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U.S. PUBLIC DEBT AS A GLOBAL SAFE ASSET: FISCAL SUSTAINABILITY IN AN ERA OF WANING CONVENIENCE YIELDS

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Abstract

The U.S. Treasuries´ status as a safe-haven asset gives the government an advantage in its cost of financing through the convenience yield: the benefit investors derive from the safety and liquidity of Treasuries, reflected in lower yields. Existing estimates end in 2020, and it is unclear whether this advantage survived the subsequent monetary tightening, fiscal deterioration, and geopolitical uncertainty.

This dissertation extends the series by Jiang et al. (2024) to assess whether the safe-haven status of U.S. debt continues to mitigate, or merely postpone, the fiscal constraints implicit in the Triffin dilemma.

An annual time series for 2021–2025 is constructed using FRED data, combined with the historical series from 1947–2020, and subjected to structural break analysis, robustness tests, and tests for specific monetary and financial episodes.

A structural break, identified in the complete series, places the shift to persistently low yields in 2009, not 2020. The 2021–2025 average (0.087%, one-quarter of the 1947–2020 average) is statistically indistinguishable from the 2009–2019 average, remaining compressed during the monetary tightening of 2022 and the banking crisis of March 2023, unlike comparable episodes in 1980 and 2008.

These results suggest that the fiscal financing advantage historically associated with Treasuries' safe-haven status has been smaller since 2009, consistent with the postponement, rather than the resolution, of the Triffin dilemma, although the short post-2020 sample prevents a definitive conclusion.

JEL codes: E43, F33, G12, H63.

Keywords: Convenience Yield; Exorbitant privilege; Safe assets; Triffin dilemma; U.S. public debt.

Resumo

O estatuto dos Treasuries dos EUA como ativo seguro confere ao governo uma vantagem no custo de financiamento através do *convenience yield*: o benefício que os investidores retiram da segurança e liquidez dos Treasuries, refletido em *yields* mais baixos. As estimativas existentes terminam em 2020, sem se saber se sobreviveu ao aperto monetário, à deterioração fiscal e à incerteza geopolítica seguintes.

Esta dissertação estende a série de Jiang et al. (2024) para avaliar se o estatuto de ativo seguro da dívida dos EUA continua a mitigar, ou apenas a adiar, as restrições fiscais implícitas no dilema de Triffin.

Constrói-se uma série anual para 2021–2025, com dados FRED, combinada com a série histórica de 1947–2020, e sujeita a análise de quebra estrutural, testes de robustez e testes a episódios monetários e financeiros específicos.

Uma quebra estrutural, identificada na série completa, situa a mudança para um *yield* persistentemente baixo em 2009, não em 2020. A média de 2021–2025 (0,087%, um quarto da média de 1947–2020) é estatisticamente indistinguível da média de 2009–2019, mantendo-se comprimida durante o aperto monetário de 2022 e a crise bancária de março de 2023, ao contrário de episódios comparáveis em 1980 e 2008.

Estes resultados sugerem que a vantagem de financiamento fiscal historicamente associada ao estatuto de ativo seguro dos Treasuries tem sido menor desde 2009, consistente com o adiamento, e não a resolução, da tensão de Triffin, embora a curta amostra pós-2020 impeça uma conclusão definitiva.

Códigos JEL: E43, F33, G12, H63.

Palavras-chave: Ativos Seguros; Convenience Yield; Dilema de Triffin; Dívida Pública dos EUA; Privilégio Exorbitante

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1. Introduction

Since the second half of the twentieth century, the international monetary and financial system has been characterised by the central role of the United States dollar as the dominant global reserve currency (Dorrucci & McKay, 2011; Eichengreen, 2016; Gourinchas et al., 2019). This status grants the United States a unique position within the global economy, allowing it to finance persistent external and fiscal deficits under conditions that differ markedly from those faced by other sovereign issuers. This exceptional position has been widely discussed in the literature under the notion of the exorbitant privilege, a term originally coined to describe the economic advantages associated with issuing the world's primary reserve currency (Eichengreen, 2012; Gourinchas & Rey, 2007a).

However, the use of a national currency as a global public good has long been recognised as giving rise to a structural tension, first identified by Triffin (1960), between the domestic objectives of the reserve-currency issuer and the liquidity needs of the international system.. In his seminal contribution, Triffin (1960) identified a fundamental contradiction at the heart of the international monetary system: in order to supply the global economy with sufficient liquidity, the issuer of the reserve currency must run persistent balance-of-payments deficits, yet the accumulation of these deficits may ultimately undermine confidence in that very currency. This insight, known as the Triffin dilemma, highlighted the tension between global monetary stability and national macroeconomic sustainability, a tension that remains relevant despite profound changes in the structure of the international financial system.

With the collapse of the Bretton Woods system and the transition to a fiat monetary regime (Eichengreen, 2016), the specific constraint at the centre of the Triffin dilemma changed, without its underlying logic being eliminated. The original formulation was centred on gold convertibility: the reserve issuer had to supply enough dollars to meet global liquidity needs, while maintaining a fixed gold price that made those dollars credible. Once convertibility was abandoned, this gold constraint was effectively replaced by a fiscal one: international liquidity is now provided through the issuance of dollar-denominated government debt, so that the stability of the system depends on the perceived safety of that debt rather than on gold reserves (Farhi et al., 2011). This reframing has shifted the literature's attention from the provision of reserve-currency liquidity as such to the provision of safe assets, particularly

government debt issued by advanced economies, as the modern locus of the tension the Triffin dilemma originally identified (Caballero et al., 2017; Farhi & Maggiori, 2018).

Within this evolving framework, the United States has continued to occupy a central position. A substantial body of empirical work documents that U.S. public debt, especially Treasury securities, functions as the dominant safe asset in the global financial system (Caballero et al., 2017; Krishnamurthy & Vissing-Jorgensen, 2012). These securities are widely held by foreign central banks, international investors, and financial institutions, serving simultaneously as reserve assets, collateral in wholesale funding markets, and benchmarks for global asset pricing (Caballero et al., 2017; Gorton, 2017). Because Treasuries occupy this position, changes in the quantity or perceived safety of U.S. public debt do not remain confined to U.S. fiscal accounts: they propagate through the collateral chains, reserve portfolios, and pricing benchmarks that depend on Treasuries globally. As a result, the accumulation of U.S. public debt has taken on a systemic dimension that extends beyond conventional considerations of national fiscal policy (Farhi et al., 2011).

At the same time, recent literature has revisited the notion of exorbitant privilege, providing empirical evidence that the United States benefits from lower borrowing costs and higher returns on its external asset position (Gourinchas & Rey, 2007a; Gourinchas et al., 2010). This privilege has been further reinforced by structural global factors, such as the so-called global saving glut, which has increased international demand for safe dollar-denominated assets and contributed to persistently low long-term interest rates (Bernanke, 2005; Caballero et al., 2008). Together, these mechanisms appear to relax the traditional fiscal constraints faced by sovereign issuers, allowing the United States to sustain high levels of public debt without triggering immediate market pressures.

Nevertheless, the increasing reliance of the global financial system on U.S. public debt raises important questions regarding sustainability and systemic risk. The expansion of public debt may be essential to meet global demand for safe assets, yet it simultaneously exposes the system to fiscal, political, and institutional vulnerabilities concentrated in a single sovereign issuer. This tension has been described in the literature as a new Triffin dilemma, in which global financial stability depends on the continued issuance of safe assets by the United States, while the long-run sustainability of such issuance cannot be taken for granted (Bordo & McCauley, 2019; Gourinchas et al., 2019; Mateos et al., 2009).

Against this background, the present dissertation addresses the following research question:

To what extent does the role of U.S. public debt as a global safe asset mitigate, or postpone, the constraints implied by the new Triffin dilemma?

The primary objective of this research is to integrate and systematise the literature on the Triffin dilemma, the exorbitant privilege of the dollar, and the modern safe asset shortage, with a particular focus on the fiscal dimension of U.S. public debt. By linking these strands of research, the study aims to assess whether the privileged status of U.S. government debt fundamentally alters the sustainability conditions traditionally associated with high public debt levels, or whether it merely delays the emergence of systemic risks.

Methodologically, this dissertation extends the convenience-yield component of the no-arbitrage fiscal framework developed by Jiang et al. (2024). An original annual series is constructed for 2021–2025, using the same private–Treasury spread methodology as the historical series. This new series is then combined with the historical one to produce a continuous convenience yield series spanning 1947–2025.

This period is of particular relevance. It follows the near-zero interest rates established after the 2008 Global Financial Crisis. Onto that legacy it layers a marked deterioration of the U.S. fiscal outlook following the COVID-19 pandemic, the 2022–2023 monetary tightening cycle, and, in 2022, the freezing of Russian reserves, the first episode to suggest that dollar-denominated safe assets carry geopolitical as well as financial risk.

Against this backdrop, the series is examined for a shift in its underlying behaviour over time. This establishes whether the persistently low values of the past two decades represent a genuine change or the continuation of a pattern already under way. The result is also checked against a set of alternative assumptions to confirm that it holds; the technical detail of both is presented in Chapter 4.

Chapter 4 then takes this question further. It compares two pairs of analogous episodes: the 2022 monetary tightening against the Volcker/Reagan tightening of 1980, and the March 2023 banking crisis against the response to the 2008 Global Financial Crisis. The aim is to

assess whether the exorbitant privilege that sustains U.S. fiscal space[1] has begun to erode (Congressional Budget Office, 2024; Weiss, 2022).

The remainder of this dissertation is structured as follows. Section 2 reviews the relevant literature, defining key concepts and outlining the theoretical and historical context of the research question. Section 3 presents the methodological approach and the estimation of the convenience yield, and Section 4 reports and discusses the empirical results, before the concluding section summarises the main findings and their implications.

[1] Fiscal space is understood here as the room a government must sustain higher debt, or to run larger deficits, without triggering a loss of investor confidence or a rise in borrowing costs that would force a change in policy.

2. Literature Review

This chapter reviews the literature underpinning the empirical analysis developed in this dissertation. It begins by situating the U.S. dollar within the structure of the international monetary system (Section 2.1), before turning to the demand for safe assets and the specific role of U.S. Treasury securities within that system (Section 2.2). Section 2.3 then develops the concept of the exorbitant privilege and its modern reformulation as the new Triffin dilemma. Section 2.4 turns to the literature on fiscal sustainability itself, examining the endogeneity of interest rates and growth, the conditions under which debt dynamics remain stable, and the specific fiscal position of the United States, before identifying the gap this dissertation addresses. Together, these sections establish the theoretical framework this dissertation tests empirically in Chapters 3 and 4.

2.1. The Dollar-Centred International Monetary System

2.1.1. The Evolution of the International Monetary System

The international monetary system (IMS) refers to the institutional and financial framework governing international payments, exchange rate arrangements, reserve accumulation, and cross-border capital flows. Its structure plays a fundamental role in shaping global liquidity provision, the adjustment of external imbalances, and the stability of the international financial system. Throughout modern economic history, the IMS has evolved through several regimes, reflecting changes in global economic structures, financial integration, and geopolitical power (Dorrucci & McKay, 2011; Mateos et al., 2009).

The classical gold standard, which prevailed until the First World War, represented one of the earliest coherent international monetary arrangements. Under this regime, national currencies were convertible into gold at fixed rates, and exchange rates between currencies were therefore implicitly fixed. Adjustment mechanisms operated through gold flows and domestic price changes, allowing external imbalances to be corrected through automatic market forces. However, the system proved increasingly fragile during periods of economic and political instability and ultimately collapsed during the interwar period (Eichengreen, 2016).

Following the Second World War, the Bretton Woods system established a new international monetary architecture based on fixed but adjustable exchange rates anchored to the U.S. dollar. Under this arrangement, the dollar was convertible into gold at a fixed price of 35

dollars per ounce, while other currencies maintained fixed exchange rates against the dollar. This institutional framework effectively placed the United States at the centre of the international monetary system, as the dollar became the principal reserve currency and the anchor for global exchange rate stability (Eichengreen, 2016). Although the Bretton Woods system collapsed in the early 1970s following the suspension of dollar convertibility into gold, the central role of the U.S. dollar persisted even after the transition to generalized floating exchange rates (Eichengreen, 2016). In the contemporary international monetary system, the U.S. dollar continues to dominate global finance, a role examined in detail in the following subsection (Dorrucci & McKay, 2011; Gourinchas et al., 2019).

This persistence of dollar dominance has led scholars to describe the current system as a dollar-centered international monetary order, in which global financial stability depends heavily on the ability of the United States to supply safe and liquid financial instruments demanded by the rest of the world (Gourinchas et al., 2019). Recent contributions emphasize that the functioning of the modern international monetary system cannot be understood solely through exchange rate regimes. Instead, the provision of safe and liquid assets has become a central feature of the system's architecture. Farhi and Maggiori (2018) argue that the emergence of dominant international currencies reflects the presence of financial frictions and differences across countries in their capacity to issue credible safe assets. In their framework, countries that can provide large quantities of liquid and reliable government securities naturally acquire a central position in the international monetary system.

This perspective highlights an important structural asymmetry. Reserve currency issuers benefit from strong global demand for their liabilities because these assets serve as stores of value and safe collateral in international financial markets. As a result, government bonds issued by reserve-currency countries become key components of international portfolios and official reserve holdings (Farhi et al., 2011). Farhi et al. (2011) also emphasize that this asymmetry plays a central role in shaping the functioning of the international monetary system, as the supply of safe assets by reserve issuers becomes essential for global financial stability.

The growing integration of global financial markets since the late twentieth century has further reinforced the importance of reserve assets within the international monetary system. Large cross-border capital flows and the accumulation of foreign exchange reserves by emerging market economies have substantially increased global demand for safe and liquid

financial instruments (Lane & Milesi-Ferretti, 2007). This pattern has been described in the literature as Bretton Woods II, an informal system in which emerging economies, particularly in Asia, pursue a development strategy of export-led growth, maintaining undervalued exchange rates relative to the dollar, accumulating large stocks of foreign exchange reserves, and recycling their external surpluses into U.S. Treasury securities (Dooley et al., 2003). Unlike the original Bretton Woods arrangement, this system rests not on a formal international agreement but on a mutually reinforcing set of incentives: emerging economies benefit from export-led growth and financial stability, while the United States gains access to cheap financing for its fiscal and external deficits. Dooley et al. (2003) argued that this configuration would prove sustainable despite its large imbalances, though subsequent literature has questioned whether the system's internal tensions, particularly the growing stock of dollar liabilities held abroad, could eventually undermine the confidence that sustains it, echoing the original Triffin dilemma (Dorrucci & McKay, 2011). In this context, U.S. Treasury securities have become the cornerstone of the international financial system, providing the liquidity and safety required by both private investors and official reserve managers (Dorrucci & McKay, 2011).

The central role of the U.S. dollar in the international monetary system has also generated an extensive debate regarding the stability and desirability of the current global monetary order. Farhi and Maggiori (2018) and Mateos et al. (2009) argue that reliance on a single dominant reserve currency creates structural vulnerabilities. The concentration of global safe asset supply in a single sovereign issuer exposes the system to fiscal and political risks, and may contribute to the build-up of global financial imbalances as surplus economies accumulate dollar reserves rather than allowing exchange rate adjustment. Obstfeld and Rogoff (2005) reinforce this concern, arguing that the resulting external imbalances are unlikely to be indefinitely sustainable and will eventually require significant adjustment. Others, however, emphasise the efficiency benefits of dollar centrality. Eichengreen (2016) points to the unmatched depth and liquidity of U.S. financial markets and the network effects that make switching to alternative currencies costly. While Gourinchas et al. (2019) document that the dollar-centred system has proven remarkably resilient precisely because no credible alternative exists at comparable scale. This debate intensified following the Global Financial Crisis (GFC), simultaneously illustrated the resilience of dollar dominance, with capital flowing into Treasuries precisely when the crisis originated in the United States, and its systemic risks (Mateos et al., 2009).

Overall, the contemporary international monetary system can be characterized as a hybrid arrangement combining flexible exchange rates, deep financial integration, and the dominance of the U.S. dollar as the principal international currency. The ability of the United States to issue large quantities of safe and liquid government debt plays a crucial role in supporting global financial intermediation and sustaining international reserve accumulation. Understanding this structural feature of the international monetary system is therefore essential for analysing the global demand for U.S. Treasury securities and their role as safe assets in international financial markets.

2.1.2. The Dollar as the Dominant International Currency

While Eichengreen (2016) emphasizes the role of inertia and network effects in sustaining dollar dominance, this perspective alone is insufficient to explain why alternative currencies have not displaced the dollar, particularly given the increasing economic weight of other regions. Siranova and Rocha (2020), using a sample of 27 currencies, provide comprehensive empirical evidence that the determinants of a currency's international status extend beyond historical inertia to include trade and financial openness, financial development, and institutional quality, factors in which the United States retains an overall structural advantage over potential competitors. This suggests that persistence must be complemented by a functional explanation of why the dollar remains uniquely suited to global financial needs.

Network effects play a central role in reinforcing the international use of the dollar. Once a currency becomes widely used in trade invoicing, financial contracts, and reserve accumulation, switching costs and coordination problems make transitions to alternative currencies difficult. Eichengreen (2016) argues that these self-reinforcing dynamics generate strong path dependence in the international monetary system, implying that even significant economic shifts do not necessarily lead to rapid changes in currency dominance. However, as Chinn and Frankel (2008) note, network effects can explain persistence but not initial emergence or continued dominance in the presence of viable alternatives. As a result, understanding the dollar's role requires going beyond historical inertia to identify the underlying economic mechanisms that sustain its position (Chinn & Frankel, 2008).

Farhi and Maggiori (2018) develop a model of the international monetary system in which financial frictions and differences in countries' ability to commit generate an equilibrium with a dominant international currency. In their work, countries that can credibly supply large

quantities of safe and liquid assets attract global demand, leading their currency to become the preferred medium for international financial transactions. Importantly, the model shows that currency dominance is not merely a historical accident, but rather the outcome of equilibrium forces linked to the supply of safe assets. This provides a micro-founded explanation for dollar dominance that complements, and in part challenges, the purely historical account proposed by Eichengreen (2016).

Building on this insight, the literature highlights a structural asymmetry at the core of the international monetary system. Reserve currency issuers benefit from strong global demand for their liabilities because these assets serve as stores of value and instruments for liquidity management (Gourinchas & Rey, 2007a). Farhi et al. (2011) argue that the international monetary system relies critically on the ability of these countries to supply safe assets to the rest of the world. In this sense, the provision of safe assets is not a peripheral feature, but rather a defining characteristic of the system's architecture. This asymmetry implies that the international role of the dollar is intrinsically linked to the fiscal and financial capacity of the United States (Farhi et al., 2011).

This central role of the dollar gives rise to a fundamental structural tension, first identified by Robert Triffin. In his seminal contribution, Triffin (1960) argued that a country issuing the global reserve currency faces a conflict between domestic macroeconomic stability and the international demand for liquidity. To supply sufficient reserves to the rest of the world, the reserve issuer must run persistent external deficits, but these deficits may eventually undermine confidence in the currency. While originally formulated in the context of gold convertibility under Bretton Woods, this insight captures a deeper contradiction inherent to any system based on a national reserve currency. Thus, the Triffin dilemma highlights that the very mechanism that sustains global liquidity may also generate long-run fragilities.

Although the institutional context has changed since the collapse of Bretton Woods, the core logic of the Triffin dilemma remains relevant. In the modern system, global demand for safe and liquid assets is largely satisfied through the issuance of U.S. government securities, rather than through gold-backed liabilities. Farhi et al. (2011) emphasize that this mechanism effectively replaces the gold constraint with a fiscal one, as the stability of the system now depends on the ability of the United States to continue issuing debt that is perceived as safe. This implies that the international monetary system is structurally dependent on the fiscal and financial credibility of the United States, particularly during periods of heightened

demand for safe assets. At the same time, this dependence introduces potential vulnerabilities, as rising public debt levels or concerns about fiscal sustainability may undermine the very assets that support global liquidity (Mateos et al., 2009). Thus, the modern reinterpretation of the Triffin dilemma highlights a fundamental tension between the provision of global safe assets and the long-term sustainability of U.S. public debt, a tension developed in full as the New Triffin Dilemma in Section 2.3.

In short, the dominance of the U.S. dollar reflects a combination of historical persistence, network effects, and structural factors related to the supply of safe assets. While these explanations are often presented separately, they are best understood as complementary mechanisms that jointly sustain the dollar-centered international monetary system. At the same time, the presence of structural tensions, captured by the Triffin dilemma, suggests that this equilibrium may not be without long-term challenges. This sets the stage for analysing the global demand for safe assets and the central role of U.S. Treasury securities in the next section.

2.2 Safe Assets, Global Imbalances and U.S. Treasuries

2.2.1. Global savings, financial imbalances, and the demand for safe assets

While the previous section characterized the structural features of the international monetary system and the central role of the United States as the primary supplier of safe assets, it remains to be explained why global demand for such assets has increased so markedly over the past decades. A key explanation is provided by the global savings glut hypothesis, originally advanced by Bernanke (2005), which highlights the emergence of large excess savings in emerging economies and their implications for global financial markets.

Bernanke (2005) argues that the widening U.S. current account deficit in the early 2000s should not be interpreted solely as a domestic imbalance, but rather as the counterpart of a global excess of savings originating in surplus economies. Following the Asian financial crisis of 1997–1998, many emerging economies adopted precautionary policies aimed at self-insurance, accumulating large foreign exchange reserves and running persistent current account surpluses. Jeanne (2007) provides a formal model of this precautionary motive, showing that the rapid build-up of reserves in the crisis's aftermath is consistent with optimal self-insurance against sudden stops in capital flows. These savings were intermediated into advanced economies, most notably the United States, through purchases of safe and liquid

financial assets. Caballero and Krishnamurthy (2009) show that this global demand for riskless assets reflects in large part the same precautionary motive: capital flows into the United States are driven not by return-chasing but by the search for safety, a demand that is structural and persistent, growing with financial globalisation and the frequency of capital account crises, and that exposes the U.S. financial sector to systemic risk by concentrating global risk onto its balance sheet.

However, the savings glut hypothesis alone does not explain why these flows concentrated so disproportionately in U.S. assets specifically. Caballero et al. (2016) provide a complementary explanation: emerging economies, lacking the institutional capacity to produce safe financial assets domestically, are structurally driven to export their savings to the United States in search of safe and liquid instruments. Together, these two mechanisms (excess savings and structural safe asset scarcity) account for the sustained compression of safe interest rates observed since the 1980s, as capital flowing into U.S. Treasuries depressed yields well below levels that domestic U.S. fundamentals alone would imply.

Lane and Milesi-Ferretti (2007) provide empirical documentation of these dynamics at the level of national balance sheets. Their evidence shows that surplus economies accumulated large stocks of foreign assets while deficit economies, particularly the United States, issued liabilities to the rest of the world. Crucially, the composition of these positions is highly asymmetric: surplus economies tend to hold safe and liquid assets, whereas the United States issues such instruments while holding riskier claims abroad, precisely the pattern that Gourinchas and Rey (2007a) formalise as the transformation from world banker to world venture capitalist. This compositional asymmetry confirms that global imbalances are not merely about net positions but about the nature of assets traded internationally, and it is this asymmetry that reinforces the structural demand for U.S. safe assets within the system.

A separate but related question is whether these imbalances are sustainable. Obstfeld and Rogoff (2005) argue that persistent current account imbalances are unlikely to be indefinitely sustainable and will eventually require significant real exchange rate adjustment, emphasising the potential for abrupt corrections if global capital flows reverse. This concern stands in contrast to Dooley et al. (2003), who argue that the Bretton Woods II configuration rests on mutually reinforcing incentives that make it structurally stable. Whether this equilibrium can be sustained depends ultimately on the fiscal credibility of the United States, a question this dissertation addresses directly.

The literature described above provides a coherent and progressive explanation for the sustained rise in global demand for safe assets. Excess savings in surplus economies, amplified by their structural inability to produce safe assets domestically, generated persistent capital flows into U.S. Treasuries and contributed to the secular decline in safe interest rates. The compositional asymmetry of global balance sheets reinforced this dynamic, concentrating demand in U.S. instruments specifically. Whether this equilibrium can be sustained depends ultimately on the fiscal credibility of the United States. What's missing is the nature of safe assets themselves: what makes an asset safe, why supply has consistently fallen short of demand, and what the consequences of that shortage are for the global financial system.

As noted, safe assets have historically played a central role in the functioning of financial systems, acting as reliable stores of value, collateral in financial transactions, and benchmarks for pricing risky securities. As Gorton (2017) emphasize, the concept of safe assets has evolved over time, encompassing government debt, bank liabilities, and highly rated private securities, but their common feature lies in the combination of low default risk, liquidity, and credibility of nominal repayment in adverse states of the world.

The endogenous nature of safe asset supply has deep theoretical roots. Holmström and Tirole (1996) establish the foundational result that private assets alone are insufficient to meet the liquidity needs of the productive sector, and that government securities play a necessary and irreplaceable role in providing public liquidity. Caballero et al. (2008) build on this insight with the first formal equilibrium model of the safe asset market, showing that differences in financial development between advanced and emerging economies generate a structural excess demand for the safe assets produced by the former.

Safe assets, however, need not come only from governments. Caballero and Farhi (2013) show how the financial sector can itself manufacture safety, transforming risky cash flows into senior, seemingly safe claims through securitisation and tranching, a process that remains constrained by underlying frictions in pledgeability and risk-sharing. Caballero et al. (2017) extend this framework to show that governments and financial intermediaries jointly determine the total supply of safe assets: sovereigns supply public debt backed by fiscal capacity, while intermediaries supply privately manufactured safety subject to the frictions just described. Caballero and Farhi (2018) show what happens when this private transformation mechanism fails: the economy can fall into a safety trap, in which safe asset

scarcity depresses aggregate demand directly, rather than remaining confined to financial markets. The capacity to produce safe assets, whether public or private, is not uniformly distributed across economies (Caballero et al., 2017). It depends on institutional quality, fiscal strength, financial development, and the credibility of monetary authorities, factors historically concentrated in a small number of advanced economies, most prominently the United States.

A key insight of the recent literature is that the global supply of safe assets has not kept pace with demand. Caballero et al. (2017) argue that this imbalance reflects structural forces in the global economy: global demand for safe assets grows broadly in proportion to global output, increasingly driven by high-saving emerging economies, while the production of safe assets remains concentrated in a small set of advanced economies whose collective growth rate has lagged behind global GDP growth. As a result, a persistent and widening gap between supply and demand has emerged, a structural conundrum with no straightforward resolution (Caballero et al., 2017).

This shortage manifests itself through a secular decline in safe interest rates, as rising prices of safe assets are required to equilibrate supply and demand. Empirically, this is consistent with the long-run downward trend in real interest rates observed since the 1980s documented by Rachel and Summers (2019) and Caballero et al. (2017). Moreover, capital flows increasingly move from surplus economies toward safe asset producers, reinforcing global imbalances and financial interdependence. Caballero et al. (2016) show that in an open economy setting, safe asset scarcity propagates across borders through the capital account, generating large cross-border flows from safe asset demanders toward safe asset producers. When scarcity is sufficiently severe, safe interest rates reach the zero lower bound, at which point output (rather than prices) becomes the adjustment variable. This dynamic is not merely a symptom of the shortage, but also a propagation mechanism: as safe asset scarcity intensifies, cross-border flows concentrate increasingly in the hands of a small number of sovereign issuers, deepening systemic dependence on their continued provision (Caballero et al., 2016).

The shortage of safe assets also has important implications for financial stability. In the 2000s, the scarcity of genuinely safe instruments led to the rapid expansion of private-label safe assets, most notably highly rated securitized products manufactured through collateralized debt obligations backed by mortgage-backed securities (Gorton, 2010). As

documented by Caballero et al. (2017), these instruments temporarily alleviated the shortage and reduced downward pressure on global safe interest rates. However, they ultimately proved fragile: when the subprime crisis erupted, the sudden loss of safe status of these pseudo-safe assets simultaneously contracted supply and amplified demand, abruptly worsening the underlying shortage. This episode reveals an important asymmetry: privately manufactured safe assets can expand supply in good times, but their fragility means they tend to disappear precisely when demand is highest, during periods of financial stress (Caballero et al., 2017; Gorton, 2010). The crisis therefore did not resolve the safe asset shortage but rather exposed its depth.

Beyond financial markets, safe asset scarcity has macroeconomic consequences. Caballero et al. (2016) and Caballero and Farhi (2018) show that when the supply of safe assets is insufficient relative to demand, equilibrium interest rates decline and may reach the zero lower bound, giving rise to demand shortfalls and persistent output gaps, a dynamic closely related to secular stagnation. In open economies, this scarcity propagates across countries through capital flows, limiting the effectiveness of national monetary policy and increasing global interdependence. Importantly, in this environment, policies that increase the net supply of safe assets, including public debt issuance by fiscally credible sovereigns, are output-enhancing, while policies that reduce private safe asset supply without replacing it can deepen the contraction (Caballero & Farhi, 2018).

Taken together, this literature establishes that safe asset scarcity is not merely a financial imbalance but a structural feature of the global economy, with far-reaching implications for interest rates, capital flows, financial stability, and macroeconomic performance. This framing sets the stage for understanding why U.S. Treasury securities have come to occupy such a central position in the global financial architecture, a question addressed in the following section.

2.2.2. U.S. Treasuries as the benchmark safe asset.

Within the global hierarchy of safe assets, U.S. Treasury securities occupy a uniquely central position. They are the principal instrument through which global demand for safe and liquid assets is satisfied. Understanding why Treasuries occupy this position, and what sustains it, is essential for analysing the structural role of U.S. public debt in the international financial system (Caballero et al., 2017).

From a theoretical perspective, the safety of sovereign debt is neither automatic nor absolute. Martinez et al. (2022) in a comprehensive survey of the sovereign debt literature, argue that sovereign debt is safe precisely because of the sovereign's power to tax, which provides a credible revenue base for debt service, but that this safety is always contingent, since the sovereign's control over its territory makes external enforcement difficult. This creates a fundamental distinction between sovereigns that are perceived as safe and those that are not, implying that safe asset status must be continuously maintained through institutional credibility and fiscal sustainability.

Building on this, He et al. (2019) provide a model in which the safety of sovereign debt is inherently relative rather than absolute: a sovereign's debt achieves safe asset status not merely because its fundamentals are strong, but because they are strong relative to those of alternative safe assets. Their model shows why the sheer size of a sovereign's debt market can itself be a source of safety, rather than merely a consequence of it. Investor actions in their model are strategic complements. The more investors already hold a sovereign's debt, the stronger the incentive for other investors to do the same, since no individual investor wants to be left holding debt that others have abandoned. A larger debt float strengthens this coordination by increasing market liquidity, making it easier for investors to find counterparties and thereby lowering the risk that a rollover crisis becomes self-fulfilling (He et al., 2019).

This mechanism operates only when global demand for safe assets is already high. When demand is low, a large debt float instead exposes the sovereign to greater rollover risk, as a larger stock of debt becomes harder to refinance if confidence weakens. As global fundamentals deteriorate elsewhere, the debt of the relatively stronger sovereign benefits disproportionately from this mechanism, becoming safer not only in absolute terms but relative to the shrinking pool of alternatives, consistent with the flight-to-quality dynamics observed when U.S. Treasury prices rise during global crises (He et al., 2019).

Complementing this theoretical perspective, Habib et al. (2020) provide systematic empirical evidence for the specific channel this model identifies, examining a sample of 40 economies between 1990 and 2018. Their central finding is that the size of the debt market, measured as a country's share of world public debt, is the single most important factor explaining the divergence in yields between the United States and other economies during periods of global stress. This is the yield-side counterpart of the mechanism formalised by He et al. (2019): a

larger, more liquid, more self-reinforcing debt market is perceived as safer, and investors accept a correspondingly lower yield in exchange for that safety.

Empirically, the special role of U.S. Treasuries is reflected in their convenience yield: the premium investors are willing to forgo in exchange for the safety and liquidity services that Treasuries uniquely provide. Krishnamurthy and Vissing-Jorgensen (2012) document that Treasury yields are systematically lower than those of other assets with similar risk characteristics, with an average spread of approximately 73 basis points over the period 1926–2008. This premium reflects the dual role of Treasuries as both a store of value and a highly liquid instrument. Importantly, Krishnamurthy and Vissing-Jorgensen (2012) decompose the convenience yield into its liquidity and safety components and find that liquidity accounts for the larger share: of the 73 basis points investors paid on average for the convenience of Treasuries between 1926 and 2008, an estimated 46 basis points reflect the liquidity attribute and 27 basis points the safety attribute.

This finding underscores that it is the depth and functioning of U.S. government debt markets, not merely creditworthiness, that underpins their privileged pricing. More recently, Du et al. (2018) document a secular decline in the convenience yield of U.S. Treasuries relative to other advanced economy government bonds since the 1970s, consistent with the gradual deepening of alternative safe asset markets and the increasing supply of Treasuries, both of which reduce the scarcity premium.

The importance of liquidity is reinforced by the foundational role of Treasuries in global financial infrastructure. As Gorton (2017) documents, safe assets have historically been essential to supporting financial intermediation, particularly through their role in short-term funding markets. Treasuries are widely used as collateral in repo markets, derivatives transactions, and regulatory liquidity requirements, making them essential to financial intermediation at a global scale (Gorton, 2017). This collateral role makes Treasuries valuable not only as assets to hold, but as instruments that support leverage, funding liquidity, and the day-to-day functioning of wholesale financial markets, services that no alternative asset currently replicates at comparable scale (Krishnamurthy & Vissing-Jorgensen, 2012).

From a global perspective, U.S. Treasuries also function as the primary vehicle through which safe asset demand is satisfied internationally. Caballero et al. (2017) document that cross-border capital flows are increasingly directed toward U.S. assets, reflecting the

concentration of safe asset supply in the United States. According to U.S. Treasury International Capital data, foreign official and private investors hold approximately one-third of outstanding U.S. Treasury securities. This scale of foreign holdings, combined with the role of Treasuries as collateral in wholesale funding markets and as the benchmark for global asset pricing discussed above (Farhi et al., 2011; Gorton, 2017), indicates that Treasuries function as more than a conventional store of value: they underpin collateral chains, benchmark pricing, and cross-border capital flows throughout the international financial system. By supplying safe assets on a scale that far exceeds what most other sovereign issuers can provide, the United States effectively supplies a public good to the international financial system, facilitating global transactions, supporting reserve accumulation, and enabling risk-sharing across borders (Caballero et al., 2017).

Historically, this arrangement has conferred substantial benefits on the United States itself: lower borrowing costs, reduced exchange rate pressure, and the capacity to sustain current account deficits of a magnitude that no other economy could maintain (Gourinchas & Rey, 2007a). Whether these benefits persist as the supply of U.S. debt continues to expand is, however, an open question: The inverse relationship between Treasury supply and the convenience yield established by Krishnamurthy and Vissing-Jorgensen (2012) implies that the convenience yield, and the borrowing-cost advantage it confers, should decline as supply grows relative to demand, a tension this dissertation returns to directly in its empirical analysis.

Recent empirical contributions raise a related but distinct question, concerning not the level of the convenience yield but the fiscal fundamentals presumed to underpin it. Jiang et al. (2024), applying a no-arbitrage framework to the U.S. government budget constraint, find that the market value of U.S. Treasuries substantially exceeds the risk-adjusted present value of expected future fiscal surpluses, a gap that implies either a convenience yield far larger than previously estimated or a systematic failure of investors to price fiscal risk correctly.

Chen et al. (2025) extend this analysis across three centuries of fiscal history in the United States, United Kingdom, and Dutch Republic, showing that when a country is the dominant safe asset supplier it can issue more debt than what is justified by its future primary surpluses. For the post-WWII United States, they find that the present value of future primary surpluses, even combined with the seigniorage revenue attributable to the convenience yield, covers only 31.93% of the market value of outstanding U.S. debt, meaning that roughly two-

thirds of the market value of U.S. debt is not accounted for by either fiscal fundamentals nor the convenience premium as conventionally measured. This gap is strikingly large in comparative terms. Despite its privileged position, U.S. debt is substantially less well backed by these two channels than the U.K. debt was during its own period as global hegemon before the First World War. The authors further find that this gap has widened considerably since 2007, a period closely coinciding with the structural break identified independently in this dissertation's own series (Section 4.2.1.).

Critically, their historical evidence shows what happens to this unbacked portion of debt when the privilege eventually ends: as occurred with the Dutch Republic and the United Kingdom, deteriorating fiscal fundamentals in the dominant safe asset supplier lead bondholders to withdraw the extra fiscal capacity they had previously extended, exposing them to substantial losses, while governments resort to financial repression to erode the value of the debt that fiscal fundamentals alone cannot support (Chen et al., 2025). These findings suggest that the sustainability of U.S. safe asset supply is not merely a function of fiscal fundamentals but is substantially contingent on the continued maintenance of the exorbitant privilege, and that the historical resolution of this tension has not been costless for those who financed it.

These findings also raise an important identification question: through what channels does the convenience yield respond to changing conditions, and how does each channel relate to the issuer's fiscal position? Krishnamurthy and Vissing-Jorgensen (2012) establish two critical results, operating through distinct and largely independent channels. In the Krishnamurthy and Vissing-Jorgensen (2012) model, the convenience yield is written as the sum of two distinct components, one driven by the supply of Treasury debt relative to GDP, and the other by a short-lived demand shock associated with flight-to-quality episodes.

First, the convenience yield is inversely related to Treasury supply: as the stock of outstanding Treasuries increases, the scarcity premium diminishes, implying that debt accumulation itself partially offsets the fiscal benefit it creates, a self-limiting dynamic absent from standard sustainability frameworks. This channel is a direct function of the issuer's own fiscal position, as measured by its debt-to-GDP ratio. Second, the convenience yield amplifies during crises, when the flight-to-safety motive strengthens; this channel is not driven by the fiscal position of the safe asset issuer, but it operates on the same convenience yield that determines the issuer's effective borrowing costs. A crisis originating anywhere in the world can therefore

lower the U.S. government's borrowing costs temporarily, providing fiscal relief precisely when global conditions might otherwise be expected to strain public finances, independently of the state of U.S. debt at that moment.

A third perspective, developed by Nagel (2016), links the liquidity component of the convenience yield to the level of short-term interest rates rather than to Treasury supply directly. Holding money incurs an opportunity cost: it earns no interest, and that forgone interest rises with the level of short-term rates. Investors therefore pay a higher premium for near-money assets, such as Treasury bills, precisely when interest rates are high. Nagel (2016) shows that this relationship is empirically strong, and that the Treasury supply variable of Krishnamurthy and Vissing-Jorgensen (2012) loses much of its explanatory power once the short-term interest rate is controlled for, suggesting that the opportunity cost of money, rather than supply scarcity alone, is the dominant driver of the liquidity premium outside of crisis periods. Taken together, these perspectives imply that the fiscal subsidy from safe asset status responds to at least three distinct forces, Treasury supply, financial-crisis stress, and the level of short-term interest rates, though the relative weight of each remains debated in the literature.

The Blanchard (2019) framework, which treats r[1] as largely determined by conditions outside the fiscal authority's control, does not capture these mechanisms: it neither distinguishes a supply-driven scarcity premium from a crisis-driven flight-to-safety premium, nor allows for the fiscal subsidy to vary independently of the debt-to-GDP ratio through which r and g[2] are typically compared. Chen et al. (2025) measure the convenience yield as a single, aggregate market-based yield differential when decomposing the market value of U.S. debt into fiscal backing and exorbitant privilege components. Their approach does not distinguish between the supply-driven and crisis-driven components identified above, though their analysis ends in 2020, leaving the post-2020 period unexamined. This empirical gap becomes particularly relevant in the post-2020 environment and is formulated in full in Section 2.4.

[1] r denotes the real interest rate on government debt: the yield the government pays to borrow, adjusted for inflation.

[2] g denotes the real rate of growth of GDP: the annual growth rate of the economy, adjusted for inflation.

2.3 Exorbitant Privilege and the New Triffin Dilemma

2.3.1. The exorbitant privilege and the United States as global insurer.

The concept of the "exorbitant privilege", originally coined by French Finance Minister Valéry Giscard d'Estaing in the 1960s to describe the asymmetric advantage the United States derives from the dollar's reserve currency status (Eichengreen, 2012), acquires its full analytical content when translated into the structure of the U.S. external balance sheet. Gourinchas and Rey (2007a) provide the foundational empirical account: the United States operates as the "banker of the world", borrowing short and in safe instruments while lending long and in risky ones. Its liabilities are dominated by low-yield, safe instruments (most notably Treasury securities and bank deposits) while its external assets consist disproportionately of higher-yielding foreign direct investment and equity claims.

This compositional asymmetry, which is the external counterpart of the safe asset mechanism established in the preceding sections, generates a persistent return differential between U.S. external assets and liabilities that constitutes the core of the privilege. Building on earlier empirical documentation of U.S. external positions by Lane and Milesi-Ferretti (2007), Gourinchas and Rey (2007a) estimate that this differential has been economically significant over the postwar period, allowing the United States to sustain a deteriorating net foreign asset position while continuing to earn positive net investment income. Habib (2010) provides complementary cross-country evidence showing that excess returns on net foreign asset positions are systematically associated with countries that occupy a central position in the international monetary system, suggesting that the privilege reflects structural features of global financial architecture rather than idiosyncratic U.S. characteristics.

The return differential decomposes into two distinct components. The first is a return effect, reflecting higher returns earned on U.S. foreign assets than paid on its liabilities within each asset class. The second is a composition effect, reflecting the structural tilt of assets toward high-return instruments and liabilities toward low-return safe instruments. Gourinchas and Rey (2007a) originally estimated the overall differential at 3.32% annually, of which 2.45 percentage points were attributed to the return effect specifically. However, the precise magnitude of the differential has been contested.

Curcuru et al. (2008) argue that existing estimates are biased upward due to inconsistencies in revised data. Using original data releases, they find the aggregate differential falls

substantially, driven almost entirely by foreign direct investment rather than portfolio securities, where the differential is close to zero. This critique suggests the privilege operates primarily through balance sheet composition rather than superior returns within each asset class.

Gourinchas et al. (2010) subsequently update and refine the original estimates, extending the sample through the 2007–2009 financial crisis, and find that the return differential averaged approximately 2.69 percent annually over 1952–2009, a downward revision from the original 3.32%, though the privilege remains economically significant even after addressing the methodological concerns raised by Curcuru et al. (2008). Nievas and Sodano (2024) extend the analysis beyond the United States to show that advanced economies as a group benefit from persistent excess yields financed by capital flows from emerging economies, with the privilege deriving primarily from the liability side, as rich countries issuing international reserve currencies gain access to cheaper financing, rather than from systematically higher returns on assets.

The mechanisms sustaining the privilege operate through several reinforcing channels. Meyermans (2022) identifies the safety-premium channel, where perceived safety of U.S. assets generates persistent strong demand and keeps U.S. borrowing costs low, and the liquidity-premium channel, where the depth and homogeneity of U.S. financial markets create network effects that further reinforce demand for dollar-denominated assets. A related mechanism operates through private savings: persistently low safe interest rates, a direct consequence of global demand for dollar assets, discourage private savings and shift more pressure onto the U.S. public sector as the residual safe asset issuer (Caballero et al., 2017; Mateos et al., 2009). Cheng and Zhang (2011) formalise these dynamics in a general equilibrium framework, showing that reserve accumulation by periphery countries is automatically recycled into U.S. government bonds, providing the United States with structural financing for its external deficits while simultaneously sustaining the dollar overvaluation that underpins the privilege.

A structural implication of the privilege that merits particular attention is its interaction with the exchange rate. Strong global demand for dollar-denominated safe assets generates persistent appreciation pressure on the U.S. dollar, keeping it structurally overvalued relative to what fundamental trade flows would imply (Meyermans, 2022). Farhi and Maggiori (2018) formalise this mechanism in a general equilibrium model of the international monetary

system, showing that the safe asset premium is reflected not only in the yield advantage on U.S. liabilities but also in the dollar exchange rate itself: the dollar is overvalued precisely because investors are willing to pay a safety premium for dollar-denominated assets.

This overvaluation has real consequences: it reduces the competitiveness of U.S. exports, contributes to the persistent current account deficit, and paradoxically deepens the external imbalances that the privilege itself finances. The result is a self-reinforcing cycle in which the privilege sustains the dollar's overvaluation, which sustains the U.S. current account deficit, which sustains the supply of dollar liabilities demanded globally as safe assets(Cheng & Zhang, 2011; Farhi & Maggiori, 2018). Cheng and Zhang (2011) show that this cycle is stable if the confidence in the dollar's reserve status is maintained, but that a loss of confidence could trigger a disorderly adjustment in both the exchange rate and U.S. borrowing costs simultaneously.

The privilege is not, however, costless. During crises, foreign investors flee toward the safety of U.S. Treasuries, which pushes U.S. yields down, while the riskier foreign assets the U.S. holds abroad lose value. The United States therefore experiences both a rise in the value of what it owes and a fall in the value of what it owns, precisely during episodes when the rest of the world needs relief most, what Gourinchas and Rey (2022) describe as the exorbitant duty, in which the United States functions as an insurer of last resort, much as an insurer collects steady premiums in normal times but pays out heavily when disaster strikes. This is not in tension with the average privilege documented above. The two coexist, the privilege reflecting the long-run average return differential, the duty reflecting its concentration into losses during specific stress episodes, just as an insurer can be profitable on average while still paying substantial claims during a catastrophe.

Gourinchas and Rey (2022) estimate that wealth transfers from the U.S. to the rest of the world during the 2007–2009 global financial crisis amounted to approximately 20 percent of U.S. GDP, the monetary counterpart of this insurance-like payout rather than evidence against the privilege documented elsewhere. Bertaut et al. (2024) corroborate this pattern using security-level data, finding that the excess return, positive on average outside of crises (+3.3 percent), reverses sign during crisis periods (−3.1 percent), direct evidence that the same return advantage that constitutes the privilege in normal times becomes a disadvantage precisely when global stress is highest, just as an insurer's premium income reverses into claims payments when the insured event occurs.

Beyond fiscal and financial pressures, the privilege faces a growing geopolitical dimension that has received increasing academic attention since 2022. The freezing of approximately $300 billion in Russian central bank reserves by G7 governments following the invasion of Ukraine demonstrated for the first time that reserve assets held in the dominant currency are not immune to sovereign risk of a political nature, a form of sanction risk that had not previously been priced into reserve allocation decisions (Weiss, 2022). The academic literature is divided on the implications. Dooley et al. (2022) argue that the sanctions episode in fact reinforces dollar dominance by strengthening the "collateral motive" for holding dollar reserves. Countries seeking to reassure foreign investors now have an even stronger incentive to hold dollars as a signal of alignment with the international financial order. Weiss (2022) finds limited empirical evidence of a reduction in the dollar share of foreign exchange reserves following the Russian freeze, noting that approximately three-quarters of foreign government holdings of U.S. safe assets belong to countries with military ties to the United States.

The absence of credible alternatives reinforces this inertia. Eichengreen (2012) shows that reserve currency status is subject to structural persistence and hysteresis, rooted in the absence of rivals capable of matching the depth, liquidity, and institutional backing of US dollar markets, an argument developed before the 2022 sanctions episode but directly relevant to interpreting its aftermath. The euro lacks a unified fiscal authority behind it, and the renminbi remains constrained by limited capital account convertibility, leaving no currency able to absorb a large-scale shift in reserve allocation even if the political incentive to diversify away from the dollar has strengthened since 2022 (Eichengreen, 2012).

The evidence reviewed above points to a privilege whose average long-run benefit remains structurally robust, but whose cost is increasingly concentrated and amplified precisely in the moments of stress when it is most needed, the "duty" side of the privilege, rather than the privilege itself, that has grown more burdensome. The return differential documented by Gourinchas and Rey (2007a) and confirmed by subsequent empirical work remains real and economically significant, and the structural persistence of US dollar demand documented by Eichengreen (2012), rooted in the absence of alternatives capable of matching the depth and liquidity of dollar markets, continues to hold: neither the euro nor the renminbi has closed this gap in the years since.

Yet this structural resilience coexists with mounting evidence of strain specific to the post-2022 period: the compression of realised excess returns during crisis episodes (Bertaut et al., 2024), the deterioration of the U.S. net foreign asset position (Atkeson et al., 2025), and the emergence of geopolitical sanction risk following the freezing of Russian reserves (Weiss, 2022), collectively point to a privilege that is becoming more costly to maintain and more contingent on sustained confidence, even as its structural underpinnings persist. This tension, between a durable structural demand for U.S. safe assets and growing, more recent constraints on the United States' capacity to supply them at the same implicit cost, is the defining contradiction of the contemporary international monetary system, and it is precisely the contradiction that the modern reinterpretation of the Triffin dilemma formalises.

2.3.2. External sustainability and the valuation channel

The structural advantages conferred by the dollar's dominant role do not, by themselves, guarantee the indefinite sustainability of the U.S. external position. As Gourinchas and Rey (2007b) document, the United States has historically adjusted its external imbalances not through conventional current account correction but through the valuation channel. Exchange rate movements and relative asset price shifts that generate capital gains on U.S. foreign assets while compressing the real value of U.S. liabilities. Because U.S. external assets are concentrated in higher-yielding equity and foreign direct investment while liabilities are dominated by low-yield debt instruments, dollar depreciation and favourable asset price movements systematically generate valuation gains that offset a significant share of cumulative current account deficits (Gourinchas & Rey, 2007b).

This asymmetric adjustment mechanism, while powerful, is inherently contingent on continued dollar depreciation and favourable global asset price dynamics, conditions that introduce a structural fragility into the sustainability calculus and cannot be assumed to persist indefinitely (Lane & Milesi-Ferretti, 2007; Obstfeld & Rogoff, 2005). Adler and Garcia-Macia (2018) further show that valuation effects play a stabilising but inherently uncertain role in the evolution of net foreign asset positions, particularly for countries such as the United States that hold riskier external assets and issue safe liabilities, implying that external sustainability cannot be assessed solely through current account dynamics.

This fragility points to a deeper tension at the core of the international monetary system. As global demand for safe assets continues to rise, the United States must expand the supply of

safe liabilities, primarily through the issuance of public debt, further deepening its external position (Caballero & Farhi, 2018; Caballero et al., 2017). Yet the capacity to sustain this role is ultimately fiscal: it depends on the credibility of U.S. public finances and the perceived safety of U.S. government securities (Farhi & Maggiori, 2018; Krishnamurthy & Vissing-Jorgensen, 2012). This structural dependency of the global system on U.S. debt issuance raises a central question that directly motivates the modern reinterpretation of the Triffin dilemma: to what extent can the fiscal capacity of the United States support this role in the long run?

2.3.3. The New Triffin Dilemma

The structural features discussed above, the dollar's dominance, the persistent shortage of safe assets, the exorbitant privilege and its associated duty, and the fragility of the external adjustment mechanism, converge on a single organising tension that the contemporary literature identifies as the New Triffin Dilemma. The original formulation of this dilemma, developed in the context of Bretton Woods, identified a contradiction between supplying global liquidity and maintaining dollar-gold convertibility that ultimately proved irresolvable. The collapse of that system removed the gold constraint, but as Gourinchas et al. (2019) emphasise, the financial fragilities inherent in a hegemonic monetary system did not disappear, they merely took a different form.

The contemporary literature has produced two reformulations of Triffin's original insight, which Bordo and McCauley (2019) critically examine in detail. The first, the current account version, holds that the reserve currency country must run persistent current account deficits to supply the rest of the world with dollar reserves, raising U.S. external indebtedness to unsustainable levels over time. Bordo and McCauley (2019), however, argue that this version misreads Triffin's original thesis: what Triffin feared was not net current account flows, but the growing stock of gross liquid dollar liabilities held abroad relative to U.S. gold reserves, and the potential loss of confidence in their convertibility. As Mateos et al. (2009) note, the supply of international liquidity does not strictly require persistent current account deficits. With global capital flows, the reserve issuer can in principle meet foreign demand for safe assets while running a balanced current account, provided its public or private sector accumulates a matching volume of foreign assets.

Gourinchas and Rey (2007a) show that this is, in practice, close to the historical experience of the United States, which behaves as the world's banker: it issues short-term, liquid, safe liabilities, such as Treasuries, while investing the proceeds abroad in longer-term, less liquid, higher-return assets, such as equities and direct investment. This is a form of maturity and liquidity transformation performed at the global level, operating through the financial account rather than the current account. Together, these accounts imply that this mechanism could sustain global liquidity provision even alongside a balanced or improving current account, decoupling the supply of international liquidity from the trade deficits with which it is traditionally associated (Gourinchas & Rey, 2007a; Mateos et al., 2009). This distinction is important. The United States can supply safe assets through financial intermediation rather than trade deficits, which relocates the sustainability constraint from the current account to the fiscal balance sheet.

The second reformulation, the fiscal or safe assets version, is more directly relevant to the question this dissertation addresses. It shifts the focus from external flows to the stock of outstanding Treasury liabilities and the fiscal capacity that backs them. Gourinchas et al. (2019) interpret the resulting tension as a modern version of the Triffin dilemma. Just as Bretton Woods faced a growing asymmetry between the stock of dollars held abroad and U.S. gold reserves, today there is a growing asymmetry between the fiscal capacity of the United States and the stock of reserve assets held abroad. As global demand for safe assets continues to grow, driven by the structural forces reviewed above, the United States' capacity to satisfy such demand is placed under growing strain by its declining share of global output. Emerging economies, led by China and India, have grown faster than the United States for several decades, steadily reducing the U.S. share of world GDP even as the U.S. economy itself continues to grow in absolute terms. If global demand for dollar-denominated safe assets scales with the size of the world economy while the issuing economy's relative weight within it shrinks, meeting that demand requires the United States to issue debt at an increasing ratio to its own GDP, placing the ability of the United States to credibly back its outstanding liabilities under increasing strain (Farhi et al., 2011; Gourinchas et al., 2019).

Farhi and Maggiori (2018) formalise the resulting fragility through a framework of multiple equilibria, where confidence in reserve assets can shift abruptly, generating discontinuous adjustment dynamics. Mateos et al. (2009) capture the essential implication: growing demand for safe Treasury assets leads to indebtedness which, in time, could undermine the very

confidence that is the basis for their reserve status. Dorrucci and McKay (2011) reinforce this point, describing a mechanism that reproduces Triffin's original concern in a different form. Triffin's deflationary bias arose from a physical scarcity of the reserve asset: under the gold-exchange standard, insufficient reserve issuance relative to the growth of global trade choked off the liquidity needed to sustain it.

Dorrucci and McKay (2011) argue that the modern equivalent operates through a scarcity of quality rather than quantity: as the reserve issuer's indebtedness grows, confidence in the safety of its liabilities may erode even as the quantity issued continues to rise. Should the reserve issuer become unable, or be perceived as unable, to credibly accommodate foreign demand for genuinely safe assets, investors would be left to substitute toward alternative instruments of inferior quality, less liquid or less creditworthy sovereign debt, reproducing a shortage of true safety analogous to Triffin's original liquidity shortage, and consistent with the safety trap mechanism described by Caballero and Farhi (2018) above.

It is worth noting that Bordo and McCauley (2019) remain sceptical of this fiscal version as well, arguing that it overstates the inflexibility of safe asset supply and lacks a clear crossover point from stability to instability. This scepticism is instructive. Tt highlights that the Triffin dilemma is not an automatic or imminent crisis, but rather a structural tension that may remain latent for extended periods before materialising in ways that are difficult to predict.

The structural nature of this tension has stimulated proposals for reform centred on broadening the fiscal base for safe asset supply beyond a single issuer. Farhi et al. (2011) argue that a transition toward a multipolar reserve system, anchored in mutually guaranteed European bonds and, in the longer run, an internationalised renminbi, is both desirable and ultimately inevitable, as it would expand the collective fiscal capacity underlying safe asset provision. However, they caution that multipolarity introduces its own fragilities: because reserve assets denominated in different currencies must be seen as largely substitutable to be considered safe, small changes in fundamentals, or in the perception of them, can trigger massive, self-fulfilling capital reallocations as investors race to anticipate one another.

Writing in September 2011, the authors point to precisely this dynamic unfolding on a smaller scale within the eurozone since the onset of the European sovereign debt crisis. Until the summer of 2009, European sovereign debt was treated as broadly interchangeable, with low spreads across issuers, a perception shattered by the Greek crisis, which triggered a sharp

reallocation toward countries such as Germany perceived as safe (Farhi et al., 2011). Eichengreen (2016) reinforces that the transition to multipolarity cannot occur rapidly, given the unmatched depth of U.S. financial markets and the absence of alternatives capable of replicating the dollar's functions at comparable scale. In the interim, the dilemma therefore persists as a defining structural feature of the system.

The New Triffin Dilemma thus crystallises the central question motivating this work. Global financial stability depends on the United States expanding its supply of safe liabilities, primarily through the issuance of public debt, in response to structural and growing demand, yet this expansion is ultimately constrained by U.S. fiscal sustainability. As Farhi et al. (2011) emphasise, the liquidity and safety of U.S. Treasuries rest on the fiscal capacity of the U.S. government, a foundation that, while not yet challenged, is subject to long-run pressures that the preceding analysis has progressively documented.

2.4. U.S. Fiscal Sustainability and Research Gap

2.4.1. The Endogeneity of *r* and *g*

The evolution of the debt-to-GDP ratio is governed by the standard debt dynamics identity $\Delta(d) = (r - g) \cdot d - pb$, where d is the debt ratio, r the real interest rate on government debt, g the real GDP growth rate, and pb the primary balance. The apparent simplicity of this expression conceals a fundamental analytical difficulty: both r and g are endogenous to the level of debt, meaning that the identity cannot be used to assess sustainability without first understanding the mechanisms through which debt accumulation feeds back into its own determinants (Mehrotra & Sergeyev, 2021; Panizza & Presbitero, 2014).

On the interest rate side, the fiscal position of a government can raise the cost of borrowing through two distinct theoretical channels. The first is the standard neoclassical crowding-out mechanism: government borrowing competes with private investment for a limited pool of domestic savings, so that if desired investment and government borrowing together exceed available savings at the prevailing interest rate, the rate must rise to restore equilibrium (Diamond, 1965; Elmendorf & Mankiw, 1999). This mechanism is partially mitigated in an open economy with capital mobility, as foreign savings can substitute for scarce domestic savings, a qualification of particular relevance to the United States given the capital inflows associated with its safe-asset status discussed in Section 2.2.

The second is a risk-premium channel, conceptually distinct from crowding-out because it operates through the price of risk rather than through the scarcity of loanable funds: as public debt rises relative to the economy's capacity to service it, investors attach a growing, non-zero probability to default, restructuring, or the erosion of the debt's real value through inflation, and demand compensation for bearing that risk in the form of a higher yield (Ardagna et al., 2007). Ardagna et al. (2007) provide empirical support for this channel using a panel of OECD countries, finding a significant, positive relationship between debt levels and long-term interest rates, but only for countries with above-average debt-to-GDP ratios, consistent with a risk premium that activates once debt crosses a threshold rather than rising uniformly from the first unit of debt issued.

These two channels are difficult to separate empirically, since both predict that higher debt raises yields, but the empirical literature has sought to quantify their combined effect. Laubach (2009) provides an estimate for the United States. It uses long-horizon forward rates, which are less contaminated by current monetary policy and business-cycle conditions than spot yields, together with Congressional Budget Office (CBO) fiscal projections rather than realised debt and deficit figures, reducing the risk that the estimated relationship simply reflects reverse causality from output conditions to both fiscal aggregates and yields. His results indicate that each one-percentage-point increase in the projected deficit-to-GDP ratio raises long-term Treasury yields by approximately 25 basis points, with a corresponding 3–4 basis-point effect for each percentage-point increase in the debt-to-GDP ratio, figures that are individually modest but accumulate meaningfully over the debt trajectory implied by current CBO projections.

A complementary perspective is offered by Rachel and Summers (2019), whose decomposition of the secular decline in neutral real rates across advanced economies confirms that r is not independent of fiscal decisions. They find that the neutral real rate has fallen approximately 300 basis points over the past four decades, but that absent the fiscal expansion, rising government debt, pay-as-you-go pensions, and social insurance programmes, the decline would have been far larger, potentially reaching 700 basis points, leaving neutral rates significantly negative. The implication is that government borrowing has exerted sustained upward pressure on r, and that the endogeneity of the interest rate to fiscal conditions is not a theoretical abstraction but an empirically documented phenomenon (Laubach, 2009; Rachel & Summers, 2019). Baum et al. (2013) find a similarly non-linear

pattern for the euro area, though attribute it to the crowding-out channel rather than to a separate risk premium: long-term interest rates come under increasing upward pressure once public debt exceeds approximately 74% of GDP, while below that threshold, additional debt is associated with lower long-term rates.

The growth (*g*) side of the identity is equally complex and operates through channels that are partly a continuation of the interest rate effects discussed above, and partly independent of them. Insofar as higher public debt raises *r* through either of the two channels described above, this in turn transmits into lower *g* through several distinct routes. Higher real interest rates directly discourage private investment and capital accumulation, at the cost of a smaller long-run capital stock, the standard crowding-out channel restated in growth terms (Diamond, 1965; Elmendorf & Mankiw, 1999).

In an open economy, higher *r* also tends to attract capital inflows and appreciate the domestic currency, which can further depress *g* by reducing external demand for domestically produced goods (Fleming, 1962; Mundell, 1963). Slower capital accumulation, in turn, is itself associated with lower productivity growth, compounding the direct investment effect (Woo & Kumar, 2015). Finally, where debt levels are perceived as unsustainable, governments may be compelled to undertake fiscal consolidation. This can itself weigh on *g* in the short run through reduced aggregate demand. The effect is particularly strong when consolidation relies on spending cuts (Alesina & Ardagna, 2009) rather than tax increases, and when is undertaken during a period of already weak demand. In the long run, it can also weigh on *g* if, as discussed below, the composition of the adjustment falls disproportionately on productive public expenditure.

Beyond this interest-rate-mediated route, the literature also documents channels through which debt affects growth more directly. Checherita-Westphal and Rother (2012), examining twelve eurozone economies, identify non-linear effects of public debt on growth operating through private savings, total factor productivity, and public investment: above a debt threshold, estimated at approximately 90–100% of GDP, with confidence intervals suggesting the negative effect may begin as early as 70–80%, the pressure of fiscal consolidation tends to fall disproportionately on productive expenditure, particularly infrastructure, with persistent long-run consequences for potential output. Woo and Kumar (2015) add further channels through reduced labour productivity, driven mainly by slower capital accumulation. This evidence should, however, be read alongside more recent meta-

analytic work: Heimberger (2022), synthesising 816 estimates from 47 studies, finds that the average negative association between debt and growth does not survive correction for publication bias, and that no consistent debt threshold emerges across studies, a caution against treating any single non-linear estimate, including those above, as a settled parameter (Panizza & Presbitero, 2013).

Yet the most consequential feature of the debt-growth relationship, and the one most often neglected in simple sustainability calculations, is that the direction of causality runs both ways. Low growth reduces tax revenues and triggers automatic spending increases, worsening the primary balance and raising the debt ratio (Panizza & Presbitero, 2014). This reverse causality, from weak g to higher d, accounts for a substantial portion of the observed correlation between high debt and low growth, and any empirical identification strategy that fails to address it risks attributing to debt effects that belong to growth shocks (Ash et al., 2017; Panizza & Presbitero, 2014).

Not all theoretical perspectives, however, point in the same direction. DeLong et al. (2012) argue that in an environment of depressed demand and low interest rates, expansionary fiscal policy may be self-financing: if the demand stimulus raises current output and hysteresis effects translate that gain into permanently higher potential output, future tax revenues may grow by more than the additional debt service required, making the net fiscal cost of borrowing zero or even negative, and that the reverse also holds, with fiscal consolidation during downturns potentially reducing potential output permanently and worsening rather than improving long-run debt dynamics.

2.4.2. The *r–g* differential and the conditions for sustainability.

The empirical literature on fiscal sustainability has relied heavily on the framework proposed by Bohn (1998), who examines whether the primary balance responds systematically and positively to lagged public debt, a sufficient, though not necessary, condition for satisfying the intertemporal government budget constraint. Applied to postwar U.S. data, this fiscal reaction function reveals strong evidence of such a stabilising response, suggesting that U.S. fiscal policy has historically been consistent with long-run solvency.

The limitation of this result, however, is that it describes average historical behaviour at debt levels well below those currently projected. It offers no guarantee that the same stabilising response will emerge as debt moves into territory outside the historical sample, nor does it

capture the non-linearities that may materialise as debt approaches credibility thresholds (Farhi & Maggiori, 2018; Ghosh et al., 2013).

Blanchard (2019) identifies two important qualifications to this result. First, even when the safe rate lies below *g*, public debt still crowds out productive private capital and generates welfare losses. Here, the safe rate (denoted as *r* throughout this discussion) refers to the yield on government debt, treated as free of default risk. The magnitude of these welfare losses depends on the spread between the marginal product of capital and the safe rate. Abel et al. (1989) document that the U.S. economy is dynamically efficient, meaning this spread is positive and the welfare cost of debt is real even in a low-r environment. Second, Blanchard (2019) identifies a multiple-equilibria risk: investors who come to perceive debt as risky require a premium that raises effective borrowing costs, worsens the fiscal position, and thereby validates their initial concern. A self-fulfilling dynamic that can emerge without any change in underlying fundamentals.

Beyond these two qualifications identified by Blanchard (2019), his framework has a further limitation from the perspective of the empirical evidence reviewed in the previous section: it treats the convenience yield as an exogenous reduction in *r*, rather than modelling the convenience yield as endogenous to the level of public debt and fiscal credibility. This simplification, as the literature reviewed above demonstrates, may significantly understate the fragility of the $r < g$ configuration at elevated debt levels.

It is precisely this limitation, the failure to account for the endogenous response of interest rates to rising public debt, that Mehrotra and Sergeyev (2021) address. Calibrating a stochastic overlapping generations model to the U.S. economy, they show that the interest rate rises endogenously as public debt accumulates, as higher debt competes with private capital in asset markets and alters the equilibrium return.

The critical implication is that the probability of transitioning from a $r < g$ regime to a $r > g$ regime is not a fixed background risk but itself increases with the level of public debt. As debt accumulates, the likelihood that the favourable condition identified by Blanchard (2019) as the historical norm will cease to hold therefor increases. This non-linearity is absent from the standard sustainability framework.

Although the model of Mehrotra and Sergeyev (2021) predates the recent episode, the sharp increase in real interest rates during the 2022–2023 monetary tightening cycle can be viewed

as a real-world illustration of a related dynamic: the $r > g$ condition re-emerged rapidly as real rates increased, consistent with the model's broader prediction that the likelihood of such a transition increases as public debt accumulates (Congressional Budget Office, 2024).

As established earlier, the convenience yield on U.S. Treasuries structurally compresses the effective *r* facing the U.S. government, a benefit with no counterpart for any other sovereign issuer (Krishnamurthy & Vissing-Jorgensen, 2012). This directly modifies the *r*–*g* differential at the centre of the sustainability assessment: the United States borrows at a rate systematically below what its fiscal fundamentals alone would imply. The modification is not, however, unconditional: Krishnamurthy and Vissing-Jorgensen (2012) show that the convenience yield declines as Treasury supply increases, and beyond a threshold at which rising debt erodes the perceived safety of the asset, the relationship can reverse, with further accumulation causing disproportionate increases in *r* that reflect not only standard crowding-out but also the partial loss of safe asset status, a mechanism formalised by Farhi and Maggiori (2018).

2.4.3. Threshold effects and the Reinhart-Rogoff controversy.

A significant strand of the empirical literature focuses on whether the debt-growth relationship contains non-linearities in the form of a threshold beyond which the effect of public debt on growth becomes sharply negative. A particularly influential contribution to this debate is Reinhart and Rogoff (2010), who classify debt-to-GDP observations for twenty advanced economies over 1946–2009 and find that economies with debt ratios above 90 percent of GDP exhibit markedly lower, and in some specifications negative, median growth rates. This result attracted enormous academic and policy attention, but it also generated a major controversy: Herndon et al. (2014) identified coding errors, selective exclusion of available data, and unconventional weighting of observations in the calculations of Reinhart and Rogoff (2010). After applying the corrections, they found an associated average growth rate of approximately 2.2 percent for high-debt economies, fundamentally inconsistent with the near-zero figure originally reported.

Reinhart et al. (2012) subsequently published a revised analysis that corrected the errors; their directional conclusions remain broadly similar, but the estimated growth penalty is considerably more modest, and the 90 percent threshold loses its character as a sharp discontinuity. Beyond the data errors, the threshold itself lacks stability across studies, and

crucially, across samples. Checherita-Westphal and Rother (2012), examining twelve eurozone economies, find a growth-constraining turning point at 90–100 percent of GDP, with evidence suggesting negative effects may begin already at 70–80 percent. Cecchetti et al. (2011), drawing on eighteen OECD countries, identify a threshold near 85 percent. Afonso and Jalles (2013), with a much broader panel of 155 countries, derive an endogenous threshold of 59 percent, though results vary substantially across income groups (for OECD economies the relevant inflection point remains closer to 90 percent). Bentour (2021), using a regression-kink approach that allows the threshold to be endogenously determined, finds that when a threshold exists at all it is country-specific and time-unstable. The variation across these studies is not incidental as it reflects genuine differences in samples, time periods, and methodologies, and is itself evidence against any universal numerical rule.

More fundamentally, Panizza and Presbitero (2013, 2014) and Ash et al. (2017) demonstrate that when endogeneity is properly addressed, the negative association between debt and growth either weakens substantially or disappears, consistent with the interpretation that the correlation largely reflects the reverse channel of low growth deteriorating the debt ratio rather than any structural causal effect of debt on growth.

For the purposes of this dissertation, the threshold literature is therefore informative not as a set of universal empirical regularities but as evidence of a signalling mechanism: debt levels beyond which market perceptions shift, risk premia rise, and the self-validating dynamics that Ghosh et al. (2013) formalise through the concept of fiscal fatigue become operative. Extending Bohn's (1998) linear reaction function to allow for non-linearity, Ghosh et al. (2013) show that the primary balance response to rising debt weakens systematically at high debt levels, implying a finite debt limit determined not by any fixed ratio but by the interaction between market perceptions, interest rate dynamics, and the government's remaining fiscal space. Their estimates suggest the United States already operates with constrained fiscal space relative to its own historical norm.

2.4.4. The contemporary U.S. fiscal position and its systemic dimension.

These analytical frameworks take on concrete urgency in the context of the current U.S. fiscal trajectory. Gross federal debt reached approximately 119 percent of GDP in fiscal year 2023, with the fiscal deficit exceeding 6 percent of GDP in three of the preceding four years, a configuration that Bohn-type historical reaction functions did not anticipate at this debt level

(Dallas & Scavone, 2024). Congressional Budget Office (2024) baseline projections extend this trajectory substantially: the deficit is projected to average above 6 percent of GDP over the next three decades, with gross debt potentially exceeding 175 percent of GDP by 2054, driven primarily by net interest costs projected to rise from 2.4 percent to more than 6.0 percent of GDP over the same period. These projections assume current policy remains unchanged and, critically, that the structural conditions sustaining the $r < g$ configuration, including the convenience yield documented above, remain intact (Krishnamurthy & Vissing-Jorgensen, 2012; Mehrotra & Sergeyev, 2021).

The literature reviewed above, while extensive, leaves a specific and important empirical gap. The theoretical case for a positive relationship between safe asset status and fiscal space is well established (Blanchard, 2019; Farhi & Maggiori, 2018), and the historical evidence confirms that dominant safe asset suppliers have historically operated with fiscal capacity well above what their fundamentals alone would justify (Chen et al., 2025; Jiang et al., 2024). The convenience yield is the variable that quantifies this advantage. It is the direct empirical measure of the premium investors attach to U.S. Treasuries as safe assets, and therefore of the borrowing-cost subsidy that underpins U.S. fiscal space.

What the existing literature does not address is whether this premium has persisted through the structural perturbations of the post-2020 period, since the most comprehensive estimates available end in 2020 (Chen et al., 2025; Jiang et al., 2024). This matters because three developments since then have placed the premium under unprecedented strain. First, the 2022–2023 monetary tightening reversed the $r < g$ configuration that the convenience yield helped sustain (Congressional Budget Office, 2024). Second, the sharp fiscal deterioration following the COVID-19 pandemic substantially increased Treasury supply at a time of heightened fiscal stress (Congressional Budget Office, 2024). Third, the freezing of Russian reserves introduced a geopolitical dimension to the demand for U.S. Treasuries as a reserve asset (Weiss, 2022). Whether the convenience yield has contracted in response to these developments is an open empirical question, and one with direct implications for the sustainability of U.S. public debt. Addressing it requires extending the measurement of the convenience yield beyond the 2020 endpoint of the existing literature, which is the contribution this dissertation seeks to make.

The significance of this contribution lies in the role the convenience yield plays within the broader dynamics of debt sustainability. As established above, the convenience yield

structurally compresses the effective *r* facing the U.S. government, directly modifying the *r*–*g* differential at the centre of the sustainability assessment. This compression, however, is contingent on investors continuing to perceive Treasuries as uniquely safe and liquid: should rising debt erode that perception, the resulting increase in *r* would simultaneously compress fiscal space and accelerate the erosion of safe asset status, a self-validating feedback loop with no counterpart in the fiscal analysis of any other sovereign (Farhi & Maggiori, 2018; Krishnamurthy & Vissing-Jorgensen, 2012). The convenience yield is the observable variable that signals where the United States stands within this dynamic: a stable or rising premium indicates that the safe asset role continues to subsidise fiscal space, whereas a sustained contraction would be an early indication that the perception underpinning the privilege is weakening. By measuring how the convenience yield has evolved in the post-2020 period, this dissertation provides empirical evidence on whether the fiscal subsidy associated with the safe asset role has begun to erode, offering a direct, if partial, reading of the tension that the new Triffin dilemma implies for U.S. fiscal sustainability.

3. Methodology

This chapter presents the empirical strategy used to assess whether the global safe-asset status of U.S. public debt relaxes, or merely postpones, the fiscal constraints implied by the new Triffin dilemma. Answering this question requires identifying the channel through which safe-asset status translates into fiscal relief and measuring whether that channel has weakened in the recent period.

That channel is the convenience yield. The dynamics of public debt are governed by the differential between the effective interest rate on the debt and the growth rate of the economy: when this differential is favourable, a given level of debt is easier to sustain. The safe-asset status of U.S. Treasuries acts directly on this differential, because the convenience yield compresses the effective interest rate the U.S. government pays, lowering it below what fundamentals alone would imply. The convenience yield is one of the main measurable channels through which the exorbitant privilege reduces the effective borrowing cost of the U.S. government: a larger convenience yield means a larger borrowing-cost subsidy and a more relaxed fiscal constraint, while a shrinking convenience yield means that this subsidy, and the relief it provides, is eroding.

It follows that the evolution of the convenience yield over time is a direct measure of whether the safe-asset status continues to mitigate these constraints or is ceasing to do so. If the convenience yield remains compressed relative to its long-run average, and if this compression can be traced to a structural shift rather than to the specific conditions of any single recent year, the fiscal relief afforded by the dollar's privileged position is weakening in a manner that is unlikely to be transient, indicating that this position is postponing, rather than durably resolving, the underlying Triffin tension. Assessing the 2021–2025 extension not only against the full historical average, but against the possibility that it continues a shift already underway earlier in the historical series, is thus the empirical strategy through which this dissertation addresses its research question.

The empirical strategy follows Jiang et al. (2024) as closely as possible, to preserve comparability with the existing literature. This choice is motivated by the fact that their no-arbitrage framework directly links the market valuation of U.S. public debt to fiscal fundamentals and to the convenience yield associated with Treasury securities, decomposing the market value of debt into the part backed by expected future primary surpluses and the

part attributable to the convenience premium[1]. Because their estimation ends in 2020, it does not capture the structural perturbations that have since placed the privilege under strain. The contribution of this dissertation is therefore not to develop a new valuation model. Instead, it extends the convenience-yield component of the empirical framework developed by Jiang et al. (2024), rather than replicating their full no-arbitrage decomposition of fiscal backing to the post-2020 period. This period is of particular relevance for the reasons set out in Chapter 2: the deterioration of the U.S. fiscal outlook following the COVID-19 pandemic (Congressional Budget Office, 2024), the 2022–2023 monetary tightening cycle, and the possible reassessment of dollar-denominated safe assets in the wake of the freezing of Russian reserves (Weiss, 2022). Whether this period represents a break from the historical norm, or the continuation of a shift already present earlier in the series, is addressed directly in Section 4.2.1.

Methodologically, the dissertation proposes to construct an annual time series of the U.S. Treasury convenience yield for 1947–2025, combining the historical estimates of Jiang et al. (2024) for 1947–2020 with an original extension for 2021–2025 based on FRED data. The empirical exercise then compares the post-2020 values with the historical benchmark (the 1947–2020 average convenience yield of approximately 0.36% obtained from the Jiang et al. (2024) series), as well as against the post-2009 sub-period specifically, whose distinctiveness as a persistent regime is established through a structural break analysis (Section 4.2.1.), and assesses whether the observed pattern is robust to alternative assumptions regarding the maturity multiplier and to an alternative measure of the convenience yield based on Aaa corporate bond spreads, the method used in Krishnamurthy and Vissing-Jorgensen (2012), the spread between Aaa-rated corporate bond yields and Treasury yields.

3.1 Measuring the convenience yield

The convenience yield is identified following the conceptual approach of Krishnamurthy and Vissing-Jorgensen (2012) and operationalised using the construction of Jiang et al. (2024). The premium is not directly observable, but, as Krishnamurthy and Vissing-Jorgensen (2012)

[1] The convenience premium refers to the additional value investors attach to Treasury securities owing to their safety and liquidity; the convenience yield is the empirical counterpart of this premium, the reduction in yield investors are willing to accept on Treasuries relative to comparable private assets. The former is the underlying valuation, the latter its observable, measurable expression.

establish, it is revealed by the spread between the yield on a short-term privately issued instrument and the yield on a Treasury security of comparable maturity. Since even the highest-rated private issuers carry marginally more default risk than the U.S. government, the comparison relies on selecting the highest-rated short-term private instrument available: commercial paper in the top tier of the short-term rating scale (A-1/P-1), commonly labelled 'AA' commercial paper in market data and in the FRED series used here, following the issuer's underlying long-term credit tier rather than the short-term scale itself. Historical default rates at this rating tier are negligible: Moody's Investors Service (2000, as cited in Krishnamurthy and Vissing-Jorgensen (2012)) reports literally zero defaults on A-1/P-1-rated commercial paper over 1972–2000. This ensures that the residual credit-risk component of the spread is small relative to the safety-and-liquidity premium being measured, even though it is not, strictly speaking, eliminated.

Following the construction of Jiang et al. (2024), the convenience yield in year t is obtained in two steps. First, a raw spread is computed as the difference between the yield on a three-month private money-market instrument and the yield on the three-month Treasury bill:

$$spread_t = r_t^{private} - r_t^{Treasury}$$

Because investors accept a lower yield on Tresuries in exchange for their safety and liquidity, Tresury yields lie systematically below that of comparable private instruments, so the spread is positive whenever Treasuries command a safety and liquidity premium. This raw spread captures the convenience yield near the short end of the maturity spectrum. Second, the raw spread must be adjusted to reflect the fact that the convenience yield is not uniform across maturities.

The spread is computed from three-month instruments and therefore captures the convenience yield only at the short end of the maturity spectrum; but Treasury debt is issued across a wide range of maturities. Following Jiang et al. (2024), it is assumed that the convenience yield diminishes as maturity lengthens, an assumption supported by the empirical estimates of Du et al. (2018), who find a convenience yield of 26 basis points at the three-month maturity against only 3.5 basis points at ten years. To obtain a measure representative of the entire stock of outstanding debt rather than of three-month bills alone,

the raw spread is rescaled by a maturity multiplier M_t(whose construction is detailed in Section 3.2):

$$CY_t = spread_t \times M_t$$

The multiplier, introduced by Jiang et al. (2024), assigns full weight to the shortest maturities and progressively smaller weights to longer ones, so that longer-dated Treasuries, which earn a smaller convenience yield than bills, contribute less. The resulting product, CY_t, is expressed as an annual percentage, the same basis as the historical series, so that the post-2020 values are directly comparable with the 1947–2020 benchmark.

A distinction between the raw spread and the convenience yield is essential for the interpretation of the results, since conflating the two risks comparing the post-2020 values against the wrong historical benchmark. The raw spread averages approximately 0.56% per year over the 1947–2020 period (Jiang et al., 2024), while the convenience yield, obtained after applying the maturity multiplier, averages approximately 0.36% over the same period. All comparisons in this dissertation are therefore made between convenience yields, never between raw spreads. In particular, the post-2020 values are compared against the 1947–2020 convenience yield benchmark of 0.36%, not against the larger 0.56% raw spread, ensuring that both figures follow the same spread-times-multiplier construction (the treatment of the multiplier itself across the two periods is detailed in Section 3.2 below).

This measure lends itself to a clear interpretation. A high convenience yield indicates a strong premium attached to the safety and liquidity of Treasuries, and therefore a larger implicit borrowing-cost subsidy enjoyed by the U.S. government. A low convenience yield indicates a weaker premium and a diminished subsidy (Jiang et al., 2024; Krishnamurthy & Vissing-Jorgensen, 2012). A persistently low convenience yield would thus constitute evidence consistent with a weakening of the exorbitant privilege.

On its own, however, a low reading over the five years of the extension would not establish that this weakening reflects a lasting shift rather than a transient cyclical episode: the historical series itself contains earlier periods of comparably low convenience yield that later reverted. Distinguishing a lasting shift from a transient one therefore requires evidence beyond the level of the series alone. This is the purpose of the structural break analysis developed in

Section 4.2.1., which tests directly whether the 2021–2025 extension continues a regime already present earlier in the historical series or instead marks a break of its own.

3.2 Data and construction

The analysis combines the historical convenience yield series of Jiang et al. (2024) with an extension to the 2021–2025 period constructed from publicly available data. All series are sampled at annual frequency, using the December observation of each year, following the procedure adopted by Jiang et al. (2024).

The Treasury benchmark is the three-month Treasury bill secondary market rate (FRED series TB3MS). The private money-market rate, against which the Treasury yield is compared, is constructed from two sources over the extension period. For 2021–2023, it is the three-month certificate of deposit rate (FRED series IR3TCD01USM156N, sourced from the OECD), the same private instrument used by Jiang et al. (2024) for the post-1964 portion of their series. This series was discontinued in December 2023 and is therefore unavailable for 2024 onward. For 2024 and 2025, it is replaced by the 90-day AA financial commercial paper rate (FRED series CPF3M, published by the Federal Reserve Board). Conceptually, the certificate of deposit is a time deposit issued by a bank, while commercial paper is a short-term, unsecured debt security issued by a high-quality financial institution, but both instruments measure the same underlying quantity: the short-term funding cost of a high-quality private issuer[2]. This substitution follows the same logic adopted by Jiang et al. (2024), who, before 1964, replaced the certificate of deposit rate by the banker's acceptance rate, two distinct instruments measuring the same underlying concept. The comparability of the two instruments is not discussed further in the article. The present substitution is the

[2] Certificates of deposit and commercial paper differ in legal claim structure. A CD is a bank deposit liability; U.S. law grants depositors' priority over general unsecured creditors in the event of a bank's insolvency, a preference added to the Federal Deposit Insurance Act by the Omnibus Budget Reconciliation Act of 1993 (Depositor preference, 1993) a protection that extends even to the uninsured portion of large deposits. CDs also carry FDIC insurance up to $250,000 per depositor per institution (Federal Deposit Insurance Corporation, n.d.) though the negotiable ("jumbo") CDs underlying this series are typically issued in denominations well above that threshold. Commercial paper, by contrast, is an unsecured debt security with no such priority or insurance. The commercial paper series used here is explicitly rated AA (Krishnamurthy & Vissing-Jorgensen, 2012); the certificate of deposit series is not disaggregated by credit rating in its source, though negotiable CDs of the denomination underlying this series are issued predominantly by large, highly rated depository institutions.

direct analogue: as the certificate of deposit series ends in 2023, it is continued with the commercial paper rate, in the same manner and for the same reason. The comparability of the two series is validated empirically over their full period of overlap, 1997–2023: the mean difference between the resulting convenience yields is small (0.045 percentage points) but statistically significant ($t = 2.76$, $p = 0.011$, $n = 27$), driven almost entirely by two episodes of acute credit-market stress, 2007–2008 and 2011. Within 2021–2023, the three years of the extension period for which both series can be directly compared, the two constructions are identical. Full annual data, test output, and discussion are reported in Annex 1 and 2. The endpoint of the extension, 2025, is the most recent full year for which the December observations of both required series are available. The variables and their roles are summarised in Table 1.

Table 1. Variables used in the construction of the convenience yield extension, 2021–2025.

Variable	Code	Source	Frequency	Period	Role
3-month Treasury bill rate	TB3MS	FRED/ Federal Reserve	Monthly	2021–2025	Safe public benchmark
3-month certificate of deposit rate	IR3TCD01USM156N	FRED/ OECD	Monthly	2021–2023	Private money-market rate
90-day AA commercial paper rate	CPF3M	FRED/ Federal Reserve	Monthly	2024-2025	Private money-market rate (substitute)
Convenience yield (spread and multiplier)	—	Jiang et al. (2024) replication files	Annual	1947–2020	Historical benchmark

Note: FRED and OECD series accessed via FRED (https://fred.stlouisfed.org)

The extension is constructed as follows. Monthly observations for each rate are obtained from FRED, and the December observation of each year is selected to match the annual convention of Jiang et al. (2024). For each year, the raw spread is computed as the private money-market rate minus the three-month Treasury bill rate, and the convenience yield is obtained by multiplying this spread by the maturity multiplier.

The maturity multiplier scales the short-term spread to reflect the maturity composition of outstanding Treasury debt, on the principle that the convenience yield is largest for the shortest maturities and declines as maturity lengthens. Following Jiang et al. (2024), each outstanding Treasury security is assigned a weight according to its remaining maturity: securities maturing within 90 days receive a weight of 1; those between 90 days and one year, 0.9; one to two years, 0.8; two to three years, 0.7; three to five years, 0.5; five to seven years, 0.3; seven to ten years, 0.1; and those beyond ten years, 0. This complete scheme is not reported in full in the published text of Jiang et al. (2024), which states only that bills maturing within one year earn the full convenience yield, one-year bonds 90%, two-year bonds 80%, and the convenience yield falls to zero by ten years; the full weighting scheme, and the resulting annual multiplier values used here, are obtained directly from the authors' publicly available replication package[3]. The multiplier for a given period is the market-capitalisation-weighted average of these individual weights across all outstanding securities, yielding a single value between 0 and 1. The multiplier converts the raw spread, expressed as an annual percentage, into a convenience yield that is also expressed as an annual percentage but scaled to the maturity structure of the debt.

It should be emphasised that the maturity multiplier yields a single convenience yield series, not a family of series by maturity. Maturity enters only in the construction of the multiplier itself, through the weights assigned to securities of different remaining maturities; these weights are then aggregated into one value per year. The sensitivity analysis described below therefore concerns the aggregate value of this multiplier, which is varied across the 0.54–0.57 range observed over 2016–2020, and not the underlying maturity weights, which follow the fixed scheme of Jiang et al. (2024). The exercise establishes whether the post-2020 result is sensitive to the assumed level of the aggregate multiplier.

[3] Replication package: Jiang, Z., Lustig, H., Van Nieuwerburgh, S., & Xiaolan, M. Z. (2024). Replication data for "The U.S. Public Debt Valuation Puzzle" [Data set]. Zenodo. https://doi.org/10.5281/zenodo.11088633

Because the security-level CRSP data required to recompute the multiplier are not publicly available for the post-2020 period, it cannot be recalculated for 2021–2025. A data request was submitted to CRSP, but no response was received. The multiplier is instead held fixed at 0.55, the average of the values reported in the Jiang et al. (2024) replication data over the final five years of their sample (2016–2020), during which it remained within a narrow band of 0.54 to 0.57.

In all other respects (the spread, the annual December-based frequency, and the application of the maturity multiplier) the extension is constructed identically to the historical series. The two parts of the sample therefore differ only in that the multiplier is computed endogenously by Jiang et al. (2024) for 1947–2020 and held fixed at 0.55 for 2021–2025.

The full series therefore combines three distinct private instruments over its history: the banker's acceptance rate before 1964, the certificate of deposit rate from 1964 to 2023 (the same instrument throughout both the historical series and the first part of this dissertation's extension) and the commercial paper rate from 2024 onward. The first transition, from banker's acceptance to certificates of deposit, reflects the fact that a liquid, negotiable market for certificates of deposit did not exist before 1961 and only became the dominant private money-market instrument by 1964. Jiang et al. (2024) do not provide a further comparability discussion for this transition. The second transition, from certificates of deposit to commercial paper, is the one introduced in this dissertation and is validated empirically above over the longest period for which both series are available (1997–2023), which is, in effect, the backward extension of the commercial paper series as far as the data allow.

4. Results and discussion

This chapter applies the empirical strategy set out in Section 3 to the 2021–2025 period and examines the resulting convenience yield in relation to its long-run historical behaviour. It first presents the extended series as a whole (Section 4.1), then examines its behaviour across distinct historical periods, including a formal test of whether the post-2020 observations mark a new departure or continue a regime identified earlier in the series (Section 4.2), reports the robustness of this analysis (Section 4.3), and finally discusses what the findings imply for the fiscal relief afforded by the safe-asset status of U.S. Treasuries and, through it, for the research question (Section 4.4).

4.1 The convenience yield, 1947–2025

Figure 1 presents the convenience yield on U.S. Treasury securities over the full period, combining the historical series of Jiang et al. (2024) for 1947–2020 with this dissertation's extension constructed here for 2021–2025. The construction of the 2021–2025 extension, summarised in Table 2, is presented first, before the full series is shown in Figure 1.

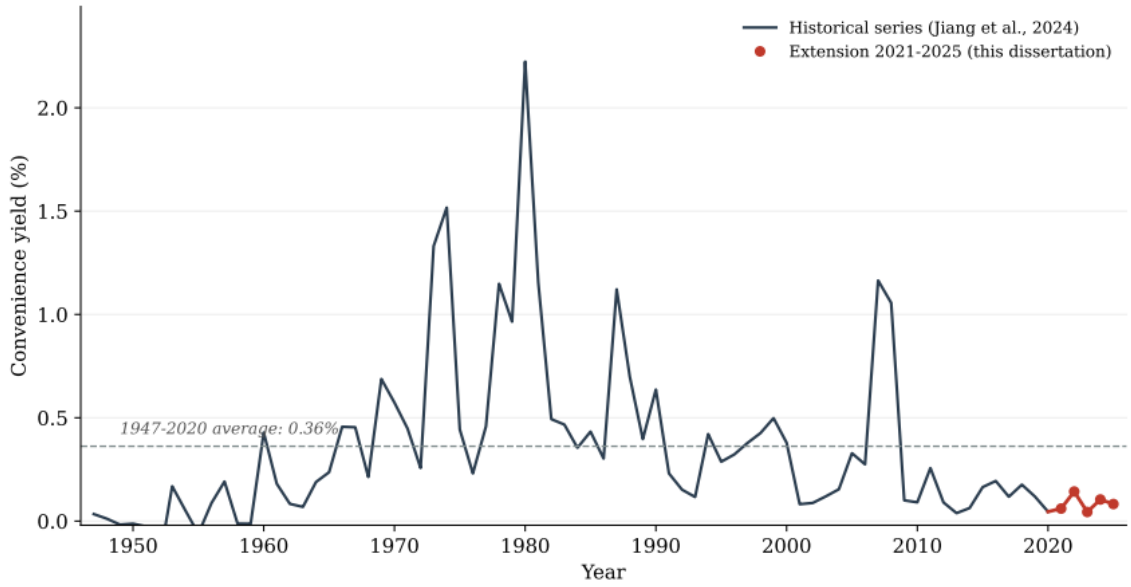
Table 2. The convenience yield on U.S. Treasury securities, 2021–2025.

Year	Private rate (%)	Instrument	TB3MS (%)	Spread (%)	Multiplier	Convenience yield (%)
2021	0.17	CD	0.06	0.110	0.55	0.061
2022	4.51	CD	4.25	0.260	0.55	0.143
2023	5.32	CD	5.24	0.080	0.55	0.044
2024	4.46	CP	4.27	0.190	0.55	0.105
2025	3.74	CP	3.59	0.150	0.55	0.083
Average				**0.158**		**0.087**

Note: Instrument denotes the private money-market rate used for that year (CD = certificate of deposit; CP = commercial paper, both AA-rated); TB3MS is the 3-month Treasury bill secondary market rate; Spread is the private rate minus TB3MS; Multiplier is the maturity-adjustment factor described in Section 3.2; Convenience yield is the spread multiplied by the maturity multiplier.

Source: Own calculations based on the replication data of Jiang et al. (2024) for 1947–2020 and FRED data for 2021–2025.

These values are combined with the historical series of Jiang et al. (2024) to produce the full 1947–2025 series shown in Figure 1.



Source: Own calculations based on the replication data of Jiang et al. (2024) for 1947–2020 and FRED data for 2021–2025.

Figure 1. The convenience yield on U.S. Treasury securities, 1947–2025.

Over the historical period, the convenience yield averages 0.36% per year, but this average conceals substantial variation. The series rises to a peak of 2.22% in 1980, amid the Volcker disinflation, and reaches a secondary peak of 1.16% in 2007, in the early stages of the financial crisis. Both episodes reflect an intensified demand for the safety and liquidity of Treasuries. Between these peaks, the convenience yield fluctuates within a lower range, occasionally approaching or falling below zero.

Part of this pattern reflects a data construction issue rather than market conditions. Treasury yields were administered under the Federal Reserve's wartime interest-rate peg until the Treasury-Fed Accord of March 1951, after which market-determined rates resumed (Romero, 2013). Even after the Accord, however, the convenience yield remained low throughout the 1950s, reaching a trough around 1959–1960. A more moderate decline also occurs in 1993 and in 2001–2003, in the aftermath of the 1990–91 and 2001 recessions respectively (National Bureau of Economic Research, n.d.), and during periods of exceptionally accommodative monetary policy. Unlike the wartime peg period, all these later troughs reflect market-determined yields on both sides of the spread, just as in the rest of the series, so the comparison is not distorted by a change in how the underlying data are

constructed. And, unlike the pattern examined below for the post-2009 period, they all proved transient, with the convenience yield reverting within one to three years.

The post-2021 observations, by contrast, fluctuate narrowly between 0.04% and 0.14%, remaining well below the 1947–2020 historical average throughout. This level is not, on its own, unprecedented: it is comparable to that observed through much of the period following the 2008 financial crisis, rather than marking an abrupt departure specific to 2021–2025. Whether this reflects the continuation of a regime already established after 2008–2009, as opposed to a new and distinct decline, is the question addressed formally in Section 4.2.

4.2 The persistence of the post-2009 compression

The extension of the convenience yield series to 2021–2025 is an original contribution of this dissertation, allowing the post-2020 period to be assessed within the long-run series for the first time. The annual values are reported in Table 2, averaging 0.087% over the five years, roughly one quarter of the 1947–2020 historical average of 0.36%. This level is not, however, distinctive relative to the years immediately preceding it: the average over 2009–2019 is 0.128%, and a formal test of equality of means between the two sub-periods does not reject the hypothesis that they are the same (Section 4.2.1.). The extension is therefore better understood as continuing an existing pattern than as marking a new departure.

Two features of this result deserve emphasis. First, the compression is not driven by a single anomalous year within the extension. Every observation in the 2021–2025 window lies well below the 1947–2020 historical average, as does every year in the preceding decade back to 2009 (Section 4.2.1.). The low level of the convenience yield is thus a feature of the post-2009 period as a whole, not a development specific to the years added by this dissertation.

Second, this persistence is notable because of the conditions under which it occurred. As established in Section 2.2, Krishnamurthy and Vissing-Jorgensen (2012) document two distinct mechanisms through which the convenience yield responds to changing conditions. The first is a supply channel: the convenience yield is inversely related to the supply of Treasury debt. The second is a flight-to-safety channel: it amplifies during episodes of acute financial stress, as the flight-to-safety motive strengthens. A complementary channel, documented by Nagel (2016), relates the liquidity component of the convenience yield to the level of the monetary policy rate. Holding cash earns no interest. As the policy rate rises, the interest income given up by holding cash rather than an interest-bearing asset also rises.

Investors therefore become more willing to accept a lower yield on assets that are almost as liquid as cash but still bear some interest, such as short-term Treasuries. This raises the demand for Treasury debt specifically as a money substitute, which in turn raises the convenience yield. Because liquidity constitutes the larger share of the convenience yield (Krishnamurthy & Vissing-Jorgensen, 2012), this channel may underlie the sharp rise of the convenience yield during the Volcker disinflation of 1980. The flight-to-safety channel is modelled explicitly by Caballero et al. (2008). Their framework of collective risk management during periods of systemic uncertainty is consistent with the sharp increase in the convenience yield during 2008. This mechanism operated despite contemporaneous monetary easing.

Both channels may have been individually present within the 2021–2025 extension. This allows a more precise illustration than a comparison of period averages affords.

The 2022 tightening cycle was the fastest pace of interest rate increases since the Federal Open Market Committee began targeting the federal funds rate in 1982 (Henry et al., 2023). It coincides with the highest convenience yield of the five-year window (0.14%). This is directionally consistent with the liquidity-premium mechanism documented by Nagel (2016), though modest in scale relative to the 1980 episode.

The failures of Silicon Valley Bank and Signature Bank, and the distressed acquisition of Credit Suisse in March 2023 (Basel Committee on Banking Supervision, 2023), provide a cleaner illustration of the flight-to-safety channel. Although Credit Suisse is not a U.S. institution, banking-sector distress of this kind typically triggers a global flight to safety into U.S. Treasuries, regardless of where the distressed institution is domiciled. On the pattern of 2008, this episode of acute financial-sector distress would therefore be expected to produce a comparable increase in the convenience yield.

Instead, the value recorded at the end of 2023, the closest annual observation to this episode, is the lowest of the entire extension period (0.04%). This suggests that the flight-to-safety mechanism did not operate as expected during this episode. The divergence should, however, be read with a caveat: the series uses December observations only, so a transitory increase around the crisis itself, followed by reversion before year-end, would not be captured.

This muted, and in one case absent, response to conditions historically associated with a rising convenience yield is not without precedent in the literature, although this is the first

time it appears in this dissertation's own series. He et al. (2022) document that during the acute phase of the COVID-19 shock in March 2020, Treasury yields rose relative to overnight-index swap rates. This is the opposite of what the classical flight-to-safety pattern observed in 2008 would predict, which is a fall in yields. They attribute this reversal to dealer balance-sheet constraints limiting the market's capacity to absorb the flight into Treasuries. The present finding extends this pattern beyond a single acute episode: within the 2021–2025 extension, the convenience yield responded only modestly to the 2022 tightening cycle and not at all to the acute financial-sector stress of March 2023, against a backdrop in which it has remained low relative to the pre-2009 historical record throughout.

This combination, a persistent compression since 2009, and its resistance to two distinct, historically grounded, and individually observable mechanisms within the extension period, is the empirical basis for the interpretation developed in the remainder of this chapter.

4.2.1. Structural break analysis

To assess whether the post-2020 observations represent a distinct decline or the continuation of an earlier shift in regime, the convenience yield series is subjected to four complementary tests of structural stability.

The first is a Quandt-Andrews unknown breakpoint test (Andrews, 1993; Quandt, 1960). Unlike a test performed at a single, researcher-specified date, this test searches over a wide range of candidate break dates and identifies the one that maximises the statistical evidence of a shift in the series' mean, avoiding the risk that the break date is chosen to fit a predetermined conclusion. The test is applied to the sample restricted to 1990–2025, a period chosen to isolate the modern era of U.S. monetary policy from the pronounced secular rise in the convenience yield that characterised the early post-war decades; applying the test to the full 1947–2025 sample instead identifies that earlier, much larger shift, rather than any change specific to the recent period. Within the restricted sample, the test identifies 2009 as the most likely breakpoint (Maximum LR F-statistic = 12.70, p = 0.0075; probabilities calculated using Hansen's method, (Hansen, 1997)). Full test output is reported in Annex 3.

The second and third are Chow breakpoint tests (Chow, 1960), which serve a different purpose: rather than searching for the most likely break date, they test directly whether the mean of the series differs significantly before and after a specified date, allowing the strength of the break to be evaluated precisely at the two dates most relevant to this dissertation's

narrative. Applied separately in 2008 and 2009, the break is considerably stronger at 2009 ($F = 12.70$, $p = 0.0011$) than at 2008 ($F = 4.55$, $p = 0.040$), consistent with 2008 marking the acute phase of the financial crisis and 2009 marking the point at which the convenience yield settled into its subsequent, persistently lower range. Full test output is reported in Annexes 4 and 5.

The fourth test addresses a different question: given that a break exists, are the 2021–2025 observations statistically distinguishable from the rest of the post-break period, or do they belong to the same regime? A test of equality of means between the 2009–2019 and 2021–2025 sub-periods (Satterthwaite–Welch t-test, (Satterthwaite, 1946; Welch, 1947))to unequal variances and sample sizes) fails to reject the null hypothesis of equal means ($t = 1.72$, $p = 0.111$). Full test output is reported in Annex 6.

Taken together, these four tests support a consistent conclusion: the convenience yield underwent a genuine structural break, most likely in 2009, rather than in the more recent period this dissertation extends; and the 2021–2025 observations are statistically indistinguishable from the rest of the post-2009 regime, consistent with the 2021–2025 observations continuing that regime rather than constituting a further, distinct decline. This conclusion should be read with the caution warranted by the small size of the most recent sub-sample ($n = 5$), which limits the statistical power of the fourth test.

4.3. Discussion

The empirical finding of this dissertation is that the convenience yield on U.S. Treasuries has remained compressed throughout the 2021–2025 period examined here, at a level comparable to that observed since the 2008–2009 financial crisis, and has not responded to two of the specific, historically grounded conditions under which the literature would predict an increase, on the basis of what we know from the literature. This section interprets this finding in light of the framework developed in Chapter 2 and considers what it implies for the research question: the extent to which the safe-asset status of U.S. public debt mitigates, or merely postpones, the fiscal constraints implied by the new Triffin dilemma.

The interpretation follows from the mechanism established in Section 2.2. The convenience yield is the channel through which the exorbitant privilege operates fiscally. Because investors accept a lower yield on Treasuries than on comparable private instruments in exchange for their safety and liquidity, the government's effective borrowing cost is lower

than fiscal fundamentals alone would command, an implicit subsidy that grows with the size of the convenience yield. Since 2009, this subsidy has remained close to a quarter of its 1947–2020 historical average, and the extension constructed here shows no sign of its recovery through 2025.

This interpretation applies specifically to the post-2009 period, and not to the earlier episodes of comparably low convenience yield discussed in Section 4.1. The immediate postwar trough reflects administered, rather than market-determined, Treasury yields, and bears no relation to the supply-demand dynamics of safe assets central to the framework developed in Chapter 2. The troughs of 1993 and 2001–2003 coincide with cyclical monetary easing and proved transient, unconnected to the debt-sustainability concerns central to the new Triffin dilemma. The post-2009 period is distinctive not only because of its duration, established in Section 4.1, but also because it coincides precisely with the conditions that the literature associates with a weakening, rather than a strengthening, of the privilege.

The absence of an increase in the convenience yield that one might have expected during the 2022 tightening cycle, and the March 2023 banking crisis admits several complementary explanations. These explanations are all consistent with the safe-asset literature reviewed in Chapter 2. Given the length of the sample available here, none of them can be separated from the others.

The first concerns the supply of safe assets. Caballero et al. (2017) argue that the global supply of safe assets has structurally failed to keep pace with demand. The corollary of this argument, established directly by Krishnamurthy and Vissing-Jorgensen (2012), is that the convenience yield is inversely related to Treasury supply specifically: a larger stock of outstanding Treasuries lowers the convenience yield, all else equal, because it makes safety and liquidity less scarce. The stock of outstanding U.S. debt has continued to grow relative to the economy since 2009. As a result, the same increase in the demand for safety now must be absorbed by a much larger pool of Treasuries than it would have before 2009, so it moves the convenience yield by less than an equivalent demand shock would have moved it in earlier decades.

The second concerns the composition of foreign demand. China's holdings of U.S. Treasury securities have declined by roughly half since their 2013 peak. This reduction has been accompanied by sustained increases in gold reserves, consistent with a structural shift in

reserve composition (U.S. Department of the Treasury). A reduction in a historically reliable source of demand works against any price effect that a stress-driven increase in demand from other investors would otherwise produce.

The third concerns the market's own assessment of Treasury credit risk. All three major credit rating agencies downgraded U.S. sovereign debt from its highest rating for the first time in the nation's history during the period considered here or the years immediately preceding it: S&P in 2011, Fitch in 2023, and Moody's in 2025. If the safety of Treasuries is itself increasingly qualified, the premium investors are willing to forgo for that safety would be expected to narrow independently of the other channels.

A fourth possibility is that the mechanisms identified in Chapter 2 have themselves weakened. This is consistent with a growing body of recent literature documenting a diminishing convenience yield on Treasuries since the global financial crisis (Du et al., 2023; Klingler & Sundaresan, 2023).

Distinguishing the relative contribution of each channel would require a reduced-form analysis relating the convenience yield to measures of debt supply, foreign holdings, and credit risk perception over a longer sample than the one available here. This is beyond the scope of the present study and is left for future research.

Returning to the research question that motivates this dissertation, the evidence assembled here speaks most directly to the distinction, developed in Section 2.3, between the mitigation of the fiscal constraints implied by the new Triffin dilemma and their postponement. It does not resolve that question definitively.

The persistence of a compressed convenience yield since 2009 is one part of the evidence. Its resistance to the two mechanisms historically capable of restoring it is another. So is the plausibility of several concurrent, literature-grounded explanations for that resistance. Together, these indicate that the safe-asset status of U.S. public debt continues to mitigate the fiscal constraints implied by the new Triffin dilemma but does so to a markedly smaller degree than the pre-2009 historical record would suggest.

The underlying tension between the expanding supply of U.S. liabilities and the demand willing to hold them at a premium persists: the dollar's reserve status has mitigated it but has not eliminated it. This is consistent with postponement of that tension rather than its

resolution. On the basis of the findings of this chapter, the margin by which that status has cushioned the fiscal cost of U.S. debt appears to be narrowing.

These conclusions must be stated with appropriate caution. The extension constructed here covers only five annual observations. The structural break analysis in Section 4.2.1 identifies 2009 as a statistically distinct regime change, using the full historical series. However, no comparable test is available to determine whether the convenience yield will remain at this compressed level, decline further, or partially reverse in the years beyond 2025. This could depend, for instance, on whether foreign official demand stabilises or the growth of outstanding Treasury debt slows relative to the economy.

The convenience yield is, moreover, an indirect measure. Its persistence at a low level is consistent with a weakening of the exorbitant privilege. On its own, however, it does not establish which of the four channels discussed above is responsible. Nor does it establish whether the underlying safe-asset status of U.S. Treasuries has been structurally impaired, rather than merely priced more cautiously. What the evidence in this dissertation establishes is narrower but not trivial. The fiscal subsidy afforded by Treasury convenience, measured consistently over nearly eight decades, has remained at historically low levels since 2009. It did not display the increases that two distinct, historically grounded mechanisms would have predicted during the extension period.

Whether this compressed level persists, deepens, or is reversed by a future shift in the supply of, or demand for, U.S. safe assets is a question that only a longer sample beyond 2025 will resolve. The series constructed here is designed to address that question as the sample extends.

4.4. Robustness

Because the central finding rests on a small number of methodological choices, its robustness depends on establishing that it does not hinge on any single one of them. Five robustness exercises are therefore designed.

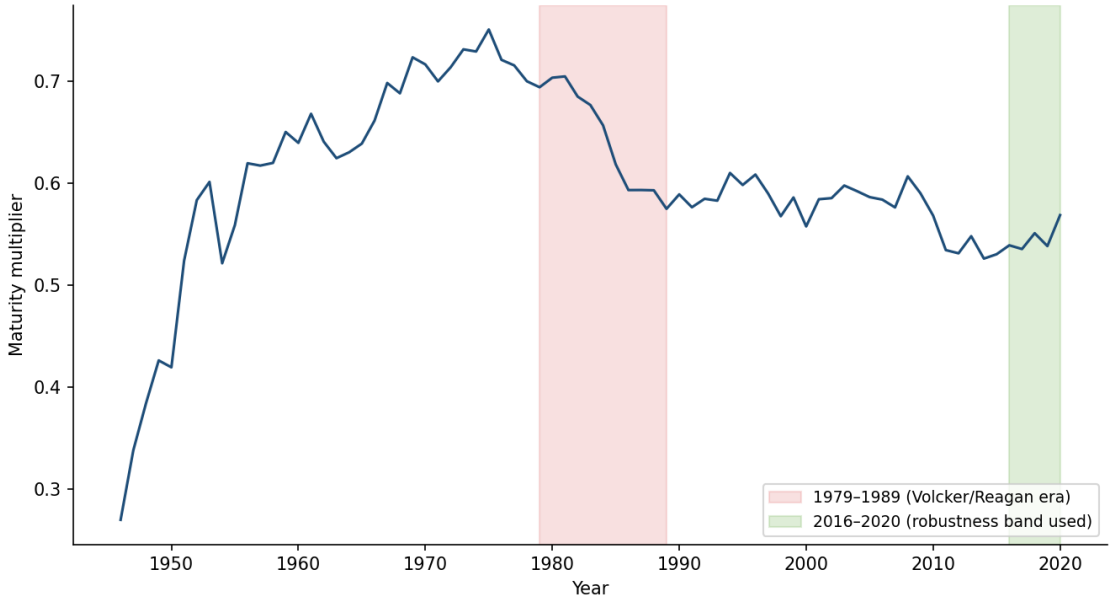
4.4.1. Sensitivity to the Maturity Multiplier

Because the security-level data required to recompute the maturity multiplier endogenously are not available for the extension period, the multiplier is held fixed at 0.55 throughout 2021–2025. This test assesses whether that assumption drives the central finding, by

recomputing the convenience yield under alternative values drawn from the historical record rather than from the fixed baseline.

Three scenarios are considered, chosen to represent increasingly demanding tests of the baseline assumption. The first uses the full range observed over 2016–2020 (0.54–0.57), the period from which the fixed value of 0.55 is itself derived. The second uses the range observed over 2009–2019 (0.526–0.590), the period identified in Section 4.2.1. as the relevant post-break comparison window, testing whether extending the reference period further back changes the conclusion. The third, and most demanding, uses the range observed during the Volcker/Reagan era (1979–1989, 0.575–0.705), a period combining contractionary monetary policy under Federal Reserve Chairman Paul Volcker with expansionary fiscal policy under President Reagan, commonly characterised as a "tight money, loose fiscal" policy mix (Blinder, 2022). This mix is broadly comparable to the environment following the 2022 tightening cycle, though not to the expansionary monetary stance of 2020–2021 that preceded it, and the resulting multiplier range is considerably more disparate from the recent values than either of the other two ranges. This last comparison directly addresses the concern that the 2016–2020 range, being drawn from the years immediately preceding the extension, may understate the true range of plausible multiplier values.

Table 3 and Figure 2 report the results of this exercise. The evolution of the multiplier over the full 1946–2020 period, including the three periods used in this exercise, is shown in Figure 2. The figure makes clear that the 2016–2020 range from which the fixed baseline of 0.55 is drawn sits toward the lower end of the multiplier's historical distribution: the multiplier reached values as low as 0.27 in the immediate postwar period, when outstanding debt was concentrated in long-dated war bonds, and as high as 0.75 in 1975, but has occupied a comparatively narrow and stable band, roughly 0.53 to 0.57, since around 2011. The Volcker/Reagan era stands out visually as the most recent period in which the multiplier was both considerably higher and more volatile than in the years immediately preceding this dissertation's extension, which is precisely what makes it a demanding robustness check rather than an arbitrary comparison.



Source: Own calculations based on the replication data of Jiang et al. (2024).

Figure 2. Evolution of the maturity multiplier, 1946–2020.

Table 3 reports the resulting convenience yield under each scenario. Recomputing the 2021–2025 average under the three alternative assumptions never increases the estimated decline beyond the fixed baseline of 76.0%; if anything, every alternative assumption produces a smaller decline. Under the 2016–2020 multiplier range, the average shifts only slightly, to 0.085%–0.090% (a decline of 75.1%–76.4%). Under the 2009–2019 multiplier range, the shift is similarly small, to 0.083%–0.093% (74.2%–77.0%). The Volcker/Reagan scenario produces the largest movement away from the baseline, raising the 2021–2025 average to between 0.091% and 0.111%, a decline of 69.2%–74.9% relative to the 1947–2020 historical average of 0.362%. Even the most demanding alternative, the Volcker/Reagan scenario, produces a smaller decline than the fixed baseline itself: 74.9% at most, against 76.0% for the baseline. The central conclusion of a substantial and persistent compression therefore does not depend on the specific value chosen for the fixed multiplier. None of the three alternative values tested come close to making the decline disappear.

Table 3. Convenience yield under alternative maturity multiplier assumptions, 2021–2025.

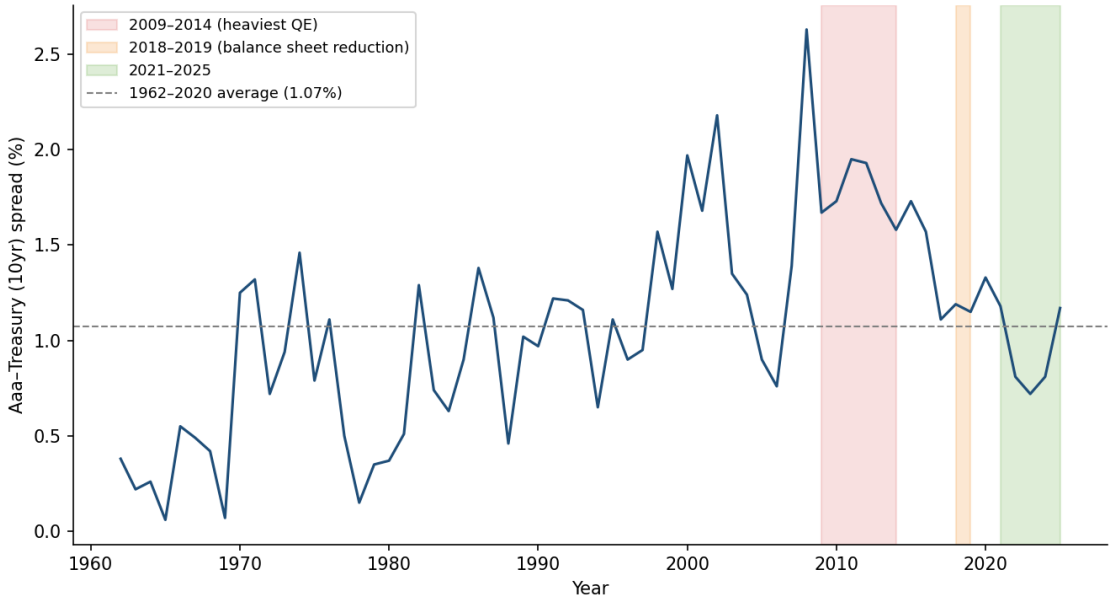
Multiplier scenario	CY 2021–2025	Decline vs. 0.362%
Fixed at 0.55 (baseline)	0.087%	76.0%
0.54–0.57 (2016–2020)	0.085%–0.090%	75.1%–76.4%
0.526–0.590 (2009–2019)	0.083%–0.093%	74.2%–77.0%
0.575–0.705 (Volcker/Reagan)	0.091%–0.111%	69.2%–74.9%

Source: Own calculations, based on the maturity-multiplier ranges reported in the replication data of Jiang et al. (2024).

4.4.2. An Alternative Measure of the Convenience Yield

This exercise checks whether an independent way of measuring the convenience yield points to the same conclusion. Rather than varying an assumption within the baseline construction, as in the previous two exercises, this test uses an entirely alternative measure, built from a different market segment, a different maturity, and a different methodology. Agreement between the two measures, despite these differences, would provide stronger evidence of robustness than a check that only varies a single assumption within the same construction.

Following the approach of Krishnamurthy and Vissing-Jorgensen (2012), in this section we proxy the convenience yield as the spread between yields on Aaa-rated corporate bonds and 10-year Treasuries. Because the convenience yield is expected to diminish with maturity (Section 3.1), the level of this measure is not comparable to the short-term baseline series; what can be compared, using this measure alone, is whether it too has declined over time. This comparison is complicated by a distortion the short-term baseline measure is not subject to: the Federal Reserve's large-scale asset purchases during 2009–2014 and 2020–2022 may have affected long-term Treasury yields (Gagnon et al., 2010). The evolution of this spread over 1962–2025 is shown in Figure 3.



Source: Own calculations, based on Moody's Seasoned Aaa Corporate Bond Yield (FRED series AAA) and the Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity (FRED series DGS10 or GS10), Board of Governors of the Federal Reserve System.

Figure 3. The Aaa corporate bond–10-year Treasury spread, 1962–2025.

Assessed over the full historical period, the direction of this measure agrees with the baseline finding: the spread averages 1.07% over 1962–2020 and 0.94% over 2021–2025. A breakdown by sub-period, however, reveals a more complex pattern (Table 4). The spread averages 1.76% during 2009–2014, the years of the most intensive quantitative easing, falling to 1.35% over 2015–2019 and to 1.19% specifically during 2018, the one full calendar year within the Federal Reserve's first balance sheet reduction programme (October 2017 – August 2019; (Estenssoro & Kliesen, 2023)). Quantitative easing compresses long-term Treasury yields directly; since the spread is calculated relative to these yields, this mechanically widens the observed spread without necessarily reflecting any change in the underlying convenience yield itself (Gagnon et al., 2010). This is a different mechanism from the liquidity-premium channel discussed in Section 4.2, where a higher policy rate is linked to a genuinely higher convenience yield. The two operate through different channels. One reflecting investors' valuation of Treasuries as a liquid, money-like asset, which rises with the opportunity cost of holding cash. The other a supply effect on long-term yields that leaves that valuation unchanged, which is how they can point in opposite directions without contradiction.

The decline in the spread as the sample moves away from the years of heaviest quantitative easing is consistent with the QE effect accounting for a substantial part of the elevated spread earlier in the period. Even the least QE-affected comparison years, however, remain above the 2021–2025 average of 0.94%. Explaining this gap falls outside the scope of this dissertation, which is concerned with whether the convenience yield has declined, not with what determines its level.

Table 4. The Aaa–Treasury spread by monetary policy regime, 2009–2025.

Period	Aaa-Treasury Spread
2009-2014 (heaviest QE)	1.76%
2015-2019 (post-QE policy normalization)	1.35%
2018 (balance sheet reduction)	1.19%
2021-2025	0.94%

Source: Own calculations, based on Moody's Seasoned Aaa Corporate Bond Yield and the Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, Board of Governors of the Federal Reserve System.

This measure therefore offers only partial support for the baseline finding. Its long-run decline, from 1.07% to 0.94%, is consistent with the baseline result at the level of the full historical average. It cannot, however, serve as independent confirmation of the specific post-2009 regime identified in Section 4.2.1, because the quantitative easing distortion described above cannot be fully corrected for within this measure.

4.4.3. The Choice of Private Money-Market Instrument

The exercise in this section concerns the construction of the private money-market rate. Because the baseline series combines the certificate of deposit rate for 2021–2023 with the commercial paper rate for 2024–2025, it is important to verify that the result does not depend on this combination. The convenience yield is therefore recomputed using the commercial paper rate throughout the entire extension period (2021–2025), producing a series built from a single, consistent private instrument. This check is further extended back to 2009, recomputing the convenience yield with the commercial paper rate in place of the certificate of deposit rate used in the official Jiang et al. (2024) series for that period, allowing the sensitivity of the finding to this choice to be assessed over the same window used for the structural break analysis in Section 3.3.1.

Table 5 reports the results. Across the full 2009–2025 window, the average difference between the two constructions is small (−0.014 percentage points), with one notable exception: 2011 shows a substantially larger divergence (−0.166 percentage points). This coincides with the European sovereign debt crisis, during which U.S. money market funds with exposure to Eurozone banks experienced significant withdrawals between June and August 2011, with documented spillover effects on the financing costs of other, non-European issuers (Chernenko & Sunderam, 2012). This is consistent with the pattern established in Section 3.2, in which the two instruments diverge specifically during episodes of acute credit-market stress rather than under calm conditions. This confirms that the post-2009 finding is not sensitive to the choice between these two private instruments outside of such episodes and identifies the conditions under which caution would be warranted.

Table 5. Comparison of the baseline convenience yield series with a counterfactual series constructed using the commercial paper rate throughout, 2009–2025.

Year	Baseline (official series)	Commercial paper throughout	Difference
2009	0.100	0.089	-0.012
2010	0.091	0.074	-0.017
2011	**0.257**	**0.091**	**-0.166**
2012	0.090	0.053	-0.037
2013–2020	(identical, see note)	(identical)	0.000
2021	0.060	0.061	0.001
2022	0.140	0.143	0.003
2023	0.040	0.044	0.004
2024	0.100	0.105	0.005
2025	0.080	0.083	0.003

Note: 2013–2020 are omitted individually as the two constructions are identical to the nearest hundredth of a percentage point in each of those years; see Section 3.2 for discussion.

Source: Own calculations. The baseline (official series) combines the replication data of Jiang et al. (2024) for 2009–2020 with the extension constructed in this dissertation for 2021–2025. The commercial paper throughout series is a counterfactual recomputation using the 90-Day AA Financial Commercial Paper Interest Rate (CPF3M), Board of Governors of the Federal Reserve System, in place of the certificate of deposit rate for the entire 2009–2025 period.

4.4.4. The Choice of Historical Benchmark

This exercise concerns the choice of historical benchmark against which the post-2020 values are assessed. The baseline comparison is made against the 1947–2020 average, which preserves comparability with Jiang et al. (2024) but includes the elevated convenience yields of the 1970s and 1980s. Because the literature documents a secular decline in the convenience yield since the 1970s (Du et al., 2018), a benchmark computed over the full post-war period may overstate the extent of the recent compression relative to more comparable conditions: if the convenience yield had already been trending downward for decades before 2009, comparing 2021–2025 against a benchmark still anchored in the elevated 1970s and 1980s values would inflate the apparent decline, attributing to the post-2009 period a compression that partly reflects this longer-run trend instead.

The post-2020 values are therefore also compared against the average over 1990–2020 (0.28%), a period that already incorporates much of that secular decline. Measured against this more recent benchmark, the decline is approximately 69%, compared with 76% against the full 1947–2020 average. The main result is therefore not an artefact of comparison with the elevated convenience yields of the 1970s and 1980s: the post-2009 compression remains substantial even when assessed against a benchmark drawn from more comparable conditions. This descriptive comparison complements the structural break evidence presented in Section 4.2.1., which formally identifies the post-2009 period as a distinct regime rather than merely selecting an alternative benchmark window.

5. Conclusion

This dissertation asked to what extent the role of U.S. public debt as a global safe asset mitigates, or merely postpones, the fiscal constraints implied by the new Triffin dilemma. The answer it offers is qualified but clear. The safe-asset status of U.S. Treasuries continues to mitigate these constraints, through the borrowing-cost subsidy that the convenience yield measures directly.

Since 2009, however, this mitigation has been markedly smaller than the pre-2009 historical record would suggest. It has not strengthened again, even when conditions comparable to those that historically restored it recurred: aggressive monetary tightening in 2022, and acute financial-sector stress in March 2023.

The evidence is consistent with an interpretation of postponement rather than resolution. The tension between the growing supply of U.S. liabilities and the demand for U.S. safe assets, despite their relatively low yields, persists. The dollar's reserve status has mitigated this tension but has not eliminated it. Based on the findings developed in this dissertation, the margin by which that status cushions the fiscal cost of U.S. debt appears to be narrowing.

This answer rests on five findings, which together indicate that the compression is well established, persistent, and robust to how it is measured.

First, the convenience yield series extended here averages 0.087% over 2021–2025, roughly one quarter of its 1947–2020 historical average. A formally tested structural break, identified in the full historical series rather than in these five observations alone, locates the shift to this lower range in 2009, not 2020. A test of equality of means finds no statistically significant difference between the 2009–2019 and 2021–2025 averages. This extends and refines the finding of Jiang et al. (2024). Their series ends in 2020, so it could establish the 2009 break within their sample, but it could not test whether this compressed regime would persist beyond 2020 rather than reverse.

Second, this compression persisted despite two conditions the literature associates with a rising convenience yield: the 2022 monetary tightening cycle and the March 2023 banking-sector crisis. Of these, only the first produced even a modest increase. The second produced the lowest value of the entire extension, a reversal of the classical flight-to-safety pattern, consistent with the COVID-era finding of He et al. (2022) that this mechanism can fail to materialise during acute stress.

The remaining three findings show that this conclusion is robust to several methodological choices. Third, the finding of a persistent post-2009 compression is materially unchanged across three alternative assumptions for the maturity multiplier, including a range drawn from the historically disparate Volcker-Reagan era. Fourth, it does not depend on the specific private instrument used to construct the extension, nor on the historical benchmark selected for comparison. Fifth, an independent measure at the long end of the maturity spectrum offers directional, though only partial, corroboration, a qualification discussed further below.

These findings carry both theoretical and practical implications. Theoretically, they refine the framework of Krishnamurthy and Vissing-Jorgensen (2012) and the broader safe-asset literature. They show that two distinct macro-financial channels linking to the convenience yield, the level of the policy rate, and acute financial-sector stress, can be examined separately, even within a short and recent sample. They also extend the recent literature on diminishing Treasury convenience (Du et al., 2023; Klingler & Sundaresan, 2023) with a continuous, nearly eight-decade series rather than an isolated post-2020 snapshot. Furthermore, they lend empirical support to the concept of the new Triffin dilemma, by locating a specific, dateable point, 2009, at which the mechanism it describes appears to have begun operating with reduced force.

In practice, if the supply-based explanation considered in Chapter 4 is correct, the findings would carry a further implication for the debt-management calculus of the U.S. Treasury. A compressed convenience yield that reflects, at least in part, the growing scale of outstanding debt would suggest that the fiscal benefit of safe-asset status is not a stable background parameter in long-run debt sustainability planning. It would instead be a subsidy that varies with the scale and composition of issuance. This dissertation's findings are consistent with that possibility. They do not, however, establish it directly. The sample available here cannot separate this explanation from the other three discussed in Chapter 4.

For international reserve managers and policymakers, this dissertation's findings offer a more precise empirical anchor than the largely qualitative accounts that have so far dominated the debate over reserve diversification discussed in Chapter 2. The mitigating effect of dollar reserve status, these findings show, has narrowed without disappearing.

These conclusions must be qualified by several limitations inherent to the empirical strategy adopted. The extension covers only five annual observations. This is sufficient, in

combination with the full historical series, to support the structural break and equality-of-means tests on which the central conclusion rests. It is not sufficient, however, to test independently for a further break within 2021–2025, or to distinguish with confidence between a durable erosion and a temporary compression that may yet reverse. This dissertation addresses that limitation by grounding its central claim in the longer historical series, rather than in the extension alone.

The maturity multiplier is held fixed at 0.55 for lack of publicly available security-level data. The robustness analysis shows this affects the level of the estimate only marginally, including under considerably wider assumptions than recent historical experience. This limits, without eliminating, the practical consequence of this approximation.

The substitution of the certificate of deposit rate by the commercial paper rate for 2024–2025 is shown to introduce measurable divergence specifically during episodes of acute credit-market stress, such as 2011. It does not do so, however, under the calm conditions that prevailed during the period in which the substitution is applied. The implications this may pose for the baseline finding are therefore assessed as low, though not zero. The annual, December-based convention inherited from Jiang et al. (2024) may understate the series' responsiveness to short-lived episodes. A transitory increase around a crisis such as March 2023, followed by reversion before year-end, would not be captured. This dissertation addresses that limitation only partially: it treats the absence of a detectable December response as suggestive, rather than as definitive evidence against a transitory reaction.

The independent, long-maturity measure used as a robustness check shows a sub-period pattern only partially explained by the distorting effect of quantitative easing on long-term Treasury yields. A residual divergence remains unaccounted for, even in the least QE-affected comparison years. This dissertation acknowledges this gap rather than resolving it.

Finally, and most fundamentally, the convenience yield is an indirect indicator. Its decline is consistent with a weakening of the exorbitant privilege. On its own, however, it cannot establish which of the several explanatory channels considered (safe-asset supply, foreign demand, credit risk perception, or a weakening of the underlying mechanism) is responsible. This dissertation was never designed to adjudicate between these channels or to test them individually. Its aim, instead, is to assess whether each channel is consistent with how the convenience yield has behaved under the specific circumstances examined here. The

channels are therefore presented throughout as complementary possibilities, not as competing claims resolved by the evidence available.

These limitations point directly to four extensions of this work. The most immediate is access to security-level CRSP data, requested, but not obtained, in the course of this research. Such access would allow the maturity multiplier to be recomputed endogenously for 2021–2025, removing the principal approximation underlying the extension.

Second, a reduced-form analysis relating the convenience yield to measures of Treasury debt supply, foreign official holdings, and sovereign credit risk perception, over a longer sample than the one available here, would allow the relative contributions of the explanatory channels discussed above to be assessed empirically. At present, these channels are treated as complementary possibilities whose contributions cannot be separately identified.

Third, and most substantially, a complete replication of the dynamic fiscal-backing framework of Jiang et al. (2024) and Chen et al. (2025) through 2025, incorporating the convenience yield estimated here, would link its decline directly to the evolution of the fiscal capacity it sustains. This would offer a more complete characterisation of the exorbitant privilege than the present analysis permits.

Fourth, and only as time passes, further annual observations will accumulate beyond 2025. The framework and series developed here are designed to accommodate them. In due course, a longer post-2020 sample will allow the stability of the post-2009 regime to be tested directly within the extension period, rather than inferred from its consistency with the broader historical series.

This dissertation set out from the same starting point as its opening chapter: that the exorbitant privilege the United States derives from the dollar's role as the dominant global reserve currency allows it to finance persistent external and fiscal deficits under conditions that differ from those faced by other sovereign issuers. At the outset of this research, whether this privilege had changed since 2020 remained undocumented. It concludes with a more precise finding. The fiscal relief this privilege affords has been substantially and persistently diminished since 2009 and it did not recover under the sharpest tests the recent period could offer. Whether this diminished privilege represents a durable feature of the international

monetary system or a passing episode within it remains an open question, one that the series constructed here is designed to help answer as the evidence continues to accumulate.

6. References

Abel, A. B., Mankiw, N. G., Summers, L. H., & Zeckhauser, R. J. (1989). Assessing dynamic efficiency: Theory and evidence. *The Review of Economic Studies*, *56*(1), 1-19. https://doi.org/10.3386/w2097

Adler, G., & Garcia-Macia, D. (2018). *The Stabilizing Role of Net Foreign Asset Returns* (IMF Working Paper No. 18/79). https://doi.org/10.5089/9781484349922.001

Afonso, A., & Jalles, J. T. (2013). Growth and productivity: The role of government debt. *International Review of Economics & Finance*, *25*, 384-407. https://doi.org/10.1016/j.iref.2012.07.004

Alesina, A., & Ardagna, S. (2009). Large Changes in Fiscal Policy: Taxes Versus Spending. *Tax Policy and the Economy*, *24*. https://doi.org/10.2139/ssrn.1502862

Andrews, D. (1993). Tests for Parameter Instability and Structural Change With Unknown Change Point. *Econometrica*, *61*(4), 821-856. https://doi.org/10.2307/2951764

Ardagna, S., Caselli, F., & Lane, T. (2007). Fiscal Discipline and the Cost of Public Debt Service: Some Estimates for OECD Countries. *Topics in Macroeconomics*, *7*, 1417-1417. https://doi.org/10.2202/1935-1690.1417

Ash, M., Basu, D., & Dube, A. (2017). *Public debt and growth: An assessment of key findings on causality and thresholds* (UMASS Amherst Economics Working Paper No. 2017-10). https://ideas.repec.org/p/ums/papers/2017-10.html

Atkeson, A., Heathcote, J., & Perri, F. (2025). The end of privilege: A reexamination of the net foreign asset position of the united states. *American Economic Review*, *115*(7), 2151-2206. https://doi.org/10.1257/aer.20230732

Basel Committee on Banking Supervision. (2023). *Report on the 2023 Banking Turmoil*. B. f. I. Settlements. https://www.bis.org/bcbs/publ/d555.pdf

Baum, A., Checherita-Westphal, C., & Rother, P. (2013). Debt and growth: New evidence for the euro area. *Journal of International Money and Finance*, *32*, 809-821. https://doi.org/10.1016/j.jimonfin.2012.07.004

Bentour, E. M. (2021). On the public debt and growth threshold: one size does not necessarily fit all. *Applied Economics*, *53*(11), 1280-1299. https://doi.org/10.1080/00036846.2020.1828806

Bernanke, B. (2005). *The global saving glut and the U.S. current account deficit* (Speech No. 77). https://EconPapers.repec.org/RePEc:fip:fedgsq:77

Bertaut, C. C., Curcuru, S. E., Faia, E., & Gourinchas, P.-O. (2024). *New evidence on the us excess return on foreign portfolios* (IMF Working Paper No. WP/24/241). https://doi.org/10.5089/9798400294921.001

Blanchard, O. (2019). Public Debt and Low Interest Rates. *American Economic Review*, *109*(4), 1197–1229. https://doi.org/10.1257/aer.109.4.1197

Blinder, A. (2022). A Monetary and Fiscal History of the United States, 1961–2021. *Princeton University Press*. https://press.princeton.edu/books/hardcover/9780691238388/a-monetary-and-fiscal-history-of-the-united-states-1961-2021

Bohn, H. (1998). The Behavior of U.S. Public Debt and Deficits. *The Quarterly Journal of Economics*, *113*(3), 949-963. http://www.jstor.org/stable/2586878

Bordo, M. D., & McCauley, R. N. (2019). Triffin: Dilemma or Myth? *IMF Economic Review*, *67*(4), 824-851. https://doi.org/10.1057/s41308-019-00088-y

Caballero, R., & Farhi, E. (2018). The safety trap. *The Review of Economic Studies*, *85*(1), 223-274. https://doi.org/10.1093/restud/rdx013

Caballero, R., Farhi, E., & Gourinchas, P.-O. (2016). Safe asset scarcity and aggregate demand. *American Economic Review*, *106*(5), 513-518. https://doi.org/10.1257/aer.p20161108

Caballero, R., Farhi, E., & Gourinchas, P.-O. (2017). The safe assets shortage conundrum. *Journal of Economic Perspectives*, *31*(3), 29-46. https://doi.org/10.1257/jep.31.3.29

Caballero, R. J., & Farhi, E. (2013). *A model of the safe asset mechanism (SAM): Safety traps and economic policy* (NBER Working Papers No. 18737). https://ideas.repec.org/p/nbr/nberwo/18737.html

Caballero, R. J., Farhi, E., & Gourinchas, P.-O. (2008). An Equilibrium Model of "Global Imbalances" and Low Interest Rates. *American Economic Review*, *98*(1), 358–393. https://doi.org/10.1257/aer.98.1.358

Caballero, R. J., & Krishnamurthy, A. (2009). Global Imbalances and Financial Fragility. *American Economic Review*, *99*(2), 584–588. https://doi.org/10.1257/aer.99.2.584

Cecchetti, S. G., Mohanty, M. S., & Zampolli, F. (2011). *The real effects of debt* (BIS Working Papers No. 352). https://www.bis.org/publ/work352.pdf

Checherita-Westphal, C., & Rother, P. (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area.

European Economic Review, *56*(7), 1392-1405. https://doi.org/10.1016/j.euroecorev.2012.06.007

Chen, Z., Jiang, Z., Lustig, H., Nieuwerburgh, S. V., & Xiaolan, M. Z. (2025). Exorbitant Privilege Gained and Lost: Fiscal Implications. *Journal of Political Economy*, *133*(12), 3713-3761. https://doi.org/10.1086/738149

Cheng, W., & Zhang, D. (2011). *The "Exorbitant Privilege": A Theoretical Exposition*. Monash University. http://aefweb.net/WorkingPapers/w435.pdf

Chernenko, S., & Sunderam, A. (2012). *The Quiet Run of 2011: Money Market Funds and the European Debt Crisis* (2012-04). https://ideas.repec.org/p/ecl/ohidic/2012-04.html

Chinn, M., & Frankel, J. (2008). Why the Euro Will Rival the Dollar. *International Finance*, *11*(1), 49-73. https://doi.org/10.1111/j.1468-2362.2008.00215.x

Chow, G. C. (1960). Tests of Equality Between Sets of Coefficients in Two Linear Regressions. *Econometrica*, *28*(3), 591-605. https://doi.org/10.2307/1910133

Congressional Budget Office. (2024). *The Long-Term Budget Outlook: 2024 to 2054*. https://www.cbo.gov/publication/59711

Curcuru, S. E., Dvorak, T., & Warnock, F. E. (2008). Cross-border returns differentials. *The Quarterly Journal of Economics*, *123*(4), 1495-1530. https://doi.org/10.1162/qjec.2008.123.4.1495

Dallas, C., & Scavone, T. J. (2024, November 21, 2024). *VantagePoint: Deconstructing U.S. Debt Dynamics*. https://www.cambridgeassociates.com/insight/vantagepoint-deconstructing-us-debt-dynamics/

DeLong, J. B., Summers, L. H., Feldstein, M., & Ramey, V. A. (2012). Fiscal policy in a depressed economy [with comments and discussion]. *Brookings papers on economic activity*, 233-297. https://www.brookings.edu/articles/fiscal-policy-in-a-depressed-economy/

Depositor preference U.S.C. § 1821(d)(11) (1993). https://www.law.cornell.edu/uscode/text/12/1821

Diamond, P. (1965). National debt in a neoclassical growth model. *American Economic Review*, *55*(5), 1126-1150.

Dooley, M. P., Folkerts-Landau, D., & Garber, P. M. (2003). *An essay on the revived Bretton Woods system* (NBER Working Papers No. 9971). https://doi.org/10.3386/w9971

Dooley, M. P., Folkerts-Landau, D., & Garber, P. M. (2022). *US sanctions reinforce the dollar's dominance* (29943). https://doi.org/10.3386/w29943

Dorrucci, E., & McKay, J. (2011). *The international monetary system after the financial crisis* (ECB Occasional Paper Series No. 123). https://ideas.repec.org/p/ecb/ecbops/2011123.html

Du, W., Hébert, B., & Li, W. (2023). Intermediary balance sheets and the treasury yield curve. *Journal of Financial Economics*, *150*(3), 103722. https://doi.org/10.1016/j.jfineco.2023.103722

Du, W., Im, J., & Schreger, J. (2018). The U.S. Treasury Premium. *Journal of International Economics*, *112*, 167-181. https://doi.org/10.1016/j.jinteco.2018.01.001

Eichengreen, B. (2012). *Exorbitant Privilege: The Rise and Fall of the Dollar and the Future of the International Monetary System*. Oxford University Press. https://ideas.repec.org/b/oxp/obooks/9780199642472.html

Eichengreen, B. (2016). Global monetary order In V. Constâncio & P. Hartmann (Eds.), *The future of the international monetary and financial architecture*. European Central Bank. https://www.ecb.europa.eu/press/conferences/ecbforum/shared/pdf/2016/eichengreen_paper.pdf

Elmendorf, D. W., & Mankiw, N. G. (1999). Government debt. In J. B. Taylor & M. Woodford (Eds.), *Handbook of macroeconomics* (Vol. 1, Part C, pp. 1615-1669). Elsevier. https://doi.org/10.1016/S1574-0048(99)10038-7

Estenssoro, A., & Kliesen, K. L. (2023, August 23, 2023). The Mechanics of Fed Balance Sheet Normalization. *Federal Reserve Bank of St. Louis, On the Economy*. https://www.stlouisfed.org/on-the-economy/2023/aug/the-mechanics-of-fed-balance-sheet-normalization

Farhi, E., Gourinchas, P.-O., & Rey, H. (Eds.). (2011). *Reforming the International Monetary System*. CEPR Press. https://cepr.org/publications/books-and-reports/reforming-international-monetary-system.

Farhi, E., & Maggiori, M. (2018). A model of the international monetary system. *The Quarterly Journal of Economics*, *133*(1), 295-355. https://doi.org/10.1093/qje/qjx031

Federal Deposit Insurance Corporation. *Deposit Insurance FAQs*. Federal Deposit Insurance Corporation. https://www.fdic.gov/resources/deposit-insurance/faq/

Fleming, J. M. (1962). Domestic Financial Policies Under Fixed and Under Floating Exchange Rates. *IMF Staff Papers*, *1962*(003), A004. https://doi.org/10.5089/9781451968873.024.A004

Gagnon, J., Raskin, M., Remache, J., & Sack, B. P. (2010). *Large-Scale Asset Purchases by the Federal Reserve: Did They Work?* (Staff Report No. 441). https://ssrn.com/abstract=1576596

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., & Qureshi, M. S. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. *The Economic Journal*, *123*(566), F4-F30. https://doi.org/10.1111/ecoj.12010

Gorton, G. (2017). The history and economics of safe assets. *Annual Review of Economics*, *9*, 547-586. https://doi.org/10.1146/annurev-economics-033017-125810

Gorton, G. B. (2010). *Slapped by the invisible hand: The panic of 2007*. Oxford University Press. https://dx.doi.org/10.2139/ssrn.1401882

Gourinchas, P.-O., & Rey, H. (2007a). From world banker to world venture capitalist: US external adjustment and the exorbitant privilege. In *G7 current account imbalances: sustainability and adjustment* (pp. 11-66). University of Chicago Press. https://doi.org/10.3386/w11563

Gourinchas, P.-O., & Rey, H. (2007b). International financial adjustment. *Journal of Political Economy*, *115*(4), 665-703. https://doi.org/10.1086/521966

Gourinchas, P.-O., & Rey, H. (2022). *Exorbitant privilege and exorbitant duty* (CEPR Discussion Papers No. 16944). https://cepr.org/publications/dp16944

Gourinchas, P.-O., Rey, H., & Govillot, N. (2010). *Exorbitant Privilege and Exorbitant Duty* (IMES Discussion Paper Series No. 10-E-20). https://www.imes.boj.or.jp/research/papers/english/10-E-20.pdf

Gourinchas, P.-O., Rey, H., & Sauzet, M. (2019). The international monetary and financial system. *Annual Review of Economics*, *11*(1), 859-893. https://doi.org/10.1146/annurev-economics-080217-053518

Habib, M. M. (2010). *Excess returns on net foreign assets: the exorbitant privilege from a global perspective* (ECB Working Paper Series No. 1158). https://doi.org/10.2139/ssrn.1551873

Habib, M. M., Stracca, L., & Venditti, F. (2020). The fundamentals of safe assets. *Journal of International Money and Finance*, *102*, 102119. https://doi.org/10.1016/j.jimonfin.2019.102119

Hansen, B. E. (1997). Approximate Asymptotic P Values for Structural-Change Tests. *Journal of Business & Economic Statistics*, *15*(1), 60-67. https://doi.org/10.2307/1392074

He, Z., Krishnamurthy, A., & Milbradt, K. (2019). A model of safe asset determination. *American Economic Review*, *109*(4), 1230-1262. https://doi.org/10.1257/aer.20160216

He, Z., Nagel, S., & Song, Z. (2022). Treasury inconvenience yields during the COVID-19 crisis. *Journal of Financial Economics*, *143*(1), 57-79. https://doi.org/10.1016/j.jfineco.2021.05.044

Heimberger, P. (2022). Do higher public debt levels reduce economic growth? *Journal of Economic Surveys*, *37*, 1061-1089. https://doi.org/10.1111/joes.12536

Henry, E., Mulloy, C., & Sarte, P.-D. G. (2023). *A Rate Cycle Unlike Any Other* (Richmond Fed Economic Brief, Issue No. 23-26). https://www.richmondfed.org/publications/research/economic_brief/2023/eb_23-26

Herndon, T., Ash, M., & Pollin, R. (2014). Does high public debt consistently stifle economic growth? A critique of Reinhart and Rogoff. *Cambridge journal of economics*, *38*(2), 257-279. https://doi.org/10.1093/cje/bet075

Holmström, B., & Tirole, J. (1996). Private and Public Supply of Liquidity. *Journal of Political Economy*, *106*. https://doi.org/10.1086/250001

Jeanne, O. (2007). International Reserves in Emerging Market Countries: Too Much of a Good Thing? *Brookings papers on economic activity*, *38*(1), 1-80. https://doi.org/10.1353/eca.2007.0013

Jiang, Z., Lustig, H., Van Nieuwerburgh, S., & Xiaolan, M. Z. (2024). The US public debt valuation puzzle. *Econometrica*, *92*(4), 1309-1347. https://doi.org/10.3982/ECTA20497

Klingler, S., & Sundaresan, S. (2023). Diminishing treasury convenience premiums: Effects of dealers' excess demand and balance sheet constraints. *Journal of Monetary Economics*, *135*, 55-69. https://doi.org/10.1016/j.jmoneco.2023.01.002

Krishnamurthy, A., & Vissing-Jorgensen, A. (2012). The aggregate demand for treasury debt. *Journal of Political Economy*, *120*(2), 233-267. https://doi.org/10.1086/666526

Lane, P. R., & Milesi-Ferretti, G. M. (2007). A global perspective on external positions. In *G7 current account imbalances: sustainability and adjustment* (pp. 67-102). University of Chicago Press. https://ideas.repec.org/h/nbr/nberch/0122.html

Laubach, T. (2009). New Evidence on the Interest Rate Effects of Budget Deficits and Debt. *Journal of the European Economic Association*, *7*(4), 858-885. https://doi.org/10.1162/jeea.2009.7.4.858

Martinez, L., Roch, F., Roldan, F., & Zettelmeyer, J. (2022). *Sovereign Debt* (IMF Working Paper No. WP/22/122). https://doi.org/10.5089/9798400213250.001

Mateos, I., Duttagupta, R., & Goyal, R. (2009). The Debate on the International Monetary System. *IMF Staff Position Notes*, *2009*(026), Article A001. https://doi.org/10.5089/9781462331369.004.A001

Mehrotra, N. R., & Sergeyev, D. (2021). Debt sustainability in a low interest rate world. *Journal of Monetary Economics*, *124*, S1-S18. https://doi.org/10.1016/j.jmoneco.2021.09.001

Meyermans, E. (2022). IV. The 'exorbitant privilege'of an international-currency status: theory and evidence. *Economic Review*, *54*(1), 97-133. https://ideas.repec.org/a/euf/qreuro/0211-04.html

Mundell, R. A. (1963). Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *The Canadian Journal of Economics and Political Science / Revue canadienne d'Economique et de Science politique*, *29*(4), 475-485. https://doi.org/10.2307/139336

Nagel, S. (2016). The liquidity premium of near-money assets *The Quarterly Journal of Economics*, *131*(4), 1927-1972. https://doi.org/10.1093/qje/qjw028

National Bureau of Economic Research. (n.d.). *US business cycle expansions and contractions*. National Bureau of Economic Research. https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions

Nievas, G., & Sodano, A. (2024). *Has the US Exorbitant Privilege Become a Rich World Privilege? Rates of Return and Foreign Assets from a Global Perspective, 1970-2022* (World Inequality Lab Working Paper No. 2024/14). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5235808

Obstfeld, M., & Rogoff, K. S. (2005). Global current account imbalances and exchange rate adjustments. *Brookings papers on economic activity*, *36*(1), 67-146. https://ideas.repec.org/a/bin/bpeajo/v36y2005i2005-1p67-146.html

Panizza, U., & Presbitero, A. F. (2013). Public debt and economic growth in advanced economies: A survey. *Swiss Journal of Economics and Statistics*, *149*(2), 175-204. https://doi.org/10.1007/BF03399388

Panizza, U., & Presbitero, A. F. (2014). Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics*, *41*, 21-41. https://doi.org/10.1016/j.jmacro.2014.03.009

Quandt, R. E. (1960). Tests of the Hypothesis that a Linear Regression System Obeys Two Separate Regimes. *Journal of the American Statistical Association*, *55*(290), 324-330. https://doi.org/10.2307/2281745

Rachel, Ł., & Summers, L. H. (2019). *On Secular Stagnation in the Industrialized World* (26198). https://doi.org/10.3386/w26198

Reinhart, C. M., Reinhart, V. R., & Rogoff, K. S. (2012). Public Debt Overhangs: Advanced-Economy Episodes since 1800. *Journal of Economic Perspectives*, *26*(3), 69–86. https://doi.org/10.1257/jep.26.3.69

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. *American Economic Review*, *100*(2), 573-578. https://doi.org/10.1257/aer.100.2.573

Romero, J. (2013). *The Treasury-Fed Accord*. Federal Reserve History. https://www.federalreservehistory.org/essays/treasury-fed-accord

Satterthwaite, F. E. (1946). An Approximate Distribution of Estimates of Variance Components. *Biometrics Bulletin*, *2*(6), 110-114. https://doi.org/10.2307/3002019

Siranova, M., & Rocha, M. D. (2020). Determinants shaping the international currency system: Where do currencies stand relative to their equilibria? *The World Economy*, *43*(2), 458-483. https://doi.org/10.1111/twec.12853

Triffin, R. (1960). *Gold and the Dollar Crisis: The Future of Convertibility*. Yale University Press.

U.S. Department of the Treasury. *Treasury International Capital (TIC) System*. Retrieved August 2026 from https://home.treasury.gov/data/treasury-international-capital-tic-system

Weiss, C. (2022). *Geopolitics and the U.S. Dollar's Future as a Reserve Currency* (International Finance Discussion Papers No. 1359). https://doi.org/10.17016/IFDP.2022.1359

Welch, B. L. (1947). The Generalization of `Student's' Problem when Several Different Population Variances are Involved. *Biometrika*, *34*(1/2), 28-35. https://doi.org/10.2307/2332510

Woo, J., & Kumar, M. S. (2015). Public Debt and Growth. *Economica*, *82*(328), 705-739. https://doi.org/10.1111/ecca.12138

7. Annexes

Annex 1. Comparison of the convenience yield computed with certificate of deposit (CY_CD) and commercial paper (CY_CP) rates, 1997–2023.

Year	CD (%)	CP (%)	TB3MS (%)	M_t	CY_CD (%)	CY_CP (%)	Difference (pp)
1997	5.80	5.70	5.16	0.590	0.378	0.319	0.059
1998	5.14	5.04	4.39	0.568	0.426	0.369	0.057
1999	6.05	5.93	5.20	0.586	0.498	0.428	0.070
2000	6.45	6.33	5.77	0.558	0.379	0.312	0.067
2001	1.83	1.81	1.69	0.584	0.082	0.070	0.012
2002	1.34	1.32	1.19	0.585	0.088	0.076	0.012
2003	1.10	1.07	0.90	0.598	0.120	0.102	0.018
2004	2.45	2.38	2.19	0.592	0.154	0.113	0.042
2005	4.45	4.37	3.89	0.586	0.328	0.282	0.047
2006	5.32	5.24	4.85	0.584	0.275	0.228	0.047
2007	5.02	4.76	3.00	0.576	1.164	1.014	0.150
2008	1.77	1.09	0.03	0.607	1.056	0.643	0.413
2009	0.22	0.20	0.05	0.590	0.100	0.089	0.012
2010	0.30	0.27	0.14	0.568	0.091	0.074	0.017
2011	0.49	0.18	0.01	0.535	0.257	0.091	0.166
2012	0.24	0.17	0.07	0.531	0.090	0.053	0.037

Year	CD (%)	CP (%)	TB3MS (%)	M_t	CY_CD (%)	CY_CP (%)	Difference (pp)
2013	0.14	0.14	0.07	0.548	0.038	0.038	0.000
2014	0.15	0.15	0.03	0.526	0.063	0.063	0.000
2015	0.54	0.54	0.23	0.530	0.164	0.164	0.000
2016	0.87	0.87	0.51	0.539	0.194	0.194	0.000
2017	1.54	1.54	1.32	0.536	0.118	0.118	0.000
2018	2.69	2.69	2.37	0.551	0.176	0.176	0.000
2019	1.76	1.76	1.54	0.538	0.118	0.118	0.000
2020	0.17	0.17	0.09	0.569	0.046	0.046	0.000
2021	0.17	0.17	0.06	0.550	0.061	0.061	0.000
2022	4.51	4.51	4.25	0.550	0.143	0.143	0.000
2023	5.32	5.32	5.24	0.550	0.044	0.044	0.000

Note: N = 27; Mean difference = 0.045 pp; Std. Dev. = 0.085 pp; paired hypothesis test (mean = 0): t = 2.76, p = 0.011. The comparability of these two series is assessed over their full period of overlap, bounded by the start of the certificate of deposit series (IR3TCD01USM156N) in June 1997. Bold rows indicate the three years of largest divergence (2007, 2008, 2011) and the three years of the 2021–2025 extension for which both series are available (2021–2023). The 2007–2008 divergence coincides with the disruption of commercial paper markets during the global financial crisis; the 2011 divergence coincides with the European sovereign debt crisis, during which U.S. money market funds with exposure to Eurozone banks experienced significant withdrawals between June and August 2011, with documented spillover effects on the financing costs of other, non-European issuers (Chernenko & Sunderam, 2012). Within the three comparable years inside the extension period, the two constructions are identical to the nearest thousandth of a percentage point, supporting the reliability of the substitution under the calm conditions that prevailed during the years directly tested; this cannot be directly confirmed for 2024–2025, since the certificate of deposit series is no longer available for those years.

Annex 2. Paired hypothesis test (mean = 0) for the difference between CY_CD and CY_CP, 1997–2023.

Hypothesis Testing for DIFF_CDCP

Sample: 1997 2023

Included observations: 27

Test of Hypothesis: Mean = 0.000000

Sample Mean = 0.045296

Sample Std. Dev. = 0.085427

Method	Value	Probability
t-statistic	2.755165	0.0106

Annex 3. Quandt-Andrews Breakpoint Test EViews 14 output (sample restricted to 1990–2025)

Quandt-Andrews unknown breakpoint test

Null Hypothesis: No breakpoints within 15% trimmed data

Varying regressors: All equation variables

Equation Sample: 1990 2025

Test Sample: 1996 2020

Number of breaks compared: 25

Statistic	Value	Prob.
Maximum LR F-statistic (2009)	12.69520	0.0075
Maximum Wald F-statistic (2009)	12.69520	0.0075
Exp LR F-statistic	3.838227	0.0045
Exp Wald F-statistic	3.838227	0.0045
Ave LR F-statistic	3.980550	0.0193

Ave Wald F-statistic	3.980550	0.0193

Note: probabilities calculated using Hansen's (1997) method

Annex 4. Chow Breakpoint Test EViews 14 output, 2008 breakpoint

Chow Breakpoint Test: 2008

Null Hypothesis: No breaks at specified breakpoints

Varying regressors: All equation variables

Equation Sample: 1990 2025

F-statistic	4.546140	Prob. F(1,34)	0.0403
Log likelihood ratio	4.517836	Prob. Chi-Square(1)	0.0335
Wald Statistic	4.546140	Prob. Chi-Square(1)	0.0330

Annex 5. Chow Breakpoint Test EViews 14 output, 2009 breakpoint.

Chow Breakpoint Test: 2009

Null Hypothesis: No breaks at specified breakpoints

Varying regressors: All equation variables

Equation Sample: 1990 2025

F-statistic	12.69520	Prob. F(1,34)	0.0011
Log likelihood ratio	11.42211	Prob. Chi-Square(1)	0.0007
Wald Statistic	12.69520	Prob. Chi-Square(1)	0.0004

Annex 6. Test for Equality of Means Between Series, 2009–2019 vs. 2021–2025. (EViews 14 output)

Test for Equality of Means Between Series

Sample: 1990 2025

Included observations: 36

Method	df	Value	Probability
t-test	14	1.423995	0.1764
Satterthwaite-Welch t-test*	12.44569	1.716389	0.1109
Anova F-test	(1, 14)	2.027761	0.1764
Welch F-test*	(1, 12.4457)	2.945993	0.1109

*Test allows for unequal cell variances

Analysis of Variance

Source of Variation	df	Sum of Sq.	Mean Sq.
Between	1	0.006731	0.006731
Within	14	0.046469	0.003319
Total	15	0.053200	0.003547

Category Statistics

Variable	Count	Mean	Std. Dev.	Std. Err. of Mean
CY_2009_2019	11	0.128249	0.063678	0.019200
CY_2021_2025	5	0.084000	0.038471	0.017205
All	16	0.114421	0.059554	0.014888