adjusted according to the scenarios to reflect the interdependence of the variables. For instance, an overheating economy would realistically necessitate higher interest rates, consistent with the simulated scenario.

The debt variable considered is the Federal Debt held by the Public as a share of GDP. This measure is more relevant than the total debt-to-GDP ratio as it focuses on the indebtedness of the United States to external investors, excluding intra-governmental debts. Seigniorage is kept constant at its historical level of -0.11%, as this figure has shown minimal fluctuation around this level.

All historical data are sourced from the Federal Reserve Economic Data (FRED).

8.4.2 Baseline scenario

In the baseline scenario, we assume that the primary balance as a share of GDP follows a downward path, leading to a gradual decrease in the primary deficit from 5.77% in 2023 – which is taken as given

since it is an historical data - to -2.57% in 2034, based on forecasts from the Congressional Budget Office (Congressional Budget Office, 2024). Achieving a primary surplus is deemed unfeasible under current law due to the high level of entitlements, making it unlikely for the primary deficit to reach zero.

Inflation and GDP growth rates are set to gradually adjust toward neutral long-term values, which are 2.5% and 1.8%, respectively. Long-term inflation is projected to be slightly higher than the 2% Fed target rate, anticipating tighter supply conditions due to a post-globalization shift towards domestic markets and a persistent slight excess demand.

With the economy not overheating, it is expected that the Federal Reserve will reduce rates from the current high levels, though not returning to the zero lower bound (ZLB) as seen during the quantitative easing (QE) era. Therefore, the interest rate is projected to stabilize around 3.0%.

Table 5. Data underlying baseline scenario analysis.

Date	Primary deficit/GDP	RIR	inflation	interest rate	Growth Rate	σ	Debt
2014	2.06%	-1.39%	1.50%	0.09%	2.52%	-0.12%	**72.45%**
2015	1.69%	0.33%	-0.20%	0.13%	2.95%	-0.12%	**72.41%**
2016	2.37%	0.70%	-0.30%	0.40%	1.82%	-0.13%	**75.09%**
2017	2.78%	-1.08%	2.10%	1.00%	2.46%	-0.13%	**74.25%**
2018	3.10%	-0.75%	2.60%	1.83%	2.97%	-0.12%	**76.03%**
2019	3.53%	0.75%	1.40%	2.16%	2.47%	-0.12%	**77.17%**
2020	11.89%	-1.49%	1.90%	0.38%	-2.21%	-0.13%	**94.51%**
2021	8.81%	-4.96%	5.30%	0.08%	5.80%	-0.12%	**95.23%**
2022	1.26%	-6.20%	8.40%	1.68%	1.94%	-0.11%	**93.92%**
2023	5.77%	1.24%	3.74%	5.02%	2.54%	-0.11%	**94.55%**
2024	3.28%	1.16%	3.50%	4.70%	2.30%	-0.11%	**96.89%**
2025	3.69%	1.17%	3.00%	4.20%	1.50%	-0.11%	**100.36%**
2026	3.17%	1.17%	2.80%	4.00%	1.50%	-0.11%	**103.31%**
2027	2.92%	1.17%	2.60%	3.80%	1.75%	-0.11%	**105.75%**
2028	3.09%	1.17%	2.55%	3.75%	2.00%	-0.11%	**108.09%**
2029	2.57%	1.17%	2.50%	3.70%	2.25%	-0.11%	**109.62%**
2030	2.57%	1.17%	2.50%	3.70%	2.50%	-0.11%	**110.88%**
2031	2.57%	1.17%	2.50%	3.70%	2.50%	-0.11%	**112.12%**
2032	2.57%	1.17%	2.50%	3.70%	2.50%	-0.11%	**113.34%**
2033	2.57%	1.17%	2.50%	3.70%	2.50%	-0.11%	**114.55%**
2034	2.57%	1.17%	2.50%	3.70%	2.50%	-0.11%	**115.74%**

What emerges from this scenario is that in the status quo scenario, the debt-to-GDP ratio will continue to rise, albeit at a slower rate than in the fiscal negligence scenario. This outcome underscores the critical need for reforms that enable the government to achieve primary surpluses. Such surpluses are essential for steering the debt trajectory downward in the long term.

8.4.3 Fiscal negligence scenario

In this scenario, we consider a fiscal policy that does not prioritize debt reduction, opting instead to stimulate excess growth. To align with this growth-centric approach, we assume both interest rates and inflation will rise. We project inflation to remain above current levels, reaching 5%, and the interest rate, following with a slight lag, is set at 700 basis points.

Table 6. Data underlying the fiscal negligence scenario analysis.

Date	Primary deficit/GDP	RIR	Inflation	Interest Rate	Growth Rate	σ	Debt
2023	5.77%	1.08%	3.90%	5.02%	2.54%	-0.11%	**94.55%**
2024	7.00%	1.45%	3.50%	5.00%	2.30%	-0.11%	**100.87%**
2025	7.00%	0.95%	5.00%	6.00%	2.50%	-0.11%	**106.46%**
2026	6.80%	1.90%	5.00%	7.00%	2.70%	-0.11%	**112.54%**
2027	6.80%	1.90%	5.00%	7.00%	2.90%	-0.11%	**118.36%**
2028	6.80%	1.90%	5.00%	7.00%	3.30%	-0.11%	**123.67%**
2029	6.80%	1.90%	5.00%	7.00%	3.70%	-0.11%	**128.44%**
2030	6.80%	1.90%	5.00%	7.00%	4.00%	-0.11%	**132.76%**
2031	6.50%	1.90%	5.00%	7.00%	5.00%	-0.11%	**135.45%**
2032	6.00%	1.90%	5.00%	7.00%	5.00%	-0.11%	**137.56%**
2033	5.50%	1.90%	5.00%	7.00%	5.00%	-0.11%	**139.12%**
2034	5.00%	1.90%	5.00%	7.00%	5.00%	-0.11%	**140.12%**

8.4.4 Fiscal consolidation scenario

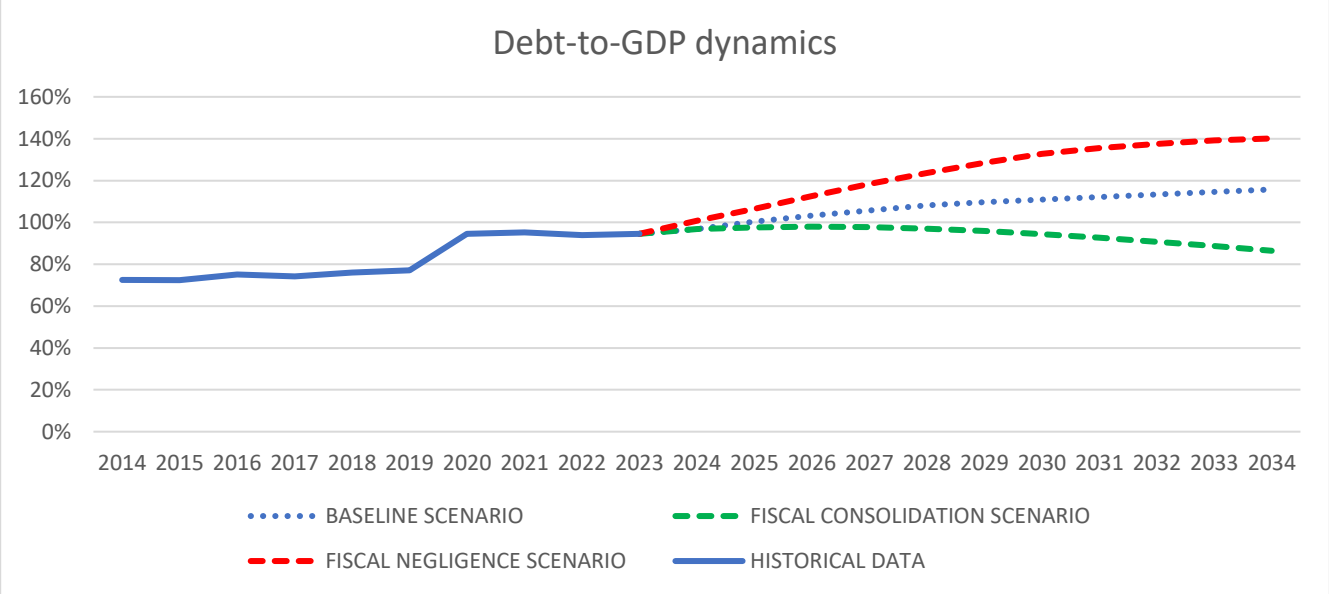
In the fiscal consolidation scenario, the primary balance is dragged down from the 5.77% of GDP level in 2023, to turn eventually positive starting from 2028 and reach the long-run level of 2034. The remaining variables are kept constant with respect to the baseline scenario.

Table 7. Data underlying the fiscal consolidation analysis.

Date	Primary deficit/GDP	RIR	inflation	interest rate	Growth Rate	σ	Debt
2023	5.77%	1.24%	3.74%	5.02%	2.54%	-0.11%	94.55%
2024	3.28%	1.16%	3.50%	4.70%	2.30%	-0.11%	96.89%
2025	1.00%	1.17%	3.00%	4.20%	1.50%	-0.11%	97.68%
2026	0.50%	1.17%	2.80%	4.00%	1.50%	-0.11%	97.96%
2027	0.20%	1.17%	2.60%	3.80%	1.75%	-0.11%	97.71%
2028	0.00%	1.17%	2.55%	3.75%	2.00%	-0.11%	97.03%
2029	-0.20%	1.17%	2.50%	3.70%	2.25%	-0.11%	95.91%
2030	-0.40%	1.17%	2.50%	3.70%	2.50%	-0.11%	94.37%
2031	-0.60%	1.17%	2.50%	3.70%	2.50%	-0.11%	92.66%
2032	-0.80%	1.17%	2.50%	3.70%	2.50%	-0.11%	90.76%
2033	-1.00%	1.17%	2.50%	3.70%	2.50%	-0.11%	88.69%
2034	-1.20%	1.17%	2.50%	3.70%	2.50%	-0.11%	86.45%

8.4.5 Considerations

Looking at the three scenarios, we observe that in the baseline scenario, the most likely, debt-to-GDP ratio will reach 115.54%, increasing by 21.19%. In the fiscal negligence case, instead, the debt-to-GDP explodes to 140.12%, increasing by 45.57% in the 10-year window, which is more than twice what we could expect in the status quo case. In the fiscal consolidation scenario, we see a decrease in the debt-to-GDP ratio of 810bp. This analysis brings several key considerations to light regarding the long-term sustainability of debt, the impact of interest rates, the balance between economic growth and fiscal policy, and the necessity for political will and policy implementation.



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Baseline	94.55%	96.89%	100.36%	103.31%	105.75%	108.09%	109.62%	110.88%	112.12%	113.34%	114.55%	115.74%
Negligence	94.55%	100.87%	106.46%	112.54%	118.36%	123.67%	128.44%	132.76%	135.45%	137.56%	139.12%	140.12%
Consolidation	94.55%	96.89%	97.68%	97.96%	97.71%	97.03%	95.91%	94.37%	92.66%	90.76%	88.69%	86.45%

Even in the baseline scenario, the debt-to-GDP ratio continues to rise, suggesting that deeper structural reforms are necessary to achieve long-term sustainability. This might include measures to address entitlement spending and finding ways to increase revenues without stifling economic growth. The relationship between interest rates and debt sustainability is critical. High interest rates can exacerbate the debt burden by increasing the cost of borrowing. Therefore, maintaining a stable and predictable monetary policy environment is essential for managing debt levels.

A balance must be struck between promoting economic growth and ensuring fiscal responsibility. Policies that stimulate growth can lead to higher tax revenues in the long run, but they must be designed to avoid excessive inflation and interest rate hikes, which can counteract the benefits. Given that entitlement programs like Social Security, Medicare, and Medicaid are significant drivers of the primary deficit, reforms in these areas are crucial. This might involve difficult political decisions, such as adjusting benefits, changing eligibility criteria, or finding new funding mechanisms.

In an increasingly polarized environment, effective debt management requires strong political will and bipartisan cooperation. The inability to implement necessary fiscal reforms due to political gridlock can

lead to unsustainable debt trajectories, so it will be of paramount importance for the government to gain credibility at the eyes of investors. Loss of confidence can lead to higher borrowing costs and a potential fiscal crisis; therefore, transparent and consistent policy measures are needed to maintain market trust.

Without addressing the underlying issues, there is a risk of entering a debt spiral where rising interest payments lead to higher deficits and further increases in debt. This can become a vicious cycle, making it increasingly difficult to stabilize the debt-to-GDP ratio. Relying on seigniorage (the revenue generated from printing money) to manage debt can lead to high inflation, which erodes purchasing power and can destabilize the economy. Therefore, it should be used cautiously and not as a primary tool for debt management.

Another area that will be crucial to touch in order to rebalance debt disequilibria is the tax revenues, which also appears politically easier than modifying social security systems. In particular, it may be the case to raise tax rate on the richest individuals and on the corporations.

Continued monitoring and updating of economic and fiscal projections are necessary to adapt to changing conditions. Contingency plans should be in place to address unexpected economic shocks or downturns. A multifaceted approach is needed, combining spending cuts, revenue increases, and structural reforms. Simplistic solutions are unlikely to be effective in addressing the complex dynamics of national debt.

By considering these factors, policymakers can develop more robust strategies to manage and eventually reduce the national debt, ensuring long-term economic stability and growth.

8.4.6 Is the U.S. debt sustainable?

By applying the government solvency constraint to the United States scenarios, we can more clearly understand how different fiscal approaches yield distinct outcomes and implications in the very long-run. Already under the baseline scenario, the present value of the debt respects the constraint in the long term, implying that the government's debt remains serviceable. This indicates that if the

government adheres to a responsible fiscal path, the present value of the debt will remain nonpositive, ensuring solvency.

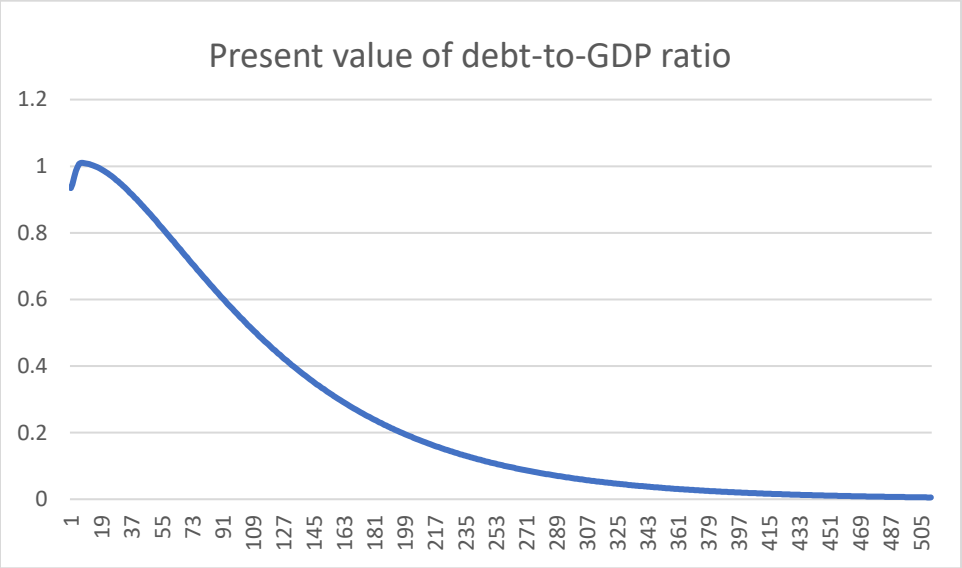


Figure 51. Present Value of debt at final time I in the baseline case. The observations have been extended beyond the timeseries range maintaining variables at their long-run levels to obtain a number of observations (20,000) that could approximate the infinite limit.

This cannot be said for the fiscal negligence scenario, where the final debt remains positive and continues to grow over time. This indicates that the longer this approach is maintained, the more challenging it will be to revert to a sustainable fiscal path, as the debt enters into a negative spiral that makes it grow at an increasingly higher rate. The continuous increase in debt highlights the urgency for policy changes to prevent further economic instability and potential fiscal crises.

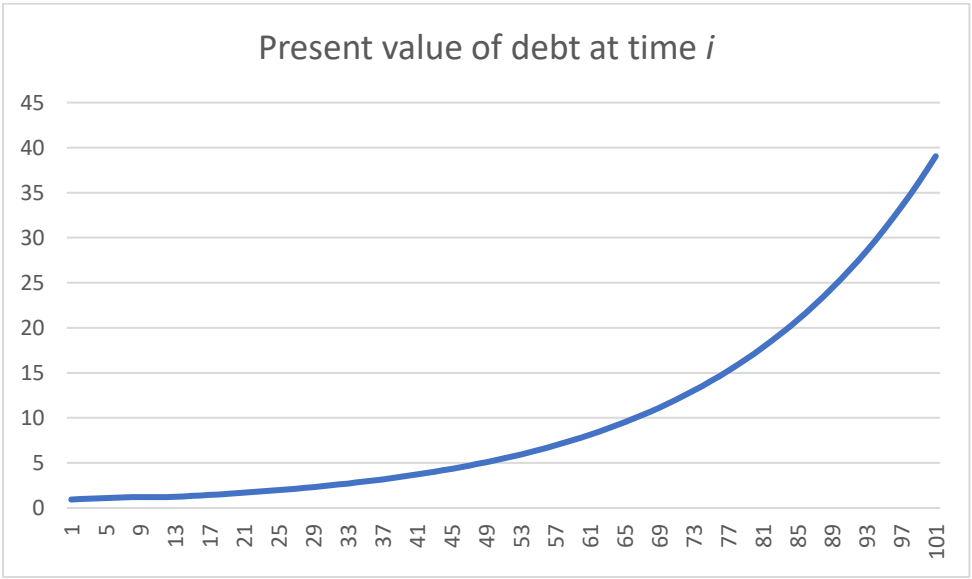


Figure 52. Present value of debt at time i in the case of fiscal negligence.

8.5 How to eliminate the solvency gap?

Restoring solvency involves addressing the present value of the "solvency gap" as a proportion of GDP, denoted as $\cap_t$. This gap represents the difference between the current debt and the expected future primary surpluses, adjusted for interest and growth rates. For solvency, $\cap_t$ must be zero or negative, indicating that future debt, when adjusted for expected interest rates, should converge to zero over time. According to the martingale property, $E_t \cap_t = \cap_t$, meaning its expected future value remains unchanged unless new information arises.

To understand the magnitude of this solvency gap, we calculate the permanent flow equivalent to the stock $\cap_t$. The long-term interest rate net of the real growth rate, $\tilde{r}_t^{\infty}$, is defined as the yield on a perpetuity paying a constant coupon each period, based on the expectations theory of the term structure of interest rates. Mathematically, this is:

$$\tilde{r}_t^{\infty} = \left[\sum_{i=0}^{\infty} E_t \prod_{j=0}^{i} \frac{1}{1 + r_{t+j}} \right]^{-1}$$

Starting from equation (11)

$$d_t = \sum_{i=0}^{\infty} E_t \prod_{j=0}^{i} \frac{1}{1 + r_{t+j}} \left[-\bar{\delta}_{t+1+i} + \sigma_{t+1+i} \right] + \cap_t \tag{11}$$

Where

$$\cap_t = \lim_{i \to \infty} E_t \prod_{j=0}^{i} \frac{1}{1 + r_{t+j}} d_{t+1+i} \tag{13}$$

And using the definition of $\tilde{r}_t^{\infty}$, we can express the permanent correction needed to close the solvency gap as:

$$\tilde{r}_t^{\infty} \cap_t = \tilde{r}_t^{\infty} \left[d_t - \sum_{i=0}^{\infty} E_t \prod_{j=0}^{i} \left(\frac{1}{1 + r_{t+j}} \right) \left(-\bar{\delta}_{t+1+i} + \sigma_{t+1+i} \right) \right] \tag{14}$$

This represents the smallest constant fraction of GDP that, if allocated to closing the solvency gap each period, would eliminate it. It underscores the "permanent correction" necessary—essentially a sustained change in the augmented primary surplus or seigniorage relative to GDP—to ensure fiscal sustainability.

To understand it fully, we need to know that the expectations theory posits that long-term interest rates are an average of expected future short-term rates, implying that the yield on a perpetuity reflects these expectations. According to this theory, no arbitrage opportunities exist, meaning investors should be indifferent between holding a sequence of short-term bonds versus a single long-term bond. This yields the following relationship for the long-term interest rate:

$$\tilde{r}_t^{\infty} = \left(\frac{1}{1 + r_{t+1}} + \frac{1}{1 + r_{t+2}} + \cdots \right) / n - 1$$

Applying this to the permanent gap equation, and recognizing the augmented primary deficit $\overline{\delta}_t = +\delta_t + \frac{b^*_{t-1}}{1+n_{t-1}}[(1+r^*_{t-1})(1+\gamma_{t-1}) - (1+r_{t-1})]$, where $\delta_t = c_t - \tau_t + a_t - \rho_{t-1}k_{t-1}$, we identify four broad policy options to reduce the augmented primary deficit: reducing government consumption spending, increasing net current revenues, reducing public sector capital formation or increasing cash revenues from public sector capital, and shifting the composition of public debt between internal and external debt. These policy options are interconnected, meaning changes in one area will likely impact others. While conceptually straightforward, implementing reductions in government spending and increasing revenues are politically challenging.

In summary, achieving debt sustainability requires a multifaceted approach to managing the primary deficit, interest rates, and overall economic growth. The outlined policy options highlight the need for strategic, and often politically sensitive, decisions to ensure long-term fiscal health.

8.5.1 The application to our scenarios

To understand the implications of the two different fiscal approaches and the required primary surplus to rebalance the fiscal situation, we apply the previously examined formulas to our two scenarios. We extend the number of observations to 10,000 to approximate the infinity limit used in equation (14) as closely as possible.

In this scenario analysis, the variables (real interest rate, seigniorage, and primary balance) are assumed to have reached their long-run equilibrium by the end of the 10-year period analyzed and are therefore kept constant. Consequently, we find that the permanent adjustment needed to close the solvency gap follows the dynamic outlined below:

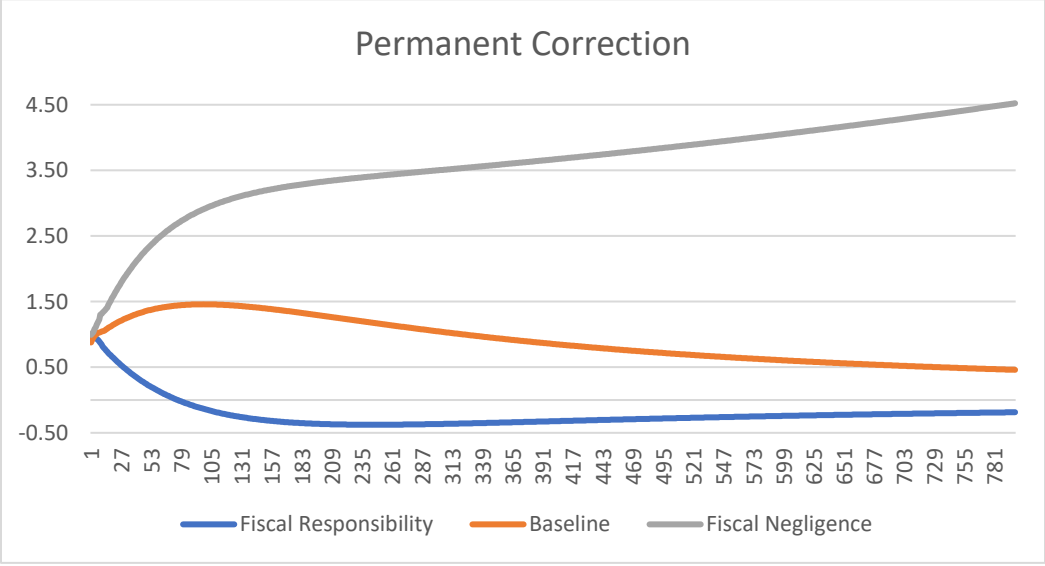


Figure 53. Dynamics of the permanent adjustment needed to close the solvency gap in the fiscal responsibility and fiscal negligence scenarios.

It is clear that closing the gap within a short timeframe is unrealistic, given the necessary spending cuts and maneuvers that could potentially hinder growth and offset fiscal efforts. Moreover, the fiscal effort required in the baseline case appears significantly larger compared to the fiscal consolidation scenario. By the end of the analysis period, achieving a permanent change in the primary balance would

necessitate measures equivalent to 3.7% of GDP under the fiscal responsibility scenario, whereas it would require -1.51% of GDP under the fiscal consolidation scenario. This suggests that the government would need to run a primary surplus higher than the debt level, which is an unrealistic scenario but effectively illustrates how different are the long-term implication on debt of the scenarios analyzed.

In the fiscal negligence scenario, we observe a debt spiral that underscores the importance of maintaining fiscal responsibility: it is clear how critical it is to act in a timely manner to avoid reaching a situation where returning to fiscal sustainability would be extremely difficult and painful, both under an economic and social viewpoint.

9 Conclusions

This study presents an in-depth analysis of debt sustainability under various fiscal scenarios, revealing critical insights into the long-term implications of different fiscal policies. The primary scenarios evaluated include the baseline scenario, the fiscal consolidation scenario, and the fiscal negligence scenario. Each scenario underscores the importance of strategic fiscal management in achieving debt sustainability.

The baseline scenario reflects the forecasts about primary balance of the Congressional Budget Office, and it is the most realistic scenario among those considered. In this setting, the ratio of Federal debt held by the public to gross domestic product reaches 115.74%, starting from the current level of 94.55%, and achieving a permanent change in the primary balance requires an adjustment to the primary balance equivalent to 3.7% of GDP. Taking the dynamics relative to this scenario to the infinite limit suggests that the current path is sustainable, but it crucial to note that the forecasts of the Congressional Budget Office estimate a reduction in the budget deficit.

The fiscal consolidation scenario demonstrates a more important fiscal adjustment, in which the debt-to-GDP ratio is dragged down to 86.45%, with a strong reduction in the primary deficit until it turn into a primary surplus. The permanent change in primary balance necessary to close the solvency gap in this case turns even negative after a while, as the primary balance decreases until it becomes even lower than the debt, making the permanent change negative.

This scenario suggests that with appropriate fiscal consolidation measures, the government can achieve debt sustainability without overly burdensome fiscal efforts.

The fiscal negligence scenario paints a stark picture of the consequences of failing to prioritize debt reduction. In this scenario, the debt-to-GDP ratio rises sharply - reaching 140.12% in 2034 - leading to a debt spiral that underscores the critical need for timely fiscal responsibility. Without such measures, returning to fiscal sustainability becomes exceedingly difficult and painful from both economic and social perspectives. This scenario also highlights the potential for excessive inflation and interest rate hikes, which can exacerbate the debt burden and undermine economic stability.

The analysis further reveals that even in the baseline scenario, where no significant fiscal adjustments are made, the debt-to-GDP ratio continues to rise. This trend underscores the necessity for deeper structural reforms to achieve long-term sustainability. Such reforms may include addressing entitlement spending and finding ways to increase revenues without stifling economic growth, such as higher taxation on wealthy individuals and corporations.

The relationship between interest rates and debt sustainability is a critical aspect of the analysis. High interest rates can significantly increase the cost of borrowing, exacerbating the debt burden. Thus, maintaining a stable and predictable monetary policy environment is essential for managing debt levels effectively.

Achieving a balance between promoting economic growth and ensuring fiscal responsibility is crucial. Policies that stimulate growth can lead to higher tax revenues in the long run, but they must be carefully designed to avoid excessive inflation and interest rate hikes. Additionally, entitlement program reforms are necessary to control primary deficits, involving potentially difficult political decisions such as adjusting benefits and changing eligibility criteria.

Effective debt management also requires strong political will and bipartisan cooperation. Political gridlock can impede the implementation of necessary fiscal reforms, leading to unsustainable debt trajectories. Therefore, gaining credibility with investors through decisive and consistent fiscal policies is of paramount importance.

In summary, this study highlights the complexities of debt sustainability and the multifaceted approach required to manage the primary deficit, interest rates, and economic growth. The scenarios analyzed demonstrate the importance of strategic, and often politically sensitive, decisions to ensure long-term fiscal health. Only through a comprehensive and balanced approach can sustainable debt levels be achieved, securing economic stability and growth for the future.

10 Appendix 1

10.1 How QE works: the transmission channels

The effectiveness of Quantitative Easing (QE) and the channels through which it operates remain subjects of debate, as highlighted by a famous remark from Ben Bernanke: "The problem with QE is that it works in practice, but it doesn't work in theory." The difficulty in understanding the mechanism lies in the necessity to deviate from standard macroeconomic models and incorporate frictions to capture the nuanced ways in which QE influences the economy.

In essence, the transmission mechanism can be simplified into two components. First is the expansion of the balance sheet achieved by purchasing short-term bills, financed by the creation of new reserves. The second component involves a maturity extension program, where short-term bonds are swapped for longer-term bonds. The so-called “Operation Twist”, through which the fed sold $667 billion of short-term bonds - which means nearly all of its short-term holdings – to purchase an equal amount of Treasuries having maturity spanning from 6 to 30 years, with the objective of decreasing long-term interest rates (Sablik, 2021).

The channels through which asset purchases influence the economy are diverse and of varying nature. Standard macroeconomic models often fall short in capturing these effects, as they rely on assumptions of market efficiencies and lack the incorporation of relevant frictions.

The Bank of England (2016) categorizes these frictions into two main groups. The first group involves information frictions, suggesting that private market agents possess less than perfect information about either the future course of monetary policy or the macroeconomic environment (Eggertsson and Woodford, 2003). These information frictions form the basis for channels such as signaling, exchange rates, and uncertainty.

The second group comprises market frictions that underlie the portfolio balance, liquidity, and bank lending channels. These frictions may arise from an imperfect degree of substitutability between asset classes, investors having a preference for assets with specific durations or risks, or constraints preventing perfect arbitrage between different assets (Vayonas and Vila, 2009). These market frictions contribute to the complexities of the transmission mechanism associated with Quantitative Easing (QE).

Whereas the conventional monetary policy leverages on the inertia in labor and good prices, that we know to be *sticky*, unconventional policy relies on frictions that are way more transient, and therefore the effectiveness of QE is more variable and less quantifiable reliably, as it depends more on the time and states of nature, for instance, it can be more effective when the financial system is in distress.

In line with the previously mentioned points, Williams (2013) discovered that the level of uncertainty surrounding the macroeconomic effects of asset purchases is at least twice as significant as that associated with conventional policy measures. This underscores the challenges and complexities in understanding the outcomes of balance sheet expansions, particularly in the context of Quantitative Easing (QE).

Additionally, not all balance sheet expansions are uniform in their objectives. According to the Bank of England (2016), there is a distinct division between central banks expanding their balance sheets

primarily to provide liquidity, such as the central banks of Canada, the European Union, and Sweden, and those aiming to use balance sheet expansion as a tool to loosen monetary policy, as observed in the practices of the Bank of Japan, the Federal Reserve, and the Bank of England. This differentiation in goals further emphasizes the diverse motivations and strategies employed by central banks in their balance sheet management.

Indeed, the significance of balance sheet expansion on prices and economic activity appears to be more pronounced when it is conducted with the explicit aim of loosening monetary policy, indicating that the asset purchase alone may not be the decisive factor. Instead, the effectiveness seems to lie in the message it conveys, suggesting that the policy signaling channel effect can be particularly influential.

Consistent with this perspective, historical balance sheet expansions conducted for financing wars and addressing financial crises between 1719 and 1822 were found to have no statistically significant effect on prices and output. This reinforces the idea that the impact of balance sheet expansion is contingent on the underlying purpose and the signaling of monetary policy intentions.

In the subsequent sections, we will explore each of the channels identified by the growing literature on the topic, shedding light on the diverse ways through which balance sheet expansion can influence the economy (D'Amico et. Al, 2012).

10.1.1 Policy signaling

The decisions made by central banks and communicated in their press conferences often carry more implications than initially apparent. Investors seek to decode these subtleties to predict the trajectory of short-term interest rates, despite direct purchases having no immediate impact on these rates, as noted by Farinha and Vidrago (2021).

Forward guidance, as defined by Sutherland (2022), is a central bank's announcement that explicitly forecasts future monetary policy directions. Initially described by Eggertsson and Woodford (2003), forward guidance involved a commitment by central banks to maintain low future spot rates, which, in turn, influenced longer-term interest rates through the expectations hypothesis. Notably, the Federal Reserve set precedents for managing future rate expectations and related uncertainties with their statements well before the Great Recession, particularly between 2003 and 2005. However, forward guidance gained prominence at the Zero Lower Bound (ZLB). During this period, forward guidance also became a crucial component of the ZLB strategies for other major central banks like the Bank of England, the Bank of Japan, and the European Central Bank, the latter of which initially hesitated as President Trichet declared the ECB would not pre-commit.

This approach to shaping expectations about future monetary policy has been acknowledged as a "critical tool of monetary policy" by Bernanke (2011) and has been consistently included in the Federal Open Market Committee's (FOMC) post-meeting statements since 2008, particularly when the federal funds rate reached the ZLB, as Nelson (2021) points out.

Campbell, Evans, Fisher, and Justiniano (2012) discovered that surprises in FOMC policy announcements significantly affect Treasury bond rates, corporate borrowing rates, and private macroeconomic forecasts. Contrary to what might be expected, news of significant monetary tightening not only raises interest rates and impacts the yield curve but also elevates inflation forecasts and reduces unemployment predictions. This seemingly paradoxical reaction suggests that private

forecasters believe the Fed possesses nonpublic information about future economic conditions, prompting some unexpected FOMC actions.

Akkaya, Gurkaynak, Kısacıkoğlu, & Wright (2015) argue, in contrast to Eggertsson and Woodford (2003), that forward guidance can influence financial conditions not only through the expectation hypothesis but also by altering term premia. Furthermore, they noted that forward guidance is more impactful when the shadow rate[3] is near the ZLB than when it is deeply negative.

10.1.2 Portfolio rebalancing

Joyce, Miles, Scott & Vayanos (2012) provide a comprehensive description of the portfolio rebalancing or portfolio substitution channel, using the example of the Bank of England. The process begins with the BoE purchasing gilts, which are the most straightforward form of UK government bonds, leading to a reduction in the available amount in the market. Initially, the proceeds from these purchases manifest in bank deposits.

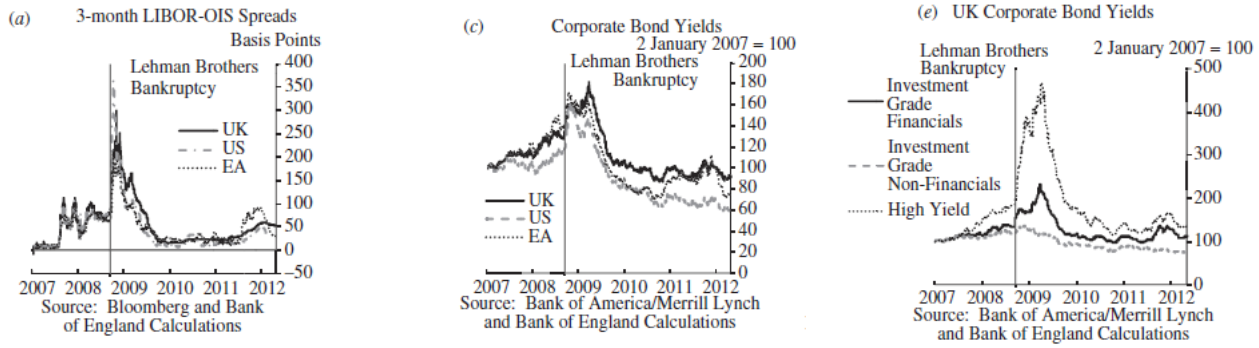
In a hypothetical scenario where gilts and cash are perfect substitutes, there would be no discernible effects, and the economy of England could potentially find itself in a liquidity trap. A liquidity trap occurs when interest rates are very low, and cash and short-term bonds become virtually indistinguishable in terms of returns, making monetary policy less effective in stimulating economic activity. The portfolio rebalancing channel hinges on the idea that, in reality, assets are not perfect substitutes, and changes in the composition of portfolios can impact economic conditions.

However, there is a key distinction between bonds and deposits: bonds are long-term assets, while deposits are short-term. Many holders of gilts, such as pension funds and insurance companies, are bound by policies that require them to match the duration of assets with the duration of liabilities. Consequently, these entities are likely to utilize the proceeds from the sale of gilts to purchase long-term assets, aiming to restore equilibrium in their portfolios.

This sets in motion a cascading effect known as the portfolio rebalancing effect: the Bank of England's asset purchases increase the demand for gilts, driving up their prices and putting downward pressure on the premiums of all long-term assets, thereby reducing yields. Subsequently, this should enable households to realize capital gains, empowering consumers to increase their spending or investments. Ultimately, this surge in demand and economic activity is expected to contribute to an increase in GDP.

[3] The "shadow rate" refers to an estimated or implied short-term interest rate derived from financial market data, particularly when the actual central bank policy rate has hit the ZLB. When central banks lower their policy rates to near zero during times of economic downturn or crisis, they may resort to unconventional monetary policy tools, to further stimulate the economy. In such cases, economists and analysts often estimate what the effective or "shadow" short-term interest rate would be if the central bank could reduce rates further. The concept of the shadow rate helps policymakers and market participants understand the effectiveness of monetary policy and its impact on financial conditions, even when the central bank's policy rate is at or near zero.

Empirical evidence has shown that assets similar to those purchased experienced a rise in prices, and the yields on corporate bonds significantly declined. However, isolating the specific contribution of QE from other influencing factors remains a challenging task.



10.1.3 Liquidity effects

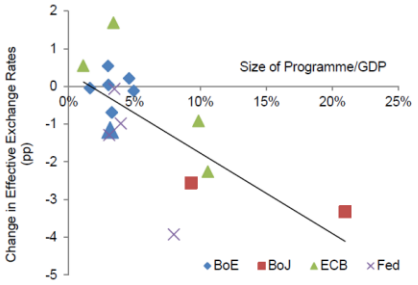
Non-standard measures may directly influence the level of very short-term interest rates, particularly the overnight rate, through what is commonly referred to as "liquidity effects" in the money market. If these measures lead to an accumulation of excess central bank liquidity in the market, they can create a spread between the "key policy rate" (e.g., the MRO rate in the context of the ECB) and the overnight market rate (e.g., EONIA). This spread forms the basis for pricing financial instruments that are more relevant for macroeconomic developments.

In essence, the excess liquidity resulting from non-standard measures can impact short-term interest rates, influencing the broader financial landscape and, by extension, macroeconomic conditions. This mechanism underscores the interconnectedness of central bank actions, liquidity conditions, and the functioning of money markets in the transmission of monetary policy.

10.1.4 Exchange Rate

Since investors consider assets like equities and corporate bonds, we might expect them to rebalance their portfolio towards these assets if their wallet is reinforced by the asset sold to the central banks, this may imply an increase in the price of those assets and a downward pressure on the exchange rate, as shown in the graph taken from Haldane, Roberts-Sklar, Young & Wieladek (2016).

Figure 15: Change in effective exchange rates around selected QE announcements



Source: Bloomberg and Bank calculations. Note: Change in effective exchange rates over two-day windows around QE events, against size of announcement relative to that economy's GDP at the time. Does not control for expectations of QE announcements or other news during two-day window.

Figure 54. Change in effective exchange rates around selected QE announcements. Source: Haldane, Roberts-Sklar, Young & Wieladek (2016).

This also has an extra implication: QE, especially for big countries, has spillovers on other economies, and to assess the effects of QE, one must net out the incoming effects from foreign QEs, that often happened simultaneously, as it was the case for US and UK. We will see this aspect later.

10.1.5 Bank lending

The Bank Funding Channel is expected to operate primarily under conditions of financial stress and is designed to enhance the availability of bank credit: when a bank holds reserves in excess of its immediate liquidity needs, it is more likely to expand its lending or avoid a contraction in lending.

However, it is important to note that the effectiveness of this channel may be limited. In practice, a bank often increases lending by an amount less than the short-term inflow of funds. The impact may be more pronounced with a longer-term inflow of funds, which is likely to strengthen the effectiveness of the Bank Funding Channel.

Consistently with that, Butt, Churm and McMahon (2015) found no evidence that QE bolstered bank lending in the UK; on the contrary Bowman et al. (2015) found a positive and statistically significant impact of Qe on bank lending for Japan, particularly for distressed banks.

10.2 Spillovers

The impact of Quantitative Easing (QE) is not confined solely to the domestic economy and to the assets targeted; it can also have repercussions on the activities of other countries and on assets others than those targeted

10.2.1 Cross-border spillovers

The effects of Asset Purchase Programs (APP) are felt not only within the borders of the implementing country; particularly when implemented by a major player like the United States, the influence extends internationally also because of the use of the U.S. dollar as a globally recognized store of value and reserve currency.

According to Bernanke (2015), there are three primary channels through which U.S. QE can affect other countries. First, if QE results in a depreciation of the U.S. currency, the trade balance may improve, potentially raising U.S. output at the expense of its trading partners.

However, if the increase in U.S. demand due to QE is substantial, it can outweigh the impact from the exchange rate, leading to a rise in output both domestically and abroad. Assuming that QE is comparatively larger than that of other countries and that it is able to stimulate growth, excess domestic demand will turn into higher imports and a deterioration in the trade balance. Additionally, U.S. QE might contribute to lowering the global risk-free rate and reducing risk premia.

Understanding these international spillovers is crucial when evaluating the impact of domestic QE. For instance, studies assessing the impact of UK QE on the exchange rate need to consider the simultaneous occurrence of U.S. QE. Goodhart and Ashworth (2012) suggest that the sterling exchange rate could have been up to 5 percent higher if the Bank of England had not implemented the first round of QE, but its actual impact was limited due to concurrent QE policies in the U.S.

10.2.2 Cross-asset class spillovers

In their working paper for the ECB, Altavilla, Carboni, and Motto (2015) delineate the main qualitative conclusions regarding the Asset Purchase Programme (APP). They identify two distinct types of

channels through which asset purchases influence financial markets: narrow channels, where the effect is concentrated on the targeted asset class with limited spillover, and broad channels, where the impact extends across multiple asset classes.

Understanding why cross-asset class spillovers occur and in which circumstances requires categorizing market participants into two groups: arbitrageurs, who invest across different market segments, and preferred-habitat investors, who exhibit demand preferences for specific maturities and asset classes.

During periods of financial distress, as it happened for the QE programs in US and UK, implemented right after the Lehman Brothers collapse, characterized by heightened risk aversion among arbitrageurs and segmented financial markets, central bank purchases tend to have significant effects on targeted assets that align with the specific demand of preferred-habitat investors.

Conversely, as financial stress subsides and the risk tolerance of arbitrageurs increases, as it was for the APP of ECB, that started in 2015, central bank asset purchases may have a more limited impact on targeted assets but are likely to influence a broader range of premia, as arbitrageurs integrate across various market segments.

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