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Whose ‘exorbitant privilege’? – Treasury yields of reserve currency issuers in the context of central bank balance sheet expansion

*Kié a “mértéktelen kiváltság”? – Tartalékdeviza-kibocsátók államkötvényhozamai a
jegybanki mérlegexpanzió kontextusában*

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Abstract

Recent increases in U.S. Treasury note yields have cast doubt on a long-recognised benefit of the dollar’s international reserve role for the United States: the ability to borrow at low costs. This paper investigates whether demand by foreign reserves significantly reduces interest rates on government bonds of reserve currency issuers. An autoregressive distributed lags–equilibrium correction model is estimated to identify the long-run effects of government bond purchases by the foreign official sector on 10-year yields, disentangling their impact from domestic central bank asset purchases and various macroeconomic factors. Results indicate that demand by foreign monetary authorities continues to exert a significant, albeit decreasing downward pressure on the yields of U.S. Treasuries, distinct from the impact of the Federal Reserve’s balance sheet expansion, amounting to 122 basis points on average over the past twenty years. This advantage, however, is not unique to the dollar and the United States: France enjoys a comparable yield compression, and Germany benefits twice as much from supplying safe assets denominated in another international reserve currency. Lower yields in the Euro area are not primarily driven by different macroeconomic conditions; rather, global demand for euro-denominated safe assets is concentrated on the bond markets of select member states, amplifying their ‘exorbitant privilege’. Without this advantage, German bunds would have traded at approximately the same yields as U.S. Treasuries over the past twenty years.

1. Introduction

In October 2023, yields on the benchmark 10-year U.S. Treasury note have briefly surpassed the 5 percent level, trading well above the long-term government bonds of many comparable developed economies such as Germany or France. On the surface, these trends may appear to be in contradiction with the dollar's international role as the leading global reserve currency, and with U.S. Treasuries as the practical definition of dollar-denominated safe assets: if there is still, as Obstfeld (2013) puts it, a 'near insatiable' global demand for safe dollar bonds, why does the U.S. have to pay such high yields for investors to buy them?

The notion that the United States enjoys lower borrowing costs as a result of the dollar's reserve currency status and the consequent demand for safe U.S. debt securities has been a long-established concept in international monetary economics. Introduced by Triffin (1978), famously described by then finance minister, later president of France Valéry Giscard d'Estaing as America's 'exorbitant privilege'¹ (Eichengreen, 2011), and echoed by Federal Reserve Chair Bernanke (2005) in his 'global savings glut' thesis on disproportionately low yields compared to macroeconomic fundamentals, the existence of America's borrowing cost advantage was widely accepted, and rarely challenged. Warnock and Warnock (2009) estimated the overall benefit to be around 80 basis points on 10-year Treasury yields, while Beltran et al (2013) found that 5-year Treasury yields would rise 20 basis points in the long run as a response to a 100 billion dollar decrease in inflows from foreign reserves.

More recently, with the widening of U.S. Treasury spreads against other nations' government bond yields, America's borrowing cost advantage seems to have melted away – and so has prominent support for the idea that yields are meaningfully reduced by foreign official demand. Bernanke (2017), a former proponent himself, downplayed its importance, stating “*the interest rates that the U.S. pays on safe assets, such as government debt, are generally no lower (and are currently higher) than those paid by other creditworthy industrial countries*”, and went as far as to quip that “*overall, the fact that English is the common language of international business and politics is of considerably more benefit to the United States than is the global role of the dollar.*” Krugman (2023) makes the same point, highlighting the fact that government

¹ This paper focuses on the fiscal interpretation of 'exorbitant privilege' as outlined in Obstfeld (2011). For broader definitions including the current account, see the overview in Bordo and McCauly (2019), the historical narrative in Eichengreen (2011), or the original formulation by Triffin (1978).

bond yields in Germany and France have been much lower recently; and McCauley (2015) declares that “*no big pot of gold sits at the end of the currency internationalisation rainbow*”.

These arguments against the concept of an ‘exorbitant privilege’ can be summarised into the following points:

1. *The dollar is losing out.* In the past two decades, as the dollar’s share of international reserves has been slowly eroding and other reserve currencies – mainly the newly introduced euro – have been gaining ground (Arslanalp et al, 2023), demand for dollar safe assets has subsided and the associated borrowing cost advantage is now more widely shared with other reserve currency issuing nations (Bernanke, 2017). For example, while the euro’s share in foreign exchange reserves is only around a third of the dollar’s, this lower demand corresponds to a lower overall supply of euro-denominated government bonds (Bordo and McCauly, 2019). Together with a more rapidly increasing supply of U.S. Treasuries, this might translate to a comparable, or even higher reduction in yields for Euro area governments.
2. *Central banks stole the show.* In the wake of the Great Recession and the Covid pandemic, central banks stepped forward as the single largest buyers of government debt in an effort to further ease monetary conditions beyond the zero lower bound of short rates, at the long end of the yield curve (Krishnamurthy and Vissing-Jørgensen, 2011). In addition, central banks have intervened to restore stability (and, conveniently, low borrowing costs) at times of increased bond market turbulence on several occasions. If there is any yield compression left unexplained by macroeconomic fundamentals, it is most likely a result of the Fed’s accumulation of bonds on its balance sheet, not purchases by foreign reserves.
3. *It is all about the macros.* Given its high debt-to-GDP ratio and permanent budget deficit, there is nothing surprising about America’s increasing borrowing costs. Nations such as Germany and France issue bonds at lower interest rates simply because they have better fiscal discipline, or lower inflation risks to compensate investors for. Foreign official demand matters little, and macroeconomic factors explain much of the spread.
4. *Exorbitant today, gone tomorrow.* Event studies are commonly used as empirical backing for claims that foreign (Bernanke et al, 2004) or domestic (Krishnamurthy and Vissing-Jørgensen, 2011; Szczerbowicz, 2015) central bank asset purchases significantly reduce interest rates. McCauly (2015) points out that the persistence of these reductions is difficult to evaluate through an event study approach with short-term focus. For example, estimates based on daily data in Bernanke et al (2004) suggest that for each billion dollars

of U.S. Treasuries purchased by Japanese authorities, 10-year yields fell by one basis point – but this would lead to the unlikely conclusion that Japan’s intervention as a whole reduced U.S. borrowing costs by more than 300 basis points. Looking at initial market reactions may lead to overestimations, and it is reasonable to expect the impact to dampen over time.

This paper contributes to existing literature by addressing each of these arguments with an empirical investigation that (1) compares the evolution of long-term sovereign bond yields in the United States and the Euro area in response to changes in foreign reserve holdings relative to the overall supply of government debt securities; (2) isolates the impact of foreign official demand from domestic central bank asset purchases; (3) controls for different macroeconomic and fiscal conditions; and (4) distinguishes long-run, persistent yield compressions from short-run, flow effects. To that end, an autoregressive distributed lags–equilibrium correction model is estimated on 10-year term premia for a panel consisting of the United States, Germany, and France. The sample covers the twenty-year period between 2004 and 2023, which includes the buildup of the ‘global savings glut’ before the financial crisis of 2008, and subsequent central bank asset purchase programmes in the post-crisis period.

Results confirm a significant yield compression driven by foreign reserve accumulation across the panel as a whole, as well as for each country separately. On average, 10-year U.S. Treasury yields were 122 basis points lower in the period under examination than they would have been in the absence of foreign official demand. These findings indicate that the effects previously estimated by Warnock and Warnock (2009) and Beltran et al (2013) still hold up, and support more recent conclusions from Choi et al (2024) regarding the questionable sustainability of U.S. public debt if America were to lose this ‘exorbitant privilege’ as result of defaulting on its debt. In addition, if we accept Bernanke’s (2005) conclusions that foreign official demand put a significant downward pressure on Treasury yields during the ‘global savings glut’ period, his later (Bernanke, 2017) suggestion that this is no longer the case must be rejected, since the estimates for those specific points in time are very similar – despite the latter value being lower than its peak in the early 2010s.

At the same time, there is some merit to each of the previous arguments.

First, while still significant, America’s borrowing cost advantage has indeed been steadily declining since the early 2010s, partly as a result of the slow erosion of the dollar’s share in foreign reserves as outlined by Arslanalp et al (2022), and partly due to the explosion of U.S. public debt. Moreover, as far as the past twenty years are considered, this advantage was not

exclusive to begin with: France has enjoyed a similar, 110 basis point average yield reduction, and Germany's savings have been truly exorbitant, amounting to double that of the U.S. at 254 basis points. However, this is not the result of disparate amounts of U.S. and Euro area bonds on the market in proportion to international demand for dollar and euro reserves like McCauly (2015) suggests. In fact, foreign reserves have held slightly less than a fifth of the total government debt of both the U.S. and the Euro area taken as a whole. The difference is that while the U.S. satisfies this demand with a single, large supply of fungible Treasury securities, the Euro area has no sizeable bond supply of its own, and investors are free to pick and choose from the debt securities of various member states – preferring the 'safer' ones with highly liquid, deep bond markets (Krishnamurthy and Vissing-Jørgensen, 2012). Foreign exchange reserves, being characteristically cautious investors (Eichengreen, 2011), typically hold bonds issued by the conventionally safest Germany, and to a lesser extent, France – while other member states such as Italy and Spain benefit little from the international reserve role of the euro.

Second, it is undeniable that in the wake of quantitative easing cycles following the Great Recession and the Covid pandemic, (domestic) central bank asset purchases have had a much larger impact on long-term government bond yields than demand by foreign exchange reserves. Moreover, in line with several event studies (Krishnamurthy and Vissing-Jørgensen, 2011; Szczerbowicz, 2015), results confirm that these interventions have an immediately tangible impact, as opposed to foreign reserve purchases which only meaningfully reduce yields on the long run; as a consequence of extracting a large supply of bonds from the market and reducing their free float. Nonetheless, the long-run (stock) effect of foreign official demand is statistically significant, and clearly distinguishable from asset purchases and market interventions conducted by the domestic central bank.

Third, certain macroeconomic factors – namely the level of inflation, the volatility of growth, and the evolution of the debt-to-GDP ratio – explain some, but not all of the variation in yields. Even after isolating the impact of different (expected) paths of monetary policy and controlling for these macroeconomic fundamentals, foreign reserve holdings continue to exert a significant exogenous effect through compressed term premia.

Finally, there is no evidence that foreign official purchases have any significant short-run impact on yields, in line with the argument laid out by McCauly (2015) on how apparently large immediate market responses must fade away. In this regard the findings are similar to those in Beltran et al (2013), where initial 40-60 basis point 5-year Treasury yield decreases are reduced

to 20 basis points once markets adjust to the temporary demand shock. The apparent lack of short-run impact is hardly surprising: as opposed to the domestic central bank's asset purchases, which serve as an indication of the central bank's commitment to low long-term interest rates (Krishnamurthy and Vissing-Jørgensen, 2011), regular inflows from foreign reserves are not part of a systemic effort to influence interest rates. As such, they contain no signals relevant to the future evolution of monetary policy, and thus, no additional information that should be immediately priced into bond yields apart from the resulting shift in supply and demand. At the same time, no short-run effect does not mean no effect at all: as foreign reserves maintain, expand, or decrease their large stock of Treasuries, they influence the free float of outstanding securities, meaning the overall supply available to be traded on the market – which inevitably affects the price (i.e. the yield) of Treasuries. This long-run, stock effect is highly significant.

Compared to previous studies on the interplay of foreign reserve demand for Treasuries and U.S. borrowing costs such as Warnock and Warnock (2009) and Beltran et al (2013), this paper takes into account the growing role of domestic central banks in shaping long-term bond yields, and provides an international comparison to put the debt financing advantage of the United States into context. In relation to earlier studies on the same phenomenon regarding the Euro area such as Gräb et al (2019), the paper expands the literature with a separate identification of French and German yield compressions due to foreign official demand instead of treating the currency union as a whole, which is less fitting considering the absence of shared fiscal policy and debt issuance. Additionally, in comparison to the more common event study approach to measuring the effects of asset purchases as in Krishnamurthy and Vissing-Jørgensen (2011) and Szczerbowicz (2015), an alternative methodology is used to quantify the long-run impact of balance sheet expansion on interest rates. These estimates could be more relevant for future policy as central banks enter quantitative tightening cycles, where a slow, gradual downsizing of the balance sheet takes the place of fast, large-scale expansions.

The following section presents the data sources, identification strategy, and the autoregressive distributed lags–equilibrium correction model I use to estimate the impact of foreign reserve holdings of government debt securities on interest rates. Then, detailed results are reported, accompanied by clarifying explanations and visualisations. Lastly, after a brief summary of my main points and conclusions, fiscal and monetary policy implications for the U.S. and the Euro area are discussed.

2. Data, identification, and methodology

Let the yield on an n -period bond be defined following Dai and Singleton (2002) as:

$$R_t^n = \frac{1}{n} \sum_{i=0}^{n-1} E_t(r_{t+i}) + TP_t^n \quad (1)$$

which can be decomposed into a risk-neutral yield, i.e. the cumulative expected short-term returns r_t over the course of the bond's maturity, and a premium TP_t^n which compensates investors for risks associated with holding the bond to term. Based on Taylor (1993), the short rate can be defined as:

$$r_t = r^* + \pi_t + \beta_\pi(\pi_t - \pi^*) + \beta_y(y_t - y^*), \quad (2)$$

meaning the short-term nominal rate is set by the central bank as a function of natural rate of interest r^* , current inflation π_t , and inflation and output gaps $(\pi_t - \pi^*)$ and $(y_t - y^*)$, respectively. In light of this, the risk-neutral yield in Equation (1) is referred to as the monetary policy component, since it is determined by expectations regarding the central bank's actions to achieve its policy objectives of target inflation and output – that is to say, exogenously from the standpoint of foreign official demand for debt securities. Thus, in line with Beltran et al (2013), I assume that any impact of Treasury purchases by foreign reserves should be reflected in the term premium component of the yield TP_t^n .

Empirically, the standard method for decomposing yields is the three-step linear regression-based affine term structure model (ATSM) introduced by Adrian et al (2013). For baseline estimates, this paper uses ATSM term premia decomposed with a specification from Favero et al (2024), which ensures stationarity and improves the model's predictive power. Alternative estimates with term premia from the original ATSM specification are also provided to check the robustness of findings.

Proper identification of foreign reserve-driven reductions in term premia requires the isolation of yield compressions due to the domestic central bank's quantitative easing policies aimed at reducing rates at the long end of the yield curve. Moreover, while I demonstrated based on Taylor (1993) that the monetary policy component of the yield is only influenced by (expected) inflation and output, this does not mean that inflation and growth dynamics can only affect the monetary policy component. In fact, Diebold et al (2006) show a strong correlation between yields and a number of macroeconomic variables even when assuming constant and negligible

term premia, which suggests the premium itself is likely to reflect risks associated with certain macroeconomic trends such as higher and more volatile inflation. To address these confounding factors, the following first-order autoregressive distributed lag (ARDL) model, similar to the ones in Beltran et al (2013) and Gräb et al (2019) is estimated:

$$TP_{i,t}^{10} = \alpha_0 + \alpha_1 TP_{i,t-1}^{10} + \beta_1 CB_{i,t} + \beta_2 CB_{i,t-1} + \gamma_1 FR_{i,t} + \gamma_2 FR_{i,t-1} + \delta' M_{i,t} + \zeta_i + \varepsilon_{i,t} \quad (3)$$

where dependent variable $TP_{i,t}^{10}$ indicates the term premium component of the 10-year benchmark bond yield of country i at period t , independent variable $CB_{i,t}$ denotes the share of general government debt on the domestic central bank's balance sheet, while $FR_{i,t}$ is the share of general government debt held in foreign reserves. Domestic and foreign official holdings of bonds are expressed as a percentage of total outstanding debt because they compress yields by reducing the free float of bonds, i.e. the supply available to be traded on the market. ζ_i captures country-specific unobserved fixed effects that could affect term premia, such as varying degrees of market liquidity or investor price sensitivity. $M_{i,t}$ is a vector of macroeconomic controls:

$$M_{i,t} = [\pi_{i,t}, \sigma(\pi)_{i,t}, y_{i,t}, \sigma(y)_{i,t}, \Delta D_{i,t}], \quad (4)$$

including the level $\pi_{i,t}$ and volatility $\sigma(\pi)_{i,t}$ of inflation, the level $y_{i,t}$ and volatility $\sigma(y)_{i,t}$ of output, as well as the first differences of the government's debt-to-GDP ratio $\Delta D_{i,t}$ as a proxy for fiscal discipline. Coefficients are estimated with dynamic ordinary least squares (DOLS) regressions for a panel consisting of the United States, Germany, and France. All data are of quarterly frequency for the twenty-year period between 2004 and 2023, which covers the timeframe of the pre-2008 'global savings glut' phenomenon, the solidifying of the euro's role as a major international reserve currency, and the subsequent era of balance sheet policies implemented by the Fed and the ECB. Domestic central bank and foreign exchange reserve holdings of government debt are obtained from the International Monetary Fund's *Sovereign Debt Investor Base* and *Currency Composition of Foreign Exchange Reserves* datasets, macroeconomic controls are provided by the FRED database of the Federal Reserve Bank of St. Louis.

As shown by Pesaran et al (2001), a reparameterization of the ARDL model as an equilibrium-correction model (ECM) allows for confirming a long-run level relationship, i.e. cointegration between foreign reserve holdings of debt securities and term premia, as well as a separate

assessment of long-run (stock) and short-run (flow) effects:

$$\Delta TP_{i,t}^{10} = \alpha_0 - (1 - \alpha_1) \left(TP_{i,t-1}^{10} - \frac{\beta_1 + \beta_2}{1 - \alpha_1} CB_{i,t} - \frac{\gamma_1 + \gamma_2}{1 - \alpha_1} FR_{i,t} - \frac{\delta'}{1 - \alpha_1} M_{i,t} \right) - \beta_2 \Delta CB_{i,t} - \gamma_2 \Delta FR_{i,t} + \zeta_i + \varepsilon_{i,t} \quad (5)$$

In the ECM specification, negative coefficients of the autoregressive variable (i.e. the error correction term) show the speed of adjustment at which the dependent variable returns to its equilibrium state after a one-time shock. Consequently, the error-corrected coefficient $\frac{\gamma_1 + \gamma_2}{1 - \alpha_1}$ captures the long-run, persistent term premia compression due to consecutive inflows into Treasury securities from the foreign official sector to maintain (or expand) their stock of safe assets, whereas γ_2 measures the immediate impact of inflows in a given period. Similarly, $\frac{\beta_1 + \beta_2}{1 - \alpha_1}$ measures the long-run reduction of yields achieved by the central bank as a result of extracting a large supply of bonds from the market and keeping it on its balance sheet, while β_2 shows the short-run market response to central bank asset purchases.

According to Pesaran et al (2001), cointegration is confirmed if *all* of the following criteria are met:

1. the coefficient of the error correction term is negative and statistically significant;
2. a successful bounds F-test is conducted;
3. and the long-run coefficient of the independent variable is statistically significant.

Heteroskedasticity- and autocorrelation-consistent robust standard errors introduced by Newey and West (1987) are used to establish statistical significance. Once the panel regression confirms a cointegrating relationship between demand by foreign reserves and term premia, country-level specifications of Equation (5) are used to estimate the international reserve-driven compression of term premia – or, the degree of ‘exorbitant privilege’ enjoyed by each nation. These coefficients are then substituted back into the formulae to construct an alternative path of government bond yields *without* the impact of foreign reserve-driven demand (all else being equal).

3. Results

Table 1. shows the panel regression’s estimates. All three specifications satisfy the necessary criteria for confirming cointegration, providing compelling evidence for a statistically significant, negative long-run relationship between foreign reserve holdings of government debt

and bond yields. Accounting for macroeconomic fundamentals slightly reduces this coefficient, but also its variance, thus the estimate is statistically stronger under the baseline specification in column (2) than without controls in column (1). Results are robust against the choice of the yield decomposition method, as shown in column (3) with similarly significant coefficients obtained from regressing the same model on different term premia estimates. While the long-run effect is smaller under the latter specification, that is equally the case with domestic central bank holdings. In addition, both foreign and domestic bond purchases have stronger short-run effects in this estimation, suggesting that different approaches to identifying term premia do not affect their overall impact, only its distribution over time.

According to the baseline estimates, government bond yields are persistently reduced by 8 basis points for each percentage point of national debt held in foreign exchange reserves. In contrast, each percentage point of debt added to the domestic central bank's balance sheet compresses yields by 19 basis points on the long run. Apart from interventions by foreign and domestic monetary authorities, term premia respond significantly to changes in the level of inflation, the volatility of output, and the government's debt-to-GDP ratio.

Table 1. – Results of the ARDL-ECM panel regression with (1) controls for central bank asset purchases, (2) controls for both central bank actions and macroeconomic variables, and (3) alternative term premia estimates for robustness check.

		(1)	(2)	(3)
Lagged term premium (error correction term)	$1 - \alpha_1$	-0.1249*** (0.0354)	-0.2385*** (0.0482)	-0.4159*** (0.0616)
Long-run (stock) effects				
Debt held by domestic central bank	$\frac{\beta_1 + \beta_2}{1 - \alpha_1}$	-15.3419*** (2.3958)	-19.3201*** (1.9772)	-13.1887*** (1.2381)
Debt held in foreign exchange reserves	$\frac{\gamma_1 + \gamma_2}{1 - \alpha_1}$	-12.2497* (5.0385)	-8.5290** (2.8563)	-3.5751** (0.9630)
Short-run (flow) effects				
Domestic central bank's treasury purchases	β_2	-5.1775*** (0.8496)	-6.2462*** (0.9712)	-6.9772*** (0.8241)
Foreign official sector's treasury purchases	γ_2	0.9919 (1.0672)	1.0731 (1.0420)	-2.4619*** (0.6003)
Control variables				
CPI inflation		-	9.1143** (3.3599)	10.2362** (3.0738)
Inflation volatility		-	6.9658 (3.8661)	7.8128 (3.9792)
Real GDP growth		-	1.9693 (1.4272)	1.5053 (1.4863)
Growth volatility		-	-0.7585** (0.2733)	-0.6619* (0.2852)
Debt dynamics		-	5.9513* (2.3709)	4.7207 (2.4665)
Country fixed effects		Yes	Yes	Yes
Number of observations		234	234	234
Adjusted R ² (ARDL)		0.8975	0.9051	0.7975
R ² (ECM)		0.3807	0.4396	0.4510
Overall F-test for significance		291.2***	185.4***	92.4***
Bounds F-test for cointegration		7.6011**	9.9113***	24.0101***

Heteroskedasticity- and autocorrelation-consistent robust standard errors in parentheses (* p <0,05; ** p <0,01; *** p <0,001).

Table 2. reports country-specific estimates. Results are consistent with the panel as a whole: each nation enjoys a significant long-run yield compression as a consequence of issuing debt securities held by foreign exchange reserves abroad. U.S. borrowing costs are reduced by almost 6 basis points for each percentage point of total government debt held in foreign

reserves, which is nearly identical to the estimate for France. In contrast, Germany's yield reduction stands above 8 basis points. Domestic central bank holdings are again more influential, reducing long-term interest rates by 32 basis points in the United States, and 27 basis points in both Euro area nations. Macroeconomic fundamentals do not seem to affect the evolution of U.S. term premia, but inflation significantly increases them in both European countries. Using alternative term premia estimates does not alter the picture radically: the relationship is still significant for all countries, with Germany's yield reduction climbing even higher to 11 basis points, while the U.S. slightly falls back, and France's coefficient remains largely unchanged.

Interestingly, German term premia show a counterintuitive short-run response to central bank asset purchases, *rising* 19 basis points. The likely explanation behind this is that the ECB's large-scale bond market interventions often came in response to the fragmentation of Euro area sovereign yields in turbulent times of elevated market uncertainty, which triggered a flight-to-safety towards German bonds shortly before the intervention. After the ECB stepped in, this extraordinary demand subdued, and Germany's yields returned to their 'normal' levels. Notwithstanding these short-run anomalies, the long-run impact of central bank asset purchases on Germany's yields is, as expected, significantly negative.

Table 2. – Results of the country-specific ARDL-ECM regressions for (1) the United States, (2) Germany, and (3) France.

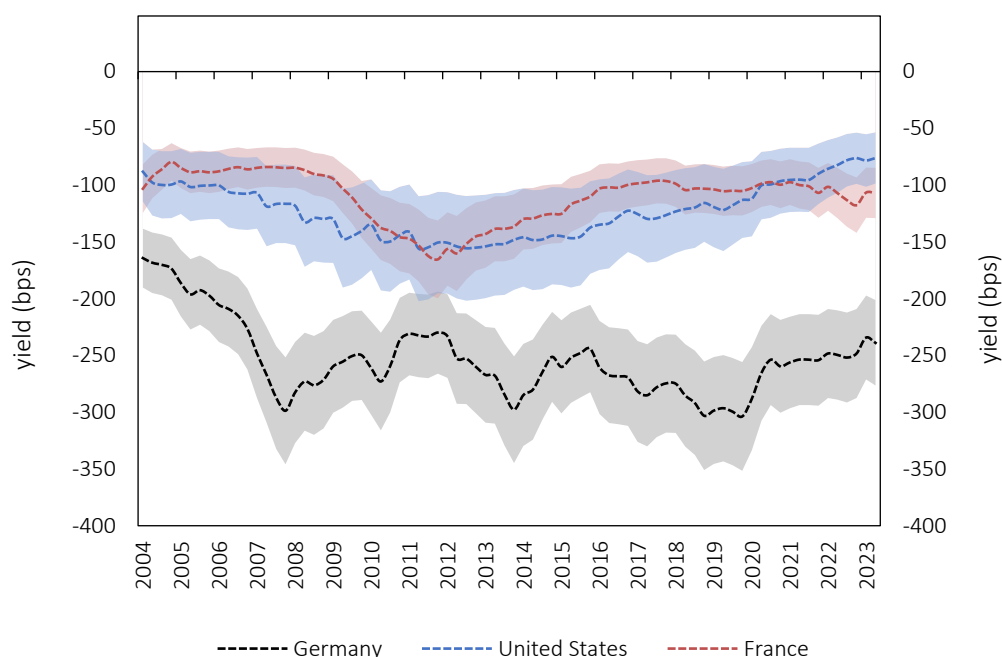
		(1)	(2)	(3)
Lagged term premium (error correction term)	$1 - \alpha_1$	-0.1826*** (0.0653)	-0.06959*** (0.0652)	-0.23998*** (0.0802)
Long-run (stock) effects				
Debt held by domestic central bank	$\frac{\beta_1 + \beta_2}{1 - \alpha_1}$	-32.0933*** (3.1375)	-27.0517*** (1.3901)	-26.8317*** (2.2537)
Debt held in foreign exchange reserves	$\frac{\gamma_1 + \gamma_2}{1 - \alpha_1}$	-5.9234** (2.1951)	-8.4633*** (1.3347)	-5.9002*** (1.2219)
Short-run (flow) effects				
Domestic central bank's treasury purchases	β_2	-3.2921 (8.4426)	19.2141* (10.8270)	1.5809 (11.852)
Foreign official sector's treasury purchases	γ_2	-7.2402 (8.8367)	-0.3552 (4.1900)	-0.9642 (6.2009)
Control variables				
CPI inflation		6.1913 (4.6553)	13.8002** (5.2644)	19.5683*** (5.9948)
Inflation volatility		-1.0639 (5.3524)	-0.1721 (12.7929)	30.4099*** (10.7261)
Real GDP growth		-6.0719 (4.7655)	-0.8229 (1.6158)	0.3256 (1.6180)
Growth volatility		0.0194 (1.4126)	-0.4311 (0.8326)	0.1838 (0.2428)
Debt dynamics		-7.844 (5.4848)	7.1013* (4.1080)	-1.2171 (3.5636)
Number of observations		78	78	78
Adjusted R ²		0.8891	0.9571	0.9562
F-test		61.91***	170.7***	167.1***

Heteroskedasticity- and autocorrelation-consistent robust standard errors in parentheses (* p <0,05; ** p <0,01; *** p <0,001).

Scaling up the estimated coefficients with the actual share of debt held in foreign reserves shows us the total borrowing cost advantage enjoyed by each nation as a result of foreign official demand for their debt securities – or, their level of ‘exorbitant privilege’. *Figure 1.* provides a visualisation of these results. While all three countries enjoy a sizeable yield compression, Germany’s is by far the largest, averaging 254 basis points over the past two decades. In contrast, there is nothing exorbitant about the benefits that international dollar reserves mean for the U.S. in terms of borrowing costs. Somewhat ironically in light of the traditional

perception articulated by Giscard-d'Estaing, America's debt financing advantage is practically equal to that of France, standing at an average of 122 and 110 basis points over the last twenty years, respectively. Most recently, as the steady decline of the U.S. yield compression continues, France has even managed to overtake the once envied issuer of the dollar in this regard.

Figure 1. – Estimated yield compression from foreign official demand. Shaded areas represent confidence intervals.



This large disparity between American and German savings on international reserves can explain much of the persistent gap between the yields of U.S. Treasuries and Germany's bunds. As shown on *Figure 2.*, Germany has been borrowing more cheaply than the U.S. for virtually all of the last two decades, with some short interruptions during the global flight-to-safety around the 2008 financial crisis. Following the European debt crisis and the subsequent launch of ECB asset purchases, the spread has expanded even further. However, once the impact of Germany's 'exorbitant privilege' is removed (see *Figure 3.*), neither country has a sustained advantage over the other. In an alternative scenario without any demand from foreign exchange reserves, U.S. Treasuries and German bunds would have traded at an average 421 and 429 basis points, respectively.

Figure 2. – 10-year sovereign bond yields (left-hand scale)
and spreads (right-hand scale)

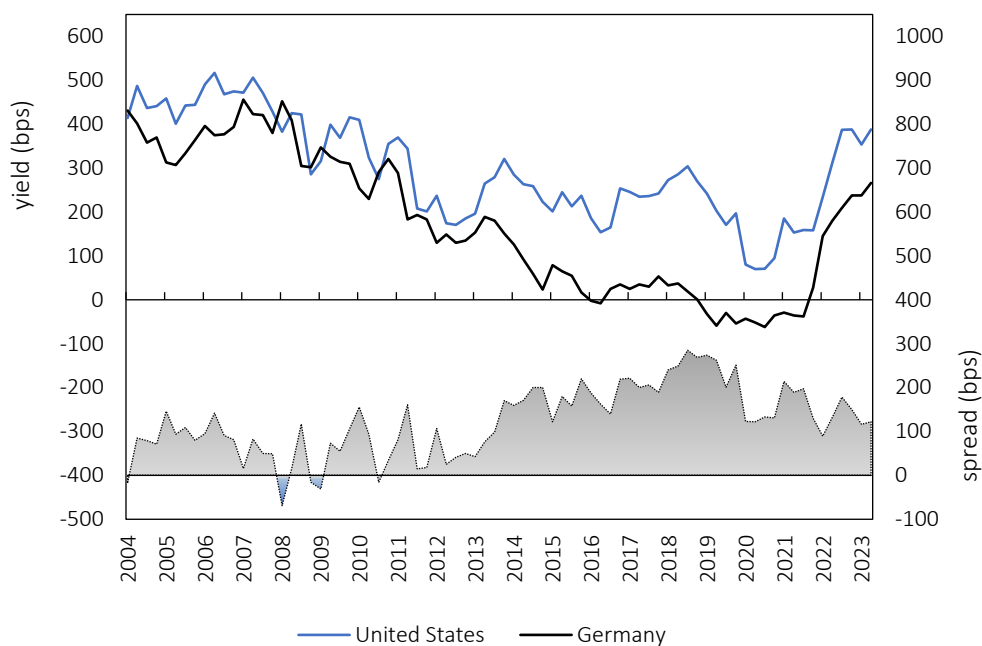
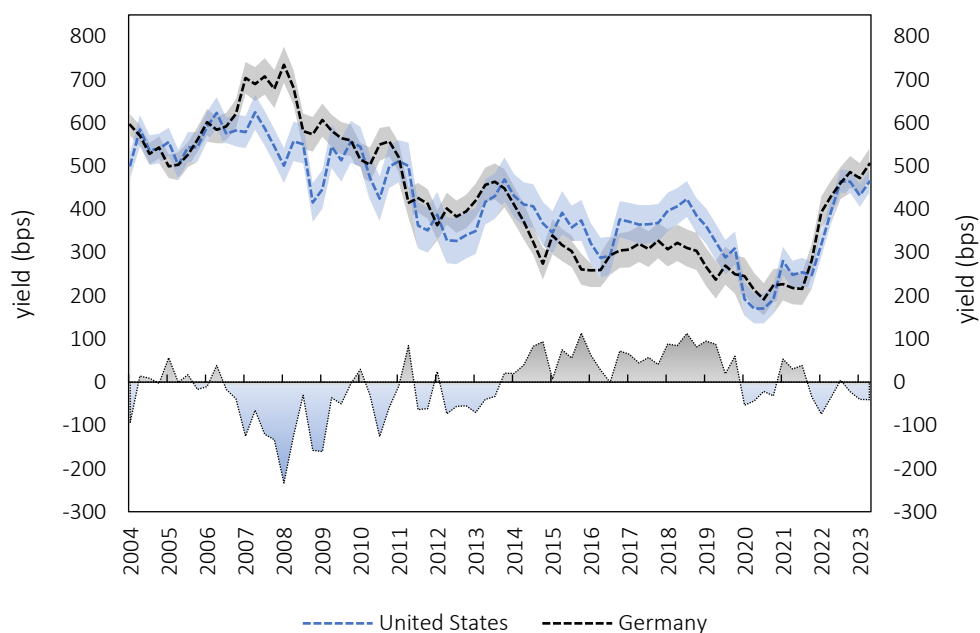


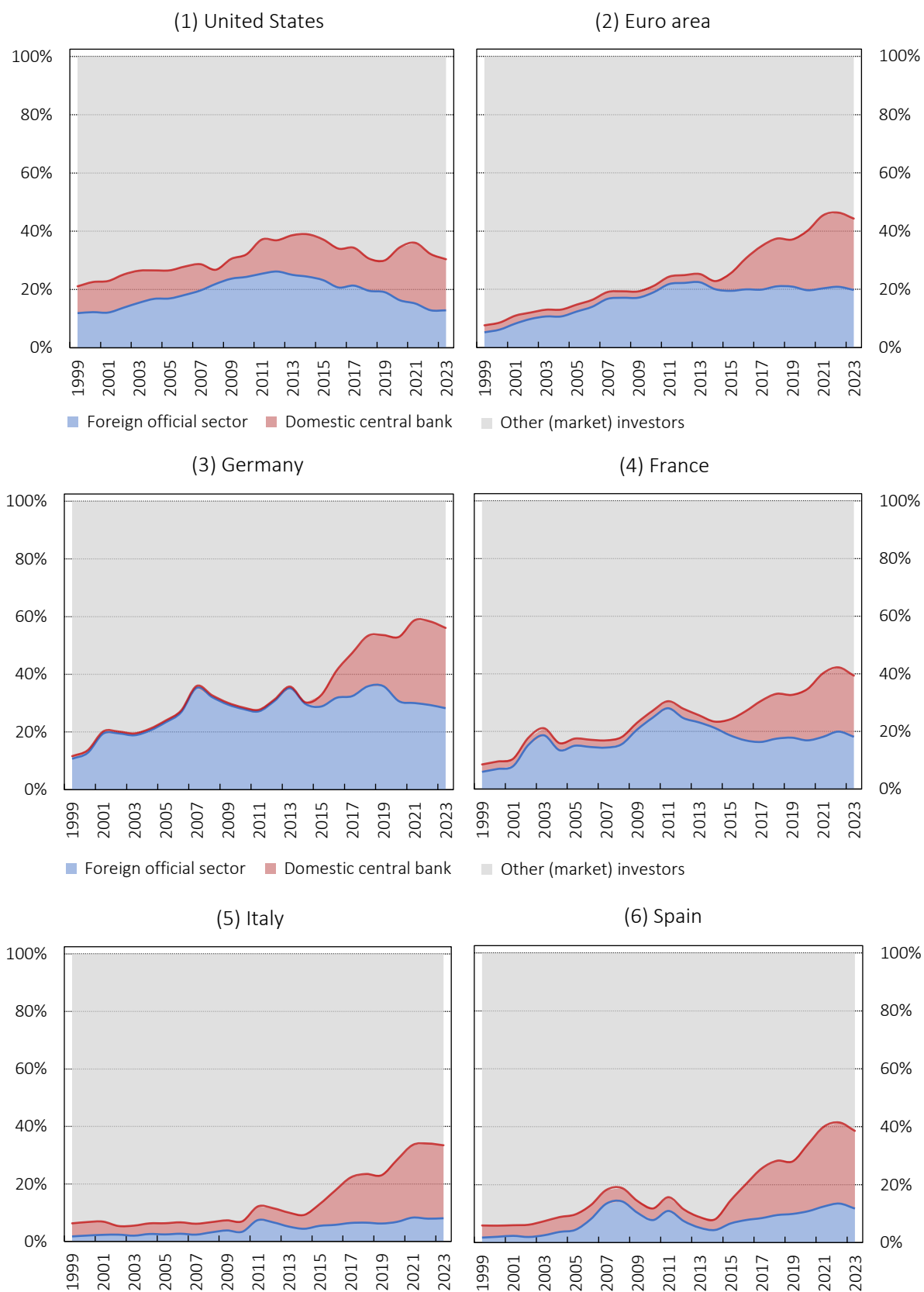
Figure 3. – Alternative path and spread of 10-year sovereign bond yields without
foreign official demand. Shaded areas represent confidence intervals.



The reasons behind such a large foreign reserve-driven borrowing cost advantage for Germany in comparison to the U.S. are far from obvious at first glance. After all, the overwhelming majority of assets held in foreign exchange reserves is still denominated in dollars, and global demand for euro reserves is only around a third of the dollar's share (Arslanalp, 2022). The disparity is not driven by bond supplies that are markedly different in size in proportion to foreign official demand: as shown on *Figure 4.*, foreign exchange reserves hold broadly similar shares of total U.S. and Euro area debt. However, the U.S. satisfies demand for safe dollar assets with a single, large supply of perfectly interchangeable Treasury securities that carry the same risks and rewards – while the Euro area consists of several member states with varying fiscal and market conditions, each issuing their own debt securities. As Krishnamurthy and Vissing-Jørgensen (2012) show, safe assets are characterised by a sense of certainty about their repayment, as well as high degrees of market liquidity, which typically stems from their large supply. Few nations in the Euro area can satisfy both: larger, but fiscally weaker economies cannot entirely guarantee the first condition, while fiscally strong, but smaller economies cannot provide a large enough supply of debt securities to ensure sufficiently high degrees of liquidity, since that would directly undermine their fiscal capacity, again threatening the certainty of repayment. Investors as cautious and conservative as foreign exchange reserves will therefore concentrate their demand on the bond markets of governments that satisfy both their safety and liquidity preferences (Eichengreen, 2011) – which, in practice, means Germany and France in the case of euro reserves.

Meanwhile, demand for safe assets denominated in the shared currency of the Euro area is larger than it used to be for the sum of its parts. As shown on *Figure 4.*, foreign official holdings of Euro area debt have increased significantly following the introduction of the single currency. This in line with the findings of Boz et al (2022) regarding the euro's strengthened role in trade invoicing compared to its predecessors: while nations with strong links to Europe invoiced most of their trade in dollars instead of deutschmarks or francs in the 1990s, they progressively shifted towards the euro after its introduction. Since there is a strong connection between trade invoicing and foreign exchange reserves (Eichengreen, 2011), this provides additional evidence that the introduction of the euro increased demand for safe assets issued by a select few of Euro area member states, amplifying their 'exorbitant privilege'.

Figure 4. – Share of general government debt held by foreign reserves, domestic central banks, and market investors



Based on Sovereign Debt Investor Base data from the IMF

Finally, the recent expansion of the ECB's balance sheet has further exacerbated the uneven distribution of the benefits stemming from the euro's international reserve role. ECB policymakers have been following the principle of 'market neutrality' in their asset purchase programmes, which meant buying government bonds in proportion to each member state's contribution to the central bank's capital key (which is broadly proportional to GDP). This approach has ignored the share of bonds held in foreign exchange reserves – even though that share is closely connected to the international role of the common currency, as described previously – and led to disproportionate reductions in the free float of debt securities across the Euro area. Taken together, foreign and domestic official holdings of German bonds have grown close to 60 percent of Germany's total debt stock, leaving little more than 40 percent of bonds to be traded on the market, thereby reducing their yields – first close to zero, and then even into negative territory. At the same time, foreign and domestic official holdings of Italy's bonds have barely approached 35 percent.

4. Implications

This paper has quantified the long-run borrowing cost reduction of reserve currency issuing nations due to the sustained demand for their government bonds by foreign exchange reserves. Results are statistically significant and differ in the United States and the Euro area as a consequence of structurally disparate bond markets.

Contrary to widespread but flawed narratives, the international role of the dollar does not give the United States a unique ability to finance its debt at low costs, let alone without limit. The yield compression on U.S. Treasuries due to foreign official demand for dollar denominated safe assets is significant, but no larger than the one enjoyed by France, and much lower than that of Germany. The growth of U.S. debt and the supply of Treasury securities has outpaced foreign official demand over the past decade, leading to a decline in America's borrowing cost advantage.

The benefits of the euro's international reserve role are unevenly shared between Euro area member states. The most straightforward solution to this imbalance would be a large common supply of debt securities similar to U.S. Treasuries. Since such levels of fiscal integration are politically unfeasible, the ECB could address the problem with a more flexible approach to asset purchases, which takes into account the share of member states' bond supply held in foreign exchange reserves.

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