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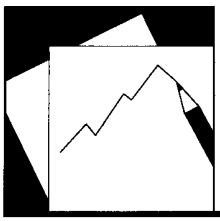

IMF Working Paper

Sovereign Debt Composition in Advanced Economies: A Historical Perspective

S. M. Ali Abbas, Laura Blattner, Mark De Broeck, Asmaa El-Ganainy, and Malin Hu

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Prepared by S. M. Ali Abbas, Laura Blattner, Mark De Broeck, Asmaa El-Ganainy, and Malin Hu*

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Abstract

We examine how the composition of public debt, broken down by currency, maturity, holder profile and marketability, has responded to major debt accumulation and consolidation episodes during 1900-2011. Covering thirteen advanced economies, we focus on debt structure shifts that occurred around the two World Wars and global economic downturns, and the subsequent debt consolidations. Notwithstanding data gaps, we are able to recover some broad common patterns. Episodes of large debt accumulation—essentially, large increases in debt supply— were typically absorbed by increases in short-term, foreign currency-denominated, and banking-system-held debt. However, this pattern did not hold during the debt build-ups starting in the 1980s and 1990s, which were compositionally skewed toward long-term local-currency debt. We attribute this change to higher structural demand for sovereign paper, linked to capital account liberalization in advanced economies, the emergence of a large contractual saving sector, and innovative sovereign debt products. With regard to debt consolidations, we find support for the financial repression-cum-inflation channel for post World War II debt reductions. However, the scope for a repeat of this strategy appears limited unless financial liberalization and globalization were materially rolled back or the current globally agreed monetary policy regime built around price stability abandoned. Neither are significant favorable structural demand shifts, as witnessed in the 1980s and 1990s, likely.

JEL Classification Numbers: JEL Numbers

Keywords: sovereign debt composition, sovereign debt management, historical debt database

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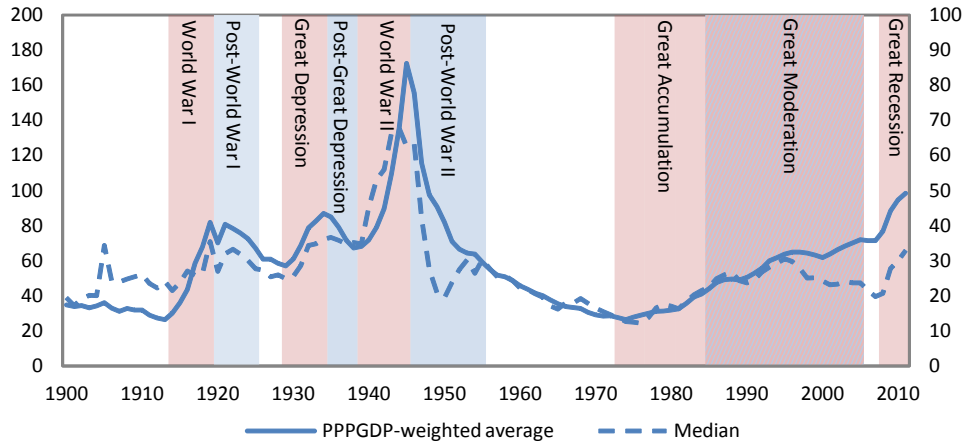
I. INTRODUCTION

The evolution of sovereign debt in advanced economies during the twentieth century is, by now, a familiar story (Figure 1). There are three visibly large spikes in the average debt-to-GDP ratio during World War I, the Great Depression, and World War II, and each of these debt accumulation episodes is followed by a period of reduction. After declining during the decades following World War II, the advanced economy sovereign debt ratio has risen consistently since the 1970s, an increase the Great Recession has exacerbated.

Figure 1. Debt-to-GDP Ratio in Advanced Economies, 1900-2011[1]



Source: Authors' calculations.

Not a lot is known about longer-term changes in sovereign debt *structure*, despite its salience in the debt management literature. It is well understood that debt structure matters for debt servicing costs, especially at high debt levels: short-duration debt can quickly re-price in the event of a rise in yields, raising the interest bill. There is also a broad consensus that proper sovereign debt management can help to provide fiscal insurance against macroeconomic shocks and can reduce crisis risks. However, our understanding of an "optimal" structure (and level) of sovereign debt from a macro-theoretical point of view, if it even were to exist, is still very limited, and there is no theoretical framework that allows us to interpret and explain in a unified way the broad historical patterns in sovereign debt structure we document in this paper.

Public debt structure is likely to be an important consideration today, as policymakers in advanced economies weigh alternative debt reduction options. With several advanced economy sovereigns under pressure to reduce debts from sixty-year peak levels, a study of past major debt reductions should be informative for the design of consolidation strategies and the management of fiscal risks. For instance, long-term local-currency debt held by the

[1] Based on data for the thirteen advanced economies covered in the paper. Belgium, France, Germany, Italy, Japan, Netherlands, Spain, Sweden, the U.K., and the U.S. have data beginning in 1900. Australia joins in 1901, Canada in 1914, and Ireland in 1936.

non-bank sector (especially non-residents) may be—at least in theory—easier and less costly to "inflate away" than if debt were held in foreign currency or held by the domestic banking system.

Against this backdrop, this paper provides first insights into sovereign debt structure trends over the last century for thirteen advanced economies. As our study covers a period going back to the beginning of the twentieth century, data gaps are inevitable. Nonetheless, using relatively inaccessible data on central government debt—broken down by currency of issuance, issuance maturity, currency of issuance, marketability and holder structure—we are able to glean broad common patterns in changes in debt structure during periods of debt accumulation and debt consolidation; offer country case studies to shed further light on interactions between debt structure, changes in debt-to-GDP ratio, and the macroeconomic environment; and draw upon historical experience to raise some policy considerations for present-day debt management, in a context of ongoing debt consolidation.

The rest of this paper is organized as follows. Section 2 discusses why debt structure matters. Section 3 documents overall trends in changes of sovereign debt structure along the dimensions outlined above. Section 4 examines changes in debt composition during major episodes of debt accumulation and debt consolidation. Section 5 looks into what lessons the history of sovereign debt composition may have for today's policymakers. Section 6 concludes and suggests further steps for research.

II. WHY DOES SOVEREIGN DEBT COMPOSITION MATTER?

Debt composition matters for debt service cost minimization.[2] In practice, sovereign debt managers generally consider minimization of longer-term borrowing costs at an acceptable level of refinancing and rollover risk to be their key objective. They use standard portfolio theory methods to determine the maturity composition of issuance in view of the prevailing yield curve, which reflects, among other factors, fiscal and monetary policies.[3] The cost-risk trade-off usually translates into issuance across the maturity spectrum, and debt managers have generally shown a preference for a relatively long average maturity. To the extent financial markets are seen to have a comparative advantage in diversifying risk, the cost-risk trade-off also implies that sovereign debt managers will typically prefer to issue marketable debt denominated in domestic currency and aim for a diversified investor base, up to the point where the benefit of additional risk transfer to investors is offset by a higher debt service cost.[4]

A prudent debt composition choice can also help reduce broader fiscal vulnerabilities and the risk of sovereign debt crisis. A literature focused on emerging market economies

[2] For a broader discussion of how debt service cost can matter for the speed and composition of fiscal adjustment, see Debrun and Kinda (2013), de Groot et al. (2013) and Dell'Erba et al. (2013).

[3] Debt managers in advanced economies typically consider fiscal and monetary policies as given, and don't seek to influence the interest rate level or the slope of the yield curve through debt management operations.

[4] These practices have been promoted as standards of good practice by international organizations (IMF and World Bank, 2000; OECD, 2002, a and b).

has identified "original sin," the inability to issue long-term sovereign debt in domestic currency, as a major source of fiscal vulnerabilities (see, for example, Eichengreen and Hausman, 2002, and Borensztein et al., 2004, which also formulates a number of proposals to address this problem). Advanced economies proved not to be immune to sovereign debt pressures during the recent global financial crisis, and now share concerns about fiscal vulnerabilities related to debt composition.[5] Issuing domestic currency debt with a long maturity can help reduce these vulnerabilities, but, depending on financial market conditions, this may not be an option or may be excessively costly.

An extensive and still growing macro-theoretical literature explores other channels through which debt composition matters. The optimal taxation approach argues that a proper choice of debt composition can help achieve tax smoothing by offsetting the impact of shocks on the budget: liabilities should be structured such that the debt service is relatively low in states of the economy where output is lower or spending higher than expected. [6] The debt composition which minimizes the need for tax adjustments will depend on the nature of the shocks affecting the budget. It will to an important degree depend on the monetary policy stance too: interest rate cuts in response to a negative growth shock can help bring down debt service costs and help offset the impact of the negative shock on the budget. From a macro-theoretical point of view, minimizing the costs and risks of interest expenditure will generally not achieve a welfare-maximizing debt composition (see, for instance, Missale, 2012).

A related strand of literature studies sovereign debt composition from the point of view of incentives to reduce the debt burden. Once investment positions are locked in, debt can be taxed away through inflation, financial repression, or outright default. A judicious choice of debt structure then can help taper these incentives, and avoid the welfare losses that can result if investors anticipate and counter the sovereign's incentives to tax away the debt. In particular, the debt can be structured ex ante in such a way that it will be very costly ex post for the sovereign to impose a debt tax. Alesina et al. (1992) and Blanchard and Missale (1994) show how the maturity composition of the debt matters from this time consistency perspective.[7] Drazen (1997), which contrasts domestic and external ownership, and De Broeck (1997), which focuses on debt held by the financial sector, examine the relationship between sovereign debt ownership and incentives to default. The importance of the

[5] These vulnerabilities have gained a prominent place in recent efforts to update the debt sustainability analysis framework for market access countries (IMF, 2013).

[6] With complete and frictionless financial markets, tax smoothing could be achieved through issuing contingent securities which yield lower returns when output is relatively low or government spending higher than expected (Missale, 1999), but such securities are not observed in practice. Furthermore, the payoff structure of conventional securities is substantially different from the one which would materialize if securities with explicit contingencies were to be issued (Faraglia et al., 2010). A more recent strand of macro-theoretical literature continues to be based on tax smoothing considerations but explores the implications of financial market imperfections, such as transaction costs of issuing debt, risk of default or monetization, and segmented investor demand (see, for example, Guibaud et al., 2013).

[7] Alesina et al. (1992) argue that a longer maturity can be better as it reduces the risk of confidence crises, while Blanchard and Missale (1994) conclude that shorter maturities could be preferable since they reduce incentives to reduce the real value of the debt through unexpected inflation.

distinction between domestic and foreign ownership of sovereign debt for incentives to tax away sovereign debt is also emphasized in Reinhart and Rogoff (2011).

In the remainder of the paper, major changes in the composition of sovereign debt are interpreted through the lens of a portfolio balance framework. Within this framework, the sovereign debt manager supplies debt to cover financing needs that are determined by broader policy considerations and economic conditions. The debt manager chooses the composition of the debt taking into account cost and risk considerations, as discussed above, and other objectives, such as the implications for the monetary policy and financial market development. The debt manager will face competing supplies from other issuers such as corporations. Matching the balance sheet of borrowers, investors will hold the debt supplied by the sovereign and other issuers. Investor demand reflects a return and risk trade-off, as studied in portfolio theory, and other considerations, for instance, regulatory requirements, "preferred habitat" preferences for particular debt characteristics or a desire for geographical diversification. If the debt is marketable and the market clears, expected returns will adjust to generate the investor demand that ensures that the supply of debt is willingly held by investors at any point in time (for an early application of this portfolio balance approach to the U.S. federal debt, see Roley, 1979, and for a survey of it, see Agell et al., 1992).

The debt composition can be affected by the sovereign's debt management and non-yield factors. If the market clearing combination of debt composition and expected returns is different from the one the sovereign debt manager prefers, debt management operations can change the composition of the supply and let expected returns adjust to make demand match supply. For example, a sovereign debt manager can issue additional long-term local currency debt to reduce risks, but could face a higher interest cost if higher returns are needed to achieve the corresponding change in the composition of demand. Factors other than relative yields will change desired supply and demand, which in turn will move relative yields up to the point where a new combination of debt composition and relative yields clears the market (for a further discussion of the adjustment process, see Friedman, 1977). The remainder of the paper focuses on these non-yield factors, and uses the historical record to help interpret major events in terms of large increases in supply or demand.

The basic insights of the portfolio balance framework continue to apply if markets do not clear. The sovereign may be unwilling to pay the very high interest rates required for market clearing and impose an interest rate ceiling. Or private sector investors could set a volume ceiling falling short of the sovereign's borrowing needs (credit rationing). In either event, the outstanding debt supply still will have to be held by investors. To have supply and demand match, the sovereign can generate additional private sector demand through non-market interventions or can change the ownership composition of the debt by placing debt with the domestic central bank or by borrowing from official lenders abroad. Non-marketable debt can be used for earmarked borrowing from designated investor classes. If markets do not clear, the portfolio balance framework does not any longer tie together the composition of sovereign debt and relative yields. However, factors other than yields will continue to influence supply and demand, and such factors will be reflected in the observed debt composition. Given the paper's focus on the non-yield factors that influence debt supply and

demand, it does not differentiate between market clearing and non-market clearing regimes and offers a unified interpretation in terms of large increases in supply or demand.

Given the range of factors that can affect sovereign debt composition, there is no uniform "optimal" composition. Under conditions of regular cyclical fluctuations and broad financial market stability, debt managers will focus on cost minimization, and investors will generally be able to accommodate debt managers' preferences for issuing in domestic currency and with a relatively long average maturity. Under such conditions, changes in the debt composition will usually be limited and primarily be linked to relative yield movements. However, in the wake of major political and military crises, such as the two World Wars; under conditions of deep economic and financial turmoil, such as during the Great Depression; or in periods of large-scale financial innovation, such as the rapid growth of global financial markets and the financial liberalization in Europe after the breakdown of the Bretton Woods currency arrangement in 1971, changes in the debt composition can be large and sudden—a manifestation of structural shifts in fiscal policy imperatives and sovereign borrowing needs, currency regimes, financial market architecture, and financial market conditions. Bordo et al. (2005) also emphasize major external shocks and financial innovation and globalization as key explanations for important changes in sovereign debt composition considered from an historical perspective.

This paper focuses on debt structure shifts during episodes of large and rapid debt accumulation and subsequent debt consolidation. Specifically, we consider the debt surges associated with the two World Wars and three deep and global economic downturns to be supply-driven. To the extent that additional borrowing needs still could be met through the market during debt surges, the sovereign generally had to accept less favorable conditions. These could include a shorter maturity or a different currency denomination than the preferred one. In some cases, market conditions deteriorated to the point that financial repression was a less costly or the only remaining option.

We also examine how the debt composition evolved during the consolidations that followed the debt surges.[8] We assess to what extent, and how quickly, the debt composition returned to patterns observed before the surge; and look for evidence of hysteresis effects. For the post-1971 period, special attention is paid to financial innovation in government debt markets and financial liberalization, in Europe in particular. Increased foreign ownership of sovereign debt in a context of financial globalization is interpreted as a demand shift. The paper does not provide a further analysis, however, of changes in the debt composition in between periods of large and rapid debt accumulation and subsequent consolidation, and how these changes could relate to evolving yield curves.

III. A BIRD'S EYE VIEW OF SOVEREIGN DEBT COMPOSITION DURING THE 20TH CENTURY

Sovereign debt structure data are remarkably elusive. Government treasuries should, in principle, keep an itemized record of all the securities they issue and loans they take up, along with terms and conditions, and publish related information in annual general accounts,

[8] For a similar approach, see Alesina (1988).

permitting construction of consistent and long time series on public debt structure by instrument. In practice, historical general accounts data are difficult to access, and debt composition series were taken from statistical yearbooks and debt management reports published by individual countries and from cross-country information published by the League of Nations and the United Nations (covering 1914–1980), the OECD (covering 1980–2010) and the IMF. Balance sheets of the central bank and the banking sector are the main source of information on debt ownership for the initial sample period. In part, this paper hopes to serve as motivation for additional efforts to further explore general accounts and other national sources of detailed debt data with a view to answering first-order macro-economic questions around sovereign debt composition.

Against this backdrop, we have focused our data collection efforts on the G-7 economies and six other advanced economies where debt structure statistics were relatively more accessible. The sample includes Australia, Belgium, Canada, France, Germany, Ireland, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom (U.K.), and the United States (U.S.). For each country, we collected debt structure data starting in 1900 (or the late 1800s, if available) along several dimensions (see below), where the ambition of our efforts was constrained by considerations of comparability over time and across countries.[9] The components of each dimension were then expressed in percent of total central government debt, summing to 100.[10] For a full accounting of the sources used, please refer to the appendix.

- ***Currency*:** foreign currency (FCY) vs. local currency (LCY) debt at issuance.[11]
- ***Maturity:*** LCY debt was sub-divided into short-term (ST), i.e., with less than one year maturity or the shortest maturity of more than one year for which data are available at the time of issuance, and medium- and long-term (MLT), the residual LCY debt. The sum of the shares of FCY debt, domestic MLT, and domestic ST debt equals 100. We have near-full coverage on these dimensions for all countries in the sample. The paper does not systematically consider a further breakdown of MLT debt by instrument (e.g., fixed versus variable rate; nominal versus indexed).[12]

[9] For instance, we use the share of debt with short maturity at issuance as a proxy for the maturity of sovereign debt overall. More detailed and more accurate maturity data, both maturity at issuance and remaining term to maturity, is available for a number of countries in our sample—and is amenable to further individual country studies—but not in a close-to-comparable form across countries over a longer period.

[10] We use central government debt rather than general government debt because the debt structure variables are, for the most part, only available for the former, especially during the earlier part of the sample period. Italy, which has continuous series on general government debt structure beginning in 1861, and Australia, for which consistent data are available for the combined Commonwealth and States only, are the exception to this.

[11] Reflecting data availability issues, the paper does not consider the laws under which debt securities were issued.

[12] The diversification of the instrument composition of MLT domestic sovereign debt in advanced economies is a relatively recent development. Variable interest rate and index linked debt instruments, for instance, were introduced on a wider scale from the late 1970s as inflationary pressures intensified; see Bröker (1993).

- ***Holders:*** central bank, domestic commercial banks, non-residents, and domestic non-bank sector.[13] A majority of countries in the sample have data on central bank holdings dating back to the 1920s. Figures on domestic commercial bank holdings are less extensive, with coverage for most countries beginning in the 1950s. Data on non-resident holdings are typically not available before mid-century, with Italy, the U.K., and the U.S. being notable exceptions.[14] For countries for which no information on non-resident holdings is available, and for the period through 1970,[15] we assume that foreign investors hold all the foreign currency debt but no domestic currency debt.
- ***Marketability*****:** non-marketable vs. marketable. Six countries in the sample (Canada, Germany, Italy, Spain, the U.K., and the U.S.) have long historical series on marketable debt that begin no later than 1936.

Reasonable attempts were made to use standardized definitions across countries, within the constraint that many primary sources were individual country sources. When dealing with data reported by individual countries over decades, it is impossible to ensure the definitional consistency across, or even within, an individual time series. This problem was attenuated, where possible, by cross-checking country data with cross-country public debt sources such as the United Nations' *Statistical Yearbooks*, but even these are quite upfront about the challenges of comparability. Thus, although we have done our best to ensure that the reported individual country shares and the group statistics are meaningful, we urge caution in their interpretation (for a further discussion of the statistical definition of public sector debt and its implications, see Dippelsman et al. 2012).

To get a glimpse of the context for major changes to debt composition, we start with long time series on PPPGDP-weighted average structure shares. We compute weighted averages using PPPGDP data from Maddison (2010).[16] As Figure 1 highlighted, there were several major events that impacted on public debt levels. Figures 2–5 show that these were also the times when debt structure—currency, maturity, marketability, and holders—underwent large changes.

The data confirm that the bulk of advanced economies' debt was and is denominated in *local currency* barring a few periods and countries (Figure 2). Debt issued in foreign currency accounted for less than 5 percent of central government debt prior to World War I. It climbed to a peak share of 17 percent by the end of the post-World War I consolidation

[13] Debt held by the domestic non-bank sector is defined as the residual share of debt not held by the central bank, domestic commercial banks, and non-residents.

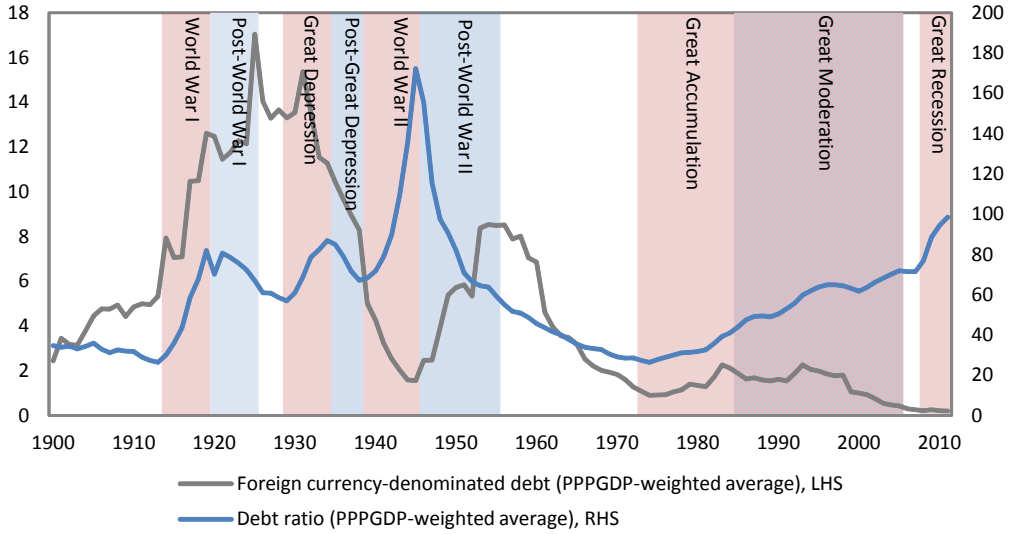
[14] Recent efforts to collect information on sovereign debt holders include Andritzky (2012); Arslanalp and Tsuda (2012); and Merler (2014). Taking into account differences in the definition of government (general government versus central government) and valuation (market value versus face value) the holdership data reported by these alternative sources are overall consistent with the ones in this paper.

[15] The 1970s marked the beginning of the era of financial globalization, during which non-resident holdings of sovereign debt denominated in the domestic currency of the issuing sovereign expanded rapidly, as discussed below.

[16] As detailed in the footnotes, sample constancy is not assured in these illustrations as some of the year-to-year fluctuations may be due to countries joining the sample.

period—as the U.S. extended loans to its European allies to finance relief and reconstruction efforts. It fell during the Great Depression, in part reflecting relief provided in 1934 on the U.S. loans (Reinhart and Rogoff, 2013),[17] and World War II, consistent with the end of the first era of globalization. There is a final spike in the share of foreign currency debt in the immediate post-World War II period, in Germany in particular,[18] but this share declines from around 8 percent in late 1950s to a negligible level today.[19]

Figure 2. Share of Foreign Currency Debt in Central Government Debt, 1900-2011[20]



Source: Authors' calculations.

Still, six of the thirteen countries saw the FCY debt share rise above 50 percent at some point during the sample period. Overall, however, the PPPGDP-weighted average share is around 5 percent, consistent with the original sin literature's stipulation that foreign currency indebtedness and associated risks have been a minor issue in advanced economies. While overall, the ratio of foreign currency debt-to-GDP was small throughout the period, it exceeded 10 percent in almost all countries at some point during the sample period and

[17] The suspension of the gold standard during World War I and its aftermath and again in the 1930s complicates the conversion of sovereign debt denominated in foreign currency into domestic currency. In some debt statistics from that period, the fixed gold standard parity was used for this conversion, even when the standard was suspended.

[18] Reflecting the 1953 London Agreement on German External Debts (a debt relief treaty between the Federal Republic of Germany and its main creditor nations), the share of foreign currency liabilities in the debt of the German central government (Bund) rose to more than 40 percent in 1953 and peaked at more than 45 percent in 1956, followed by a rapid decline. The aggregate evolution of the foreign currency share in the period between World War II through the mid-1950s needs to be interpreted taking into account the jump in Germany in 1953.

[19] Sweden is a notable exception, where foreign currency borrowing has been a permanent feature of the debt profile in the context of international reserves management.

[20] Australia joins the sample in 1901, Canada and Sweden join in 1914, and Ireland joins in 1924. All other countries are present in the sample from 1900 onwards.

reached very high levels in France and Italy after World War I.[21] The U.S. represents a notable exception to this, which could reflect the country's very low debt ratio before World War I and the increasingly important reserve currency status of the U.S. dollar subsequently.

The share of domestic medium- and long-term debt exhibits an intuitive trend, rising in good times and falling in bad (Figure 3). It is striking that the PPPGDP-weighted average share of domestic MLT debt never falls below 50 percent during our 111-year sample period.[22] This supports the view that advanced economies have generally not suffered from the "domestic original sin" problem—i.e., the inability to issue long-dated debt instruments in local currency—in a way that emerging economies have (Hausmann et al., 2003, and Hausmann and Panizza, 2003). In the pre-World War I era of fiscal orthodoxy, governments issued over 90 percent of their debt as domestic MLT securities, often perpetuities (consols). The share of domestic MLT debt fell dramatically during World War I, as governments rushed to meet military spending needs from short-term and foreign funding sources. The ratio rebounded to about 80 percent during the late 1930s. It plunged to about 64 percent during World War II but, somewhat in contrast to the post-World War I outturn, continued to fall until 1960 before recovering gradually to pre-World War II peaks by the mid-1990s.[23] It was interrupted, only temporarily, by the Great Recession.

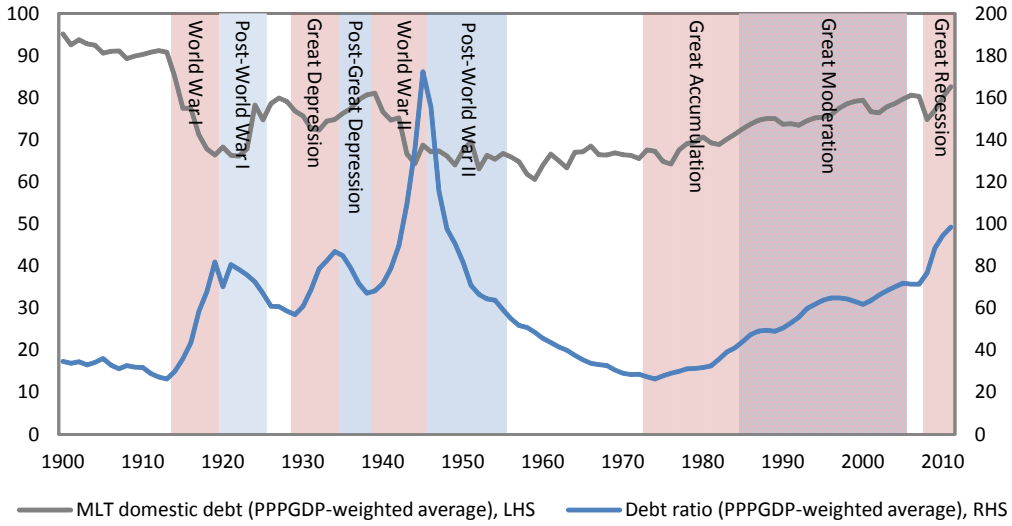
It is also useful to look at the share of short-term domestic debt in relation to GDP. This ratio averaged 12 percent of GDP, but exceeded 40 percent of GDP in seven countries at some point during the sample period. Most such increases were observed during the World War II debt build-up, reflecting financing pressures that had to be met through short-term funding sources. However, a sustained increase in the ratio of short-term debt-to-GDP took place from the mid-1970s through the mid-1990s, a period of relatively high inflation, when it climbed from 9 percent of GDP to 15 percent of GDP, respectively.

[21] The ratio of foreign-currency debt-to-GDP approached 100 percent in France in the mid 1930s and was subsequently brought down, in part by the 1934 relief on U.S. loans.

[22] There is some variation around the central tendency: the median standard deviation in the share across the 13 countries was 17 percentage points.

[23] The increase during the 1980s and 1990s was facilitated by demand-side developments: a surge in the demand for long-dated government securities by investor groups with long-term liabilities—such as insurance companies and pension funds.

Figure 3. Share of Domestic Medium- and Long-Term Debt in Central Government Debt, 1900-2011[24]



Source: Authors' calculations.

The cross-sectional variation in the domestic MLT debt shares reflects vulnerability to fiscal/military crises, reserve currency status, and debt management preferences. The drop in the share of MLT debt in 1923 reflects the hyperinflation in Germany, which wiped out MLT debt in that country.[25] The near-100 percent shares in the earlier years are in large part due to the two countries with reserve currencies, the U.K. and the U.S., where domestic MLT shares never fell below 50 percent.[26] In other countries, such as the Netherlands, the sovereign also preferred long maturities: the share of domestic MLT debt was high throughout most of the period, close to the median share of 74 percent, and fell below 40 percent for just six years during 1945–50.

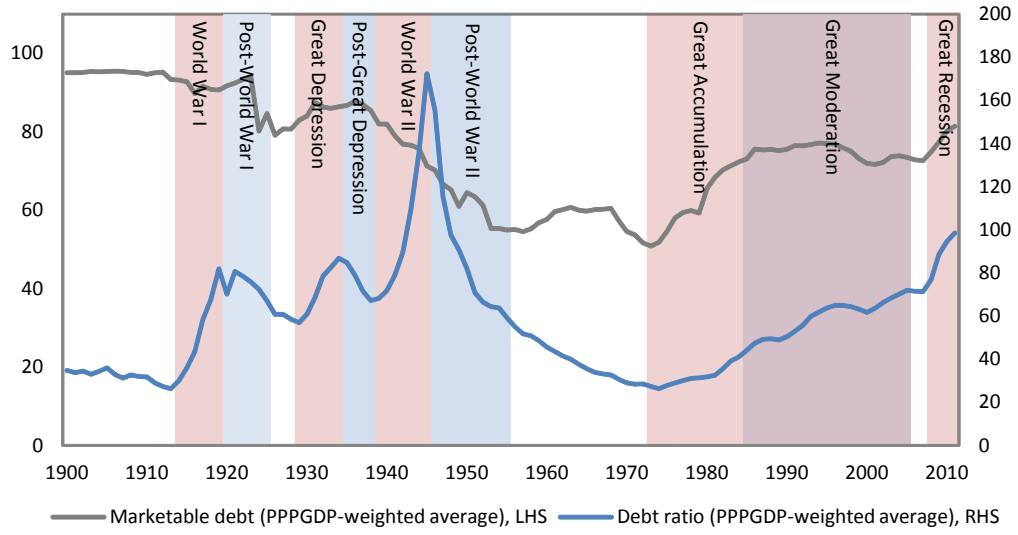
[24] Australia, Canada, and Sweden join the sample in 1914, and Ireland joins in 1924. All other countries are in the sample from 1900 onwards.

[25] France was on the edge of a hyperinflation in 1926, as political deadlocks, including on fiscal policy, constrained the ability to raise taxes and resulted in speculative movements against the franc. However, this was averted by the "Poincare stabilization program," which included tax measures, the appointment of an independent governor of the Central Bank, and the creation of a "Caisse d'Amortissement" to manage public debt—with focus on lengthening the maturity profile of public debt. In Italy, the period 1919–22 witnessed very little progress on debt and deficit reduction. Even though a levy on wealth was introduced, it faced implementation difficulties, and as a result deficits remained high, and inflation and money supply increased substantially. However, expenditure cuts and tax increases during 1923–27 placed a lid on the growth of public debt, which together with rapid growth contributed to a large decline in the debt ratio. In addition, two mandatory conversions, "conversione forzosa," in 1926 and 1934 helped lengthen maturity but at a substantial reputational cost: in the 10–15 years following the "conversione forzosa," the government found it extremely difficult and costly to borrow on short term basis.

[26] The fall in the share in the mid-1910s corresponds to the addition of Canada, which, as a relatively nascent independent state at the time, started with a zero share of domestic MLT debt.

The share of marketable debt illustrates governments' reliance on unconventional means in periods of high indebtedness (Figure 4). Almost all central government debt was issued in the form of marketable securities prior to World War I. The marketable share of debt declined during the post-World War I consolidation with the expansion and establishment of various government programs in the U.S., before falling precipitously (to as low as around 55 percent) during and after World War II, an era characterized by financial repression and captive markets. Reinhart and Sbrancia (2011) have suggested that the combination of unorthodox debt management strategies, including non-marketable debt issuance, and a steady dose of inflation, was critical to liquidating the unprecedented burden of World War debts in many advanced economies, especially the U.S. It was not until the mid-1970s that the share of marketable debt began to recover, standing at about 80 percent of total central government debt today. This trend has not been reversed by the Great Recession.[27]

Figure 4. Share of Marketable Debt in Central Government Debt, 1900-2011[28]



Source: Authors' calculations.

The data suggest an interesting pattern of holder substitutions, with commercial banks usually picking up the tab from the domestic nonbank sector during crisis periods (Figure 5a).[29] The share of sovereign debt held by domestic commercial banks varies across countries and over time. Large debt increases during the wars and the "tough" 1970s were

[27] It should be noted that the distinction between marketable and non-marketable debt varies across countries. The dip visible in the latter half of the 1990s is primarily due to the U.S., where non-marketable debt includes securities issued to targeted investors for specific purposes, e.g., the funding of government programs.

[28] Germany, Italy, Spain, the U.K., and the U.S. are in the sample from 1900 onwards. Canada joins in 1914, the Netherlands in 1933, France in 1949, and Australia in 1950. Series for Belgium, Japan, and Sweden begin in 1980. No data are available for Ireland.

[29] An increase in the share of a given holder (e.g., the share of commercial bank-held debt) has to be matched by a drop in the share(s) of the other holder(s), given the adding-up constraint. This mechanism cannot be interpreted as suggesting causality. For instance, it is not necessarily the case that an increase in the share of commercial bank-held debt indicates an ex ante decision by commercial banks to hold more government debt. It is rather an ex post reflection of the combined portfolio decisions of all possible debt holders, based on a large number of factors.

typically absorbed by domestic commercial banks, with the opposite trend for the domestic nonbank sector's participation. This inverse relationship breaks down with the Great Moderation (mid-1980s until 2007), during/after which both shares fall. Changes in the regulatory framework, including those since the 1988 Basel Capital Accord, could have been an influencing factor in domestic banks' holdings of sovereign debt.

Similarly to commercial banks, central banks' ownership of government debt has also typically increased in times of distress (Figure 5b). The share of debt held by the central bank rose substantially from the early 1930s in line with acute financing needs in the aftermath of the Great Depression, and continued to increase sharply through World War II and the immediate post-war period, reaching 17 percent and staying broadly at that level until the mid-1970s before falling to about 6 percent in the run up to the Great Recession.

Over the sample period, relative to GDP, central bank holdings of government debt in advanced economies were relatively small, averaging about 5 percent of GDP. They peaked at 19 percent of GDP during World War II—with central bank holdings rising across almost all countries, particularly in Belgium, France, Italy, the U.K., and the U.S. The instances when the holdings rose to above 10 percent of GDP were largely confined to periods of military conflicts, particularly during World War II. However, central bank holdings in some countries, the U.K. and the U.S. in particular, are now quite high by historical standards, and developments in these countries largely explain the noticeable uptick in the average ratio of central bank holdings to GDP during the Great Recession.

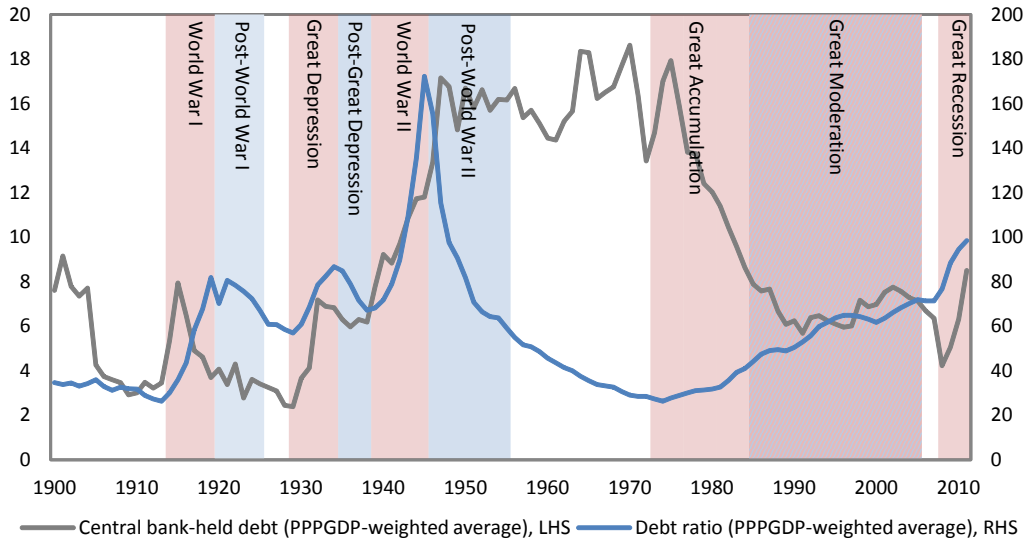
Non-resident holdings as share of GDP have exhibited a rising trend since the "Great Accumulation."[30] The ratio increased steadily from 2 percent of GDP in the mid-1970s to 29 percent of GDP in 2011. A number of factors underlie this trend: financial innovation and globalization during the 1970s and 1980s; reduced capital controls; improved debt management in issuing countries; independent central banks committed to low inflation; the introduction of the euro, which led to the de facto elimination of currency risk within the euro zone and mispricing of sovereign risk for euro zone peripheral economies; and the accumulation of U.S. government debt in the portfolios of emerging Asian countries, China in particular.[31]

[30] The term "Great (Debt) Accumulation" was coined in Abbas et al. (2014), and refers to the period from the early-1970s till the mid-2000s during which public debt (in PPPGDP-weighted average terms) of advanced economies rose by about 40 percentage points, despite the absence of a global crisis. A number of factors combined to deliver this increase: a reduction in the rate of growth from the first three post-World War II decades; the collapse of the Bretton Woods system; the two oil price shocks; and, most notably, the rise of welfare states, and the accompanying permanent increase in government expenditure, in advanced economies.

[31] China's holdings of U.S. treasury securities rose from 10 percent of total foreign holding in 2003 to 26 percent by 2010 (Morrison and Labonte, 2013).

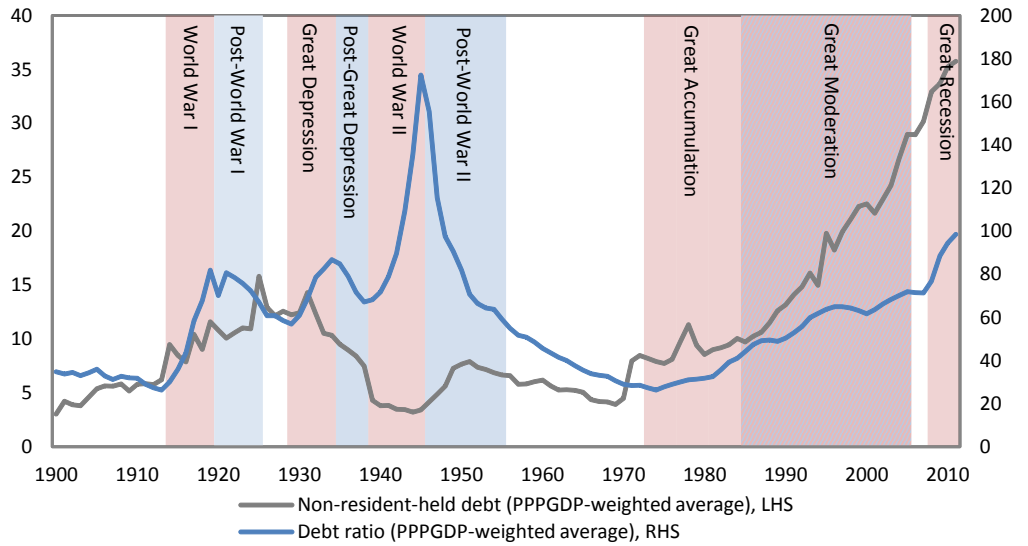
Figure 5. Holder Composition of Central Government Debt, 1900-2011

a. Shares of central bank holdings[32]



Source: Authors' calculations.

b. Shares of non-resident holdings[33]

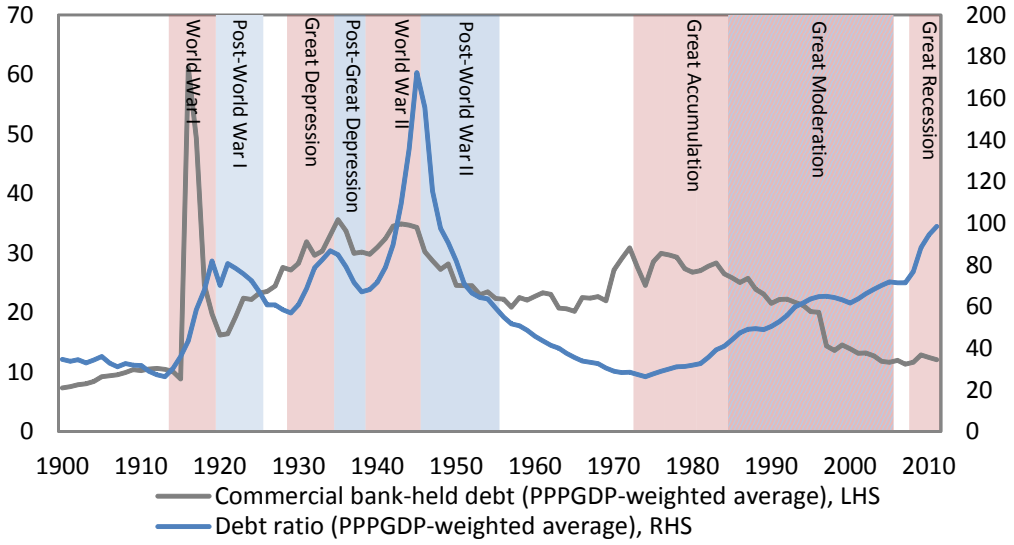


Source: Authors' calculations.

[32] Belgium, Italy, Japan, and the Netherlands are in the sample throughout the period. The U.S. joins in 1916, the U.K. in 1920, Sweden in 1922, France in 1936, Canada in 1946, Australia and Germany in 1950, Ireland in 1959, and Spain in 1987.

[33] Italy is the only country for which data are available from 1900. The U.S. joins in 1916, Canada in 1953, Belgium and the U.K. in 1957, Germany in 1961, Japan and the Netherlands in 1980, Australia in 1986, France and Spain in 1987, and Ireland and Sweden in 1995. For the countries for which no data on non-resident holdings are available and until 1970, the share of foreign currency debt (coverage of which is discussed in footnote 20) is used as proxy for the share of externally held debt.

c. Shares of domestic commercial bank holdings[34]



Source: Authors' calculations.

IV. Debt Structure Changes During Large Debt Increases and Decreases

Unsurprisingly, most noteworthy debt structure shifts in individual economies occurred around large episodes of debt accumulation and consolidation. Put simply, the relative sizes of the various components of the debt stock changed the most when the debt stock itself was expanding or contracting in a big way. Moreover, barring a few exceptions, the country-level expansions and contractions themselves coalesced around major *global* events: World Wars I and II (1914–18 and 1939–45), the Great Depression (1929–34), the "Great Accumulation" (1975–2005); the Great Recession (2007 onward); and the debt consolidations which followed these surges. We study these episodes individually. Reflecting data availability and the nature of the episodes,[35] only a sub-sample of countries will be discussed for each episode.

Debt Structure Changes During Large Debt/GDP Increases

The <u>two World Wars</u> resulted in large increases in the supply of government debt, which then had to be met through better "risk-return terms" for voluntary investors, or by forced holdings. Table 1 illustrates the intuitive decrease in the share of domestic MLT debt during World War I, effectively representing a transfer of risk from voluntary investors

[34] Italy and the Netherlands have data from 1900 onwards. The U.S. joins in 1916, the U.K. in 1920, France in 1936, and Ireland in 1937. Sweden enters the sample in 1945, Canada in 1946, Australia and Germany in 1950, Japan in 1953, Belgium in 1957, and Spain in 1987.

[35] For example, Sweden's debt-to-GDP ratio declined during World War I—as it remained neutral in the war—even as debts built up for all other countries in our sample.

to the issuing government. Foreign currency and/or domestic ST debt compensated the shortfall, where the latter is likely to have been facilitated by the emergence of the banking system as a source of short-term finance.[36] A similar decrease in the share of domestic MLT debt was observed during World War II (Table 2), but unlike World War I, it was not offset by an increase in the share of foreign currency debt (consistent with the compression in world trade and capital flows which had set in with the Great Depression), and involuntary demand had to fill the gap. Thus, the share of central bank-held debt and non-marketable debt generally increased during this period, symptoms of "financial repression" à la Reinhart and Sbrancia (2011).[37]

The Great Depression saw similar changes as above in the holder composition of debt, but there was no clear pattern in relation to maturity structure. Increases in the share of central/commercial bank holdings were observed for Italy, Japan, the Netherlands and the U.K., and the U.S., while non-resident holdings for all but one country fell (consistent with implosion of capital and trade flows that began in this period). Although the share of domestic debt rose commensurately during these episodes—suggesting an interpretation in terms of a large increase in supply—there was no clear pattern with regards to issuance maturity: in one group of countries (Canada, Netherlands, Sweden, the U.K., and the U.S.), the share of domestic MLT debt declined, whereas in a second group (Belgium, France, Italy, Japan, and Spain) it increased. It is likely that a complex interplay of the increase in supply with changes in demand factors (such as a greater appetite for safe government assets in times of uncertainty) underlies these divergent patterns; and requires deeper/further analysis beyond the ambit of this paper.

[36] In France and the U.K., the shares of both foreign debt and domestic ST debt grew at the expense of domestic MLT debt, reflecting the increase in foreign loans extended by the U.S. to its European allies during that time, as well as acute financing needs during and after the war that were met through the issuance of short-term debt. Indeed, out of the countries that experienced a growth in debt during this period, France registered the largest drop in the share of domestic MLT debt, which fell from 94 percent in 1913 to 41 percent in 1919.

[37] For instance, the share of central bank-held rose from 3 percent in 1938 to 48 percent in 1945 in Belgium, and from 5 percent to 45 percent during the same period in Italy.

Table 1. World War I: Maturity and Currency

(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP			Domestic MLT			Domestic ST			Foreign currency		
	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
BEL (1914-22)	39	136	97	90	35	-54	10	47	37	6	18	12
CAN (1914-21)	22	71	49	0	65	65	42	16	-27	57	19	-38
DEU (1913-19)	9	100	90	95	52	-44	5	48	44	0	0	0
FRA (1913-19)	68	244	176	94	41	-53	6	33	27	0	26	26
GBR (1914-23)	28	178	151	98	75	-23	2	10	9	0	15	15
ITA (1913-20)	85	186	101	65	27	-38	23	20	-3	12	53	41
NLD (1914-22)	47	64	17	87	73	-14	13	23	10	0	4	4
USA (1916-21)	2	34	32	100	89	-11	0	11	11	0	0	0
Median	*33*	*118*	*94*	*92*	*59*	*-30*	*8*	*22*	*11*	*0*	*16*	*8*
Average	*37*	*127*	*89*	*79*	*57*	*-21*	*13*	*26*	*13*	*9*	*17*	*7*

Source: Authors' calculations.

Table 2. World War II: Maturity, Currency, and Marketability

(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP			Domestic MLT			Domestic ST			Foreign currency			Marketable		
	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
1946 AUS (1938-46)	118	160	43	48	63	14	4	17	13	48	21	-28			
1943 BEL (1939-43)	74	182	108	59	31	-28	9	57	48	32	12	-19			
1946 CAN (1941-46)	57	150	92	79	93	15	8	5	-3	14	1	-12	87	85	-2
1944 DEU (1937-44)	19	200	181	58	43	-15	32	56	25	9	0	-9	77	99	22
1944 FRA (1938-44)	102	280	179	45	35	-10	23	64	42	32	0	-31			
1946 GBR (1940-46)	121	249	128	72	68	-4	16	26	10	11	6	-6	73	52	-21
1943 ITA (1939-43)	91	133	42	60	40	-20	39	59	20	1	1	0	68	50	-18
1946 JPN (1935-44)	67	484	417	81	65	-16	6	35	28	13	0	-12			
1945 NLD (1939-46)	70	368	298	74	34	-41	26	66	41	0	0	0	96	99	3
1945 SWE (1939-48)	20	50	30	94	76	-18	6	24	18	0	0	0			
1946 USA (1941-46)	39	126	88	96	74	-22	4	26	22	0	0	0	78	73	-5
Median	*70*	*182*	*108*	*72*	*63*	*-16*	*9*	*35*	*22*	*11*	*0*	*-9*	*78*	*79*	*-4*
Average	*71*	*217*	*146*	*70*	*57*	*-13*	*16*	*40*	*24*	*15*	*4*	*-11*	*80*	*76*	*-4*

Source: Authors' calculations.

Exchange rate depreciations and the associated valuation effects partly account for the observed debt surges during 1914–1945.[38] Some countries in our sample saw large increases in foreign currency and total debt (as shares of GDP) that were accompanied by

[38] The exchange rate did not play a major role for public debt dynamics in advanced economies outside this period. As documented by Eichengreen (1996), before World War I, a system of fixed exchange rates prevailed where, with monetary authorities credibly committed to maintaining exchange rate stability, currency speculation was rare. This stability was challenged in the inter-war period, characterized by fiscal crises and the Great Depression, with several currency and banking crises occurring despite, and, perhaps, "partly because of" (Bernanke, 2004) the gold standard. In the post-World War II period, characterized by low reliance on foreign currency debt and, with the exception of Canada, fixed exchange rates under the Bretton Woods arrangement, occasional devaluations preceded or accelerated debt reductions, as in the U.K. (1949, 1967 and 1973), the Netherlands (1949), France (1957), and Spain (1955–59).

sizable real effective exchange rate (REER) depreciations. For instance, in France (1925) three-fourth of the 16 percent of GDP rise in foreign currency debt was the valuation effect of a 20 percent real depreciation.[39] The most significant episode was Italy (1913–20), where foreign currency debt grew by 88 percent of GDP, two third of which reflected a 130 percent cumulative real depreciation.[40]

Interestingly, the Great Accumulation (1975–2005) saw lengthening debt maturities, greater marketability and stronger non-resident participation (Table 3).[41] The trend is interesting because longer debt maturities would—ceteris paribus—typically imply a reduction in risk for the government, something one would not expect when governments are expanding issuance. The explanation for this rests on a number of factors, both supply and demand side. Sovereigns made an effort during this period to enhance the marketability and liquidity of their debt instruments, and strengthened the institutional frameworks for debt and inflation management, the latter through the emergence of independent central banks.[42] Sovereigns were also willing to borrow at relatively high real interest rates.[43] This supported the demand for domestic currency sovereign paper at a time when financial liberalization/global capital mobility, and the associated search for diversification, were on the rise, as was the appetite for long-dated instruments from the contractual saving sector (e.g., pension funds and insurance companies).Together, these structural changes enabled countries to finance their rising debts via higher domestic MLT debt and non-resident holdings while reducing reliance on central banks and financial repression—see Box 1 for an illustration of the French and Belgian experiences.

[39] In another French episode (1933–35), the foreign currency debt increase was larger (55 percent of GDP), but the valuation effect was more modest (6 percent), consistent with a 5 percent cumulative depreciation. The absence of REER data prevents further decomposition of the 57 percent of GDP increase in foreign currency debt observed in France between 1916 and 1922.

[40] Other counties also witnessed large foreign currency debt increases during this period—such as Australia (1927–32, 40 percent of GDP); and Belgium (1918–26, 57 percent of GDP)—but lack of data prevents a further breakdown of these increases into valuation effects and net borrowing.

[41] Sovereign debt during this episode exhibited the slowest pace of accumulation in the sample period, increasing at a weighted average of 3 percentage points of GDP per year.

[42] The shares of marketable debt rose substantially in the typical country episode, reflecting innovations in financial markets—including the issuance of index-linked instruments, and higher-liquidity "benchmark" securities—in a number of advanced economies.

[43] This marks an important difference with the debt surges related to the two World Wars. Reflecting a pick-up in inflation, during these war episodes, real long-term interest rates generally turned negative, with a moderating effect on the debt dynamics.

Table 3. The Great Accumulation: Maturity, Holders, and Marketability[44]

(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP			Domestic MLT			Central bank			Non-residents			Marketable		
	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
BEL (1974-88)	39	108	69	80	56	-24	5	3	-2	2	20	19	…	56	
CAN (1981-95)	26	57	31	57	44	-13	18	5	-13	11	27	16	72	92	21
DEU (1971-98)	7	49	42	94	97	3	8	0	-8	1	34	33	27	86	60
ESP (1978-96)	6	54	48	98	61	-37	…	7		…	12		22	87	65
FRA (1974-2005)	7	51	44	54	68	14	13	1	-12	1	56	55	55	100	45
IRL (1973-87)	46	103	57	61	51	-10	17	8	-9	…	…		…	…	
ITA (1964-94)	29	126	97	27	68	41	24	10	-14	4	15	10	41	86	46
NLD (1974-93)	19	61	42	79	98	20	0	1	1	…	26		61	76	14
JPN (1964-87)	5	57	51	32	78	45	56	6	-50	5	2	-3	…	84	
SWE (1966-85)	16	69	53	81	47	-34	32	11	-20	0	…		…	85	
USA (1979-96)	33	71	38	68	78	10	14	7	-6	14	21	7	62	65	4
Median	*19*	*61*	*48*	*68*	*68*	*3*	*15*	*6*	*-11*	*3*	*21*	*16*	*55*	*86*	*45*
Average	*21*	*73*	*52*	*66*	*68*	*1*	*19*	*6*	*-13*	*5*	*24*	*19*	*48*	*82*	*36*

Source: Authors' calculations.

Finally, the Great Recession has overall not significantly dented the maturity or currency structure of debt in the countries in our sample, but there is a clear rise in the share of the banking system's holdings (Table 4). The additional debt supply resulting from widening deficits and banking sector support was partially met by additional demand from central banks, which acquired own-government debt instruments in the secondary market to facilitate monetary policy transmission and achieve quantitative easing. These interventions benefitted both the sovereign and the central bank, an unusual confluence of interest explained by the uncommon financial market conditions. "Flight to safety" considerations sustained demand from domestic commercial banks and non-residents in spite of very low yields.[45] As a result, there was no clear change in the maturity, currency, or marketability of debt during the Great Recession in the countries in our sample.[46] Some preliminary patterns on holder structure are visible, however. An increase in the holdings of commercial banks, central banks, and, to a lesser extent, non-residents—as also noted in Arslanalp and Tsuda (2012)— was matched by a decline in the share of the non-bank domestic sector's holdings.[47] The decline was greatest in the United Kingdom (a 33 percentage-point drop) and was picked up mainly by the central bank and the domestic banking sector.

[44] For three countries (France, Japan, and Spain), the starting year of a country's debt increase episode predates the series on non-resident holdings of debt. In these cases, the "start" figure for non-resident holdings refers to the first year for which data on non-resident holdings are available. A similar substitution is performed for the series on Spain's central bank holdings.

[45] The very high share of resident-held debt in Japan may suggest massive home bias. However, this may be a premature conclusion given that Japan's private sector holds very large net assets, and only a part of these are invested domestically.

[46] However, in the euro zone crisis countries—Cyprus, Greece, Ireland and Portugal—flow data show a clear shift toward shorter maturity and foreign currency debt issuance; see De Broeck and Guscina (2011).

[47] In euro zone countries that have faced financial market pressures sovereign debt purchased by the ECB under the Securities Market Programme—only aggregate information on which is available before 2012—would be classified as non-resident debt, even though it might be more naturally construed as central bank-held debt. Moreover, financing provided by the ECB to domestic banks in these countries served as a mechanism to support demand for sovereign paper, which is reflected in the share of bank holdings.

Box 1. Financial Innovation in Belgium and France, 1976-1998

Belgium and France present two instructive examples of the structural changes that occurred between 1976 and 1998 (the last pre-euro year), in spite of the different paths their respective debt stocks and debt composition profiles have taken. During the first decade of the Great Accumulation (highlighted in pink), Belgium experienced rapid debt growth accompanied by a shortening of the maturity profile, an increase in foreign currency debt, and a slight uptick in central bank holdings. Funding pressures delayed the introduction of financial innovation in the domestic sovereign debt market. France, by contrast, went through a more gradual debt increase during the Great Accumulation and saw the forces of financial innovation introduced in the early to mid-1980s play out in full. In both countries, but in Belgium more than half a decade later than in France, standardized bills and bonds issued through competitive auctions following a pre-announced schedule and using a primary dealer arrangement replaced instruments with different characteristics tailored to particular investor groups and issued using different techniques. Lines of linear bonds were introduced, each line consisting of several successive tranches of straight bullet bonds with the same characteristics, including the coupon and the maturity. These innovations greatly enhanced the liquidity and efficiency of the secondary markets for government bills and bonds, and stimulated foreign investor interest in these markets, a positive demand shift. They also took the ownership composition of the debt beyond the sovereign's choice. In the Great Recession (highlighted in yellow), both countries experienced large debt increases without major changes to debt composition, suggesting financial innovation has made the debt structure more resilient.

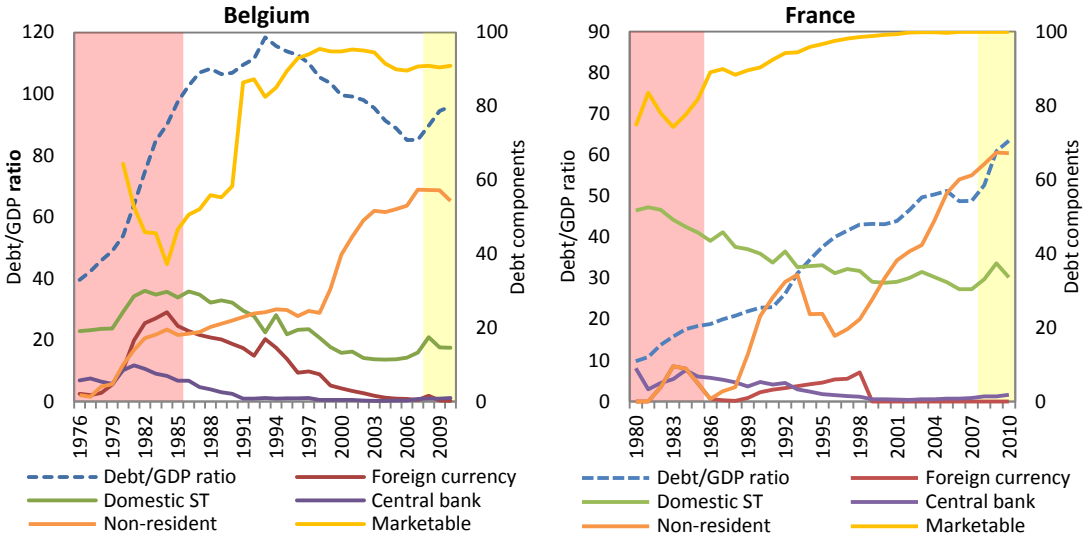


Table 4. The Great Recession: Holders

(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP			Central bank			Com banks			Non-residents			Non-bank domestic		
	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
AUS (2008-11)	5	14	8	2	2	0	6	16	10	59	67	8	34	15	-19
BEL (2007-11)	85	98	13	1	1	1	25	31	6	57	48	-10	17	20	3
CAN (2007-11)	25	36	11	13	10	-4	17	15	-1	12	26	14	57	49	-9
DEU (2007-10)	39	43	4	0	0	0	30	23	-7	49	54	5	21	22	2
ESP (2007-11)	30	56	26	3	5	2	3	12	8	39	50	10	54	33	-21
FRA (2007-11)	49	66	17	1	3	2	9	6	-3	61	65	4	29	26	-3
GBR (2007-11)	40	73	34	0	17	17	-3	9	12	24	27	3	79	46	-33
IRL (2007-11)	20	75	55	0	2	1	6	21	14	93	78	-15	1	0	-1
ITA (2007-11)	103	121	17	4	5	1	23	27	4	41	38	-2	32	30	-2
JPN (2007-11)	166	204	38	10	9	-1	36	35	-1	5	7	1	49	50	0
NLD (2007-11)	42	60	18	0	0	0	10	12	1	63	62	-1	27	26	-1
USA (2007-11)	66	101	35	8	11	3	1	2	0	26	33	7	64	54	-10
Median	*41*	*70*	*18*	*1*	*4*	*1*	*10*	*16*	*3*	*45*	*49*	*4*	*33*	*28*	*-3*
Average	*56*	*79*	*23*	*4*	*5*	*2*	*14*	*17*	*4*	*44*	*46*	*2*	*39*	*31*	*-8*

Source: Authors' calculations.

Debt Structure Changes During Large Debt/GDP Decreases

The post-World War I debt consolidations witnessed sovereigns reverting, to varying extents, to the pre-war funding orthodoxy (Table 5). The massive increase in supply generated by the War was reversed through fiscal consolidation efforts and, in Germany, by hyperinflation which wiped out the debt.[48] Leaving aside the case of Germany, the return to pre-War patterns of debt composition is evidenced by the 7 percentage-point increase, on average, in the share of domestic MLT debt. This increase came at the expense of domestic ST debt, while the share of foreign currency debt continued to grow slightly, as foreign loans from the U.S. to European allies were channeled to fund post-war relief and reconstruction efforts.

[48] In the U.K., however, the debt-to-GDP ratio continued to increase in the early 1920s, reflecting the very high real interest rates during the price deflation in that period, and remained at or near peak levels through the 1930s; see Crafts (2014 a and b) for a further discussion.

Table 5. Post-World War I Consolidation: Issuance and Currency
(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP			Domestic MLT			Domestic ST			Foreign currency		
	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
DEU (1919-23)	100	0	-100	52	1	-51	48	99	51	0	0	0
BEL (1922-30)	136	60	-76	35	47	12	47	2	-45	18	51	33
CAN (1921-29)	71	43	-28	65	66	0	16	13	-3	19	22	3
FRA (1922-29)	236	138	-98	44	51	7	24	9	-16	32	40	8
ITA (1920-26)	186	103	-83	27	34	7	20	20	1	53	46	-8
NLD (1922-29)	64	41	-24	73	86	13	23	10	-14	4	5	1
USA (1921-29)	34	16	-18	89	90	1	11	10	-1	0	0	0
Median 1/	*104*	*52*	*-52*	*55*	*58*	*7*	*22*	*10*	*-8*	*18*	*31*	*2*
Average 1/	*121*	*67*	*-54*	*56*	*62*	*7*	*24*	*11*	*-13*	*21*	*27*	*6*

1/Excluding Germany.
Source: Authors' calculations.

Debt decreases following the Great Depression were characterized by a decline in the share of foreign currency debt as earlier war-related debts fell due or were forgiven. In most cases, this decline was largely mirrored by an increase in domestic ST debt with the emergence of the banking sector as a source of financing, as opposed to MLT debt. Finally, where data are available, it appears that financial repression emerged as a consolidation strategy for the first time. Marketable debt, which is typically harder to inflate away or technically default on (by changing the terms of the contract, for instance), declined as a share of total debt. In Italy and the U.K., the decline was 16 and 4 percentage points, respectively. Unsurprisingly, non-residents' holdings of central government debt also fell.

The post-World War II consolidations—the largest and, in many countries, the most rapid consolidation episode—saw heterogeneous debt structure changes (Table 6). As noted by Abbas et al. (2014), most of these debt reductions occurred in an environment of low, often negative, real interest rates, and strong growth. Negative real interest rates in a number of countries reflected a combination of steady relatively high inflation and financial repression (Reinhart and Sbrancia, 2011). Negative real interest rates influence both supply and demand of debt. On the supply side, they help bring down debt measured in real terms (or as a share of GDP). On the demand side, they have a negative impact, the more so the longer the debt maturity. Depending on countries' ability and preference for financial repression, different outcomes are possible. Indeed, we find that in one group of countries (Canada, France, Italy, Japan, and the U.S.) the shares of central bank-held and non-marketable debt rose, on average, while the share of domestic MLT debt declined. In a second group (Australia, Belgium, the Netherlands, Spain, Sweden, and the U.K.), central bank-held and non-marketable debt shares fell, on average, but maturity lengthening was observed.

Further investigation reveals the key role of inflation in explaining these divergent patterns, as well as its double-edged effects. In the first group, where the debt ratio fell much more, the resort to inflation was noticeably more intensive. But this was not costless. First, there was greater reliance on distortionary non-market interventions to extract the necessary (involuntary) demand for debt. Second, debt maturities shortened, reflecting the

likely reduction in (voluntary) investor demand for longer-dated paper. Once the welfare costs of higher inflation are incorporated (à la Fischer, 1981 and 1994; Lucas, 2000), the calculus on the net benefits of inflating away debt becomes even more complex. However, it appears that tolerance for higher inflation in the first group of countries reflected institutional arrangements for coordinating fiscal and monetary policies and broader monetary policy choices, and was not primarily motivated by explicit sovereign debt reduction objectives.[49]

Heterogeneity also marked the debt reductions during the Great Moderation, but for quite different reasons (Table 7). The reductions were slower than after World War II as financial repression was generally avoided and interest-growth differentials were less favorable. In a number of countries (Australia, Belgium, Ireland, Italy, Spain and Sweden) consolidation efforts had positive financial market confidence effects and supported investor demand, manifested in a large increase in the share of domestic MLT debt, increasingly held by non-residents. In Canada and the U.S., the share of domestic MLT debt changed little, and Canada is the only country that saw a drop in the non-resident share. In the Netherlands and the U.K., the share of domestic MLT debt decreased. It is worth noting that the maturity profile of sovereign debt in these two countries was already heavily weighted towards longer-term securities and that the confidence effects of consolidation efforts were overall less pronounced compared with the other group of countries. This suggests that the maturity shortening in this case was mainly coming from the supply side, possibly reflecting active debt management operations. In both groups of countries, a general reduction in central bank holdings was observed, in line with the monetary policy reforms discussed above.

Table 6. Post-World War II Consolidation: Maturity, Holders, and Marketability
(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Inflation	Debt/GDP			Domestic MLT			Central bank			Marketable		
	(average)	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
CAN (1946-76)	12	150	30	-119	93	63	-31	11	14	3	85	37	-48
FRA (1944-52)	14	280	30	-250	35	32	-4	33	19	-14	…	38	
ITA (1943-47)	118	133	30	-103	40	25	-15	38	48	10	50	44	-6
JPN (1946-64)	158	484	5	-200	65	32	-33	16	56	40	…	…	
USA (1946-74)	10	126	32	-89	74	61	-13	9	16	7	73	56	-17
Group 1	*62*	*235*	*26*	*-152*	*61*	*42*	*-19*	*21*	*31*	*9*	*69*	*44*	*-24*
AUS (1946-64)	11	160	44	-117	63	80	17	…	7		…	75	
BEL (1943-52)	10	182	67	-115	31	45	14	48	16	-32	…	…	
ESP (1945-78)	16	51	6	-45	79	98	20	…	…		100	22	-78
GBR (1946-80)	6	249	38	-211	68	89	21	11	17	6	52	91	38
NLD (1945-74)	12	368	19	-349	34	79	45	0	0	0	99	61	-38
SWE (1945-66)	5	50	16	-34	76	81	5	14	32	18	…	…	
Group 2	*10*	*177*	*32*	*-145*	*58*	*79*	*20*	*18*	*14*	*-2*	*84*	*62*	*-26*

Source: Authors' calculations.

[49] For instance, for a discussion as to how in the 1950s sovereign debt management, along with official controls and variations in short-term interest rates, was in the U.K. used as monetary policy tool, see Allen (2012).

Table 7. The Great Moderation: Issuance and Holders
(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP			Domestic MLT			Central bank			Com banks			Non-residents		
	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ	Start	End	Δ
AUS (1995-2008)	21	5	-16	84	100	16	14	2	-12	23	6	-17	26	59	32
BEL (1993-2007)	118	85	-33	64	86	22	1	1	0	55	25	-30	24	57	33
CAN (1995-2007)	57	25	-32	44	47	3	5	13	8	17	17	-1	27	12	-14
ESP (1996-2007)	54	30	-24	61	88	27	7	3	-4	5	3	-1	12	39	27
GBR (1986-1991)	44	34	-10	96	88	-8	3	0	-3	6	6	0	10	10	0
IRL (1987-2007)	103	20	-84	51	86	36	8	0	-8	16	6	-9	…	93	
ITA (1994-2004)	126	103	-23	68	83	14	10	4	-6	22	14	-8	15	36	22
NLD (1993-2007)	61	42	-19	98	80	-18	1	0	-1	17	10	-7	26	63	37
SWE (1995-2011)	84	32	-52	50	80	30	5	0	-5	10	30	20	38	54	16
USA (1996-2000)	71	56	-14	78	79	2	7	9	2	6	4	-2	21	21	0
Average	*74*	*43*	*-31*	*69*	*82*	*12*	*6*	*3*	*-3*	*18*	*12*	*-5*	*22*	*45*	*17*

Source: Authors' calculations.

V. What Does This Mean for Debt Reduction Prospects Today?

This analysis of consolidation episodes reveals that governments pursued two broad types of debt reduction strategies in the past. The first strategy consisted of increasing reliance on marketable instruments and non-resident holders, and was also marked by maturity lengthening. The second strategy, on the other hand, relied on a larger share of non-marketable debt, and increased debt holdings by a captive domestic investor base, and was accompanied by a shortening of the maturity profile and marked by higher inflation. Given the current environment of low growth and politically challenging primary balance adjustments, it bears asking which consolidation strategy will be most feasible in the years to come.

Financial repression policies are unlikely to be similarly amenable for debt reduction/liquidation today as they were in the aftermath of World War II. While financial repression is likely to have contributed to many successful debt reductions then, advanced economies' debt structures today are not as well suited for a similar strategy (Table 8). Debt liquidation strategies through financial repression relied, in good measure, on captive domestic holders of non-marketable instruments, capital controls, and lack of viable alternative investment opportunities (e.g., in emerging market economies). These conditions are not met today: 36 percent of debt is now held by non-residents (compared with 3 percent at end-World War II), and 81 percent of it is marketable (compared with 75 percent in 1945). The use of regulatory measures to compel banks to hold larger amounts of domestic government debt does not seem to be a viable option either:[50] It will not reduce the debt burden unless real interest rates can be brought down, possibly through surprise inflation (see below). Moreover, and as observed during the euro zone crisis, to the extent sovereign debt carries a risk premium, higher bank holdings of own sovereign debt can increase exposure to

[50] A cursory glance at Table 8 could lead some to argue that there is scope to raise the domestic commercial banks' share of own sovereign debt, which today is less than half of its 1945 level.

negative feedback loops between the sovereign and banks. The global nature of modern financial institutions and scope for regulatory arbitrage would be additional complicating factors, and present cross-border regulatory coordination challenges.

Table 8. Sovereign Debt Composition, Past and Present
(Percent of GDP for debt/GDP; otherwise, percent of central government debt)

	Debt/GDP	Marketable	Domestic MLT	Domestic ST
End of WWII	172	71	69	30
End of Great Recession	98	81	83	17
	Central bank	**Com banks**	**Non-residents**	**Non-bank dom**
End of WWII	12	34	3	51
End of Great Recession	9	12	36	44

Source: Authors' calculations.

Surprise inflation is the other unorthodox alternative that has been suggested. With the majority of sovereign debt being issued in domestic MLT securities and inflation expectations now well anchored, an unexpected inflation burst could reduce the real value of debt. This approach presents non-trivial problems too, however:

- resort to material surprise inflation is near-impossible within the current globally-accepted regimes of open capital accounts and price stability (as the anchor for monetary policy). Notwithstanding the recent blip in financial globalization, and focus on countering deflationary pressures in some advanced economies, the underlying policy regimes are stable.

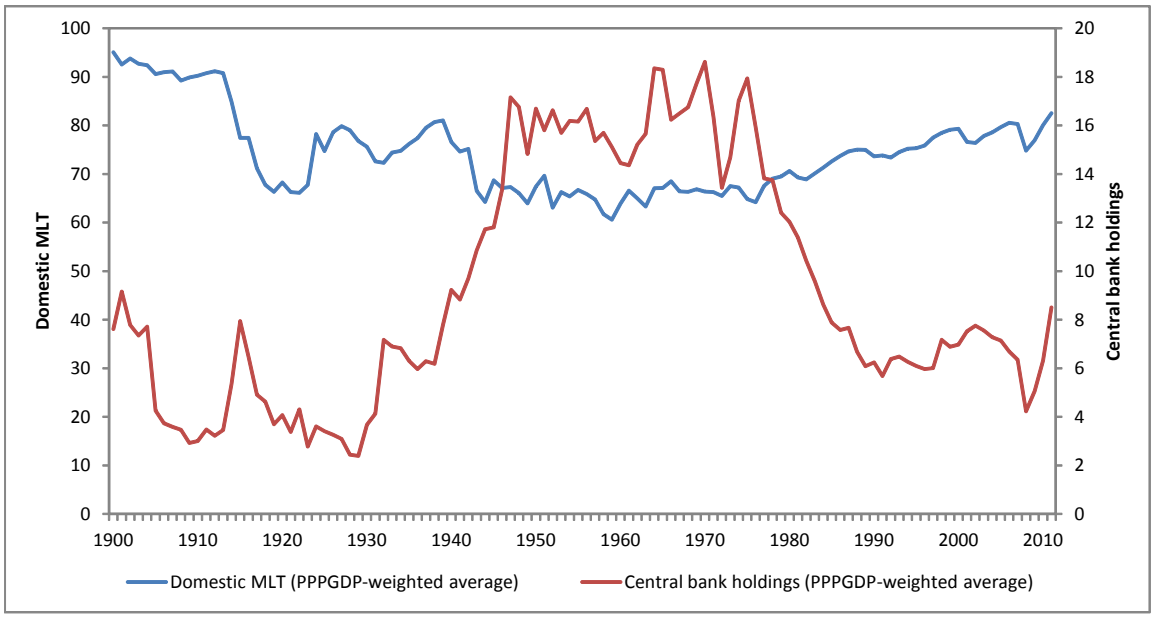
- surprise inflation is not a free lunch and involves significant economic costs: either the government must accept permanently higher inflation with direct costs to efficiency and investment, or, if it wishes to return to low inflation, it must accept the inevitably painful disinflation process (e.g., Fischer, 1994; Bordo and Orphanides, 2013). The real economic costs associated with higher inflation over a longer period or with disinflation need to be taken into account in the calculus of the net benefits of a debt reduction strategy built around surprise inflation. The experience of post-1970s Italy is a case in point (Box 2).

- debt liquidation through inflation can entail a permanent hidden "cost" in terms of departure from a less risky debt structure. In revisiting the post-World War II consolidation period, we find that countries where domestic MLT debt declined as a share of total government debt experienced, on average, higher annual rates of inflation—and, in the cases of Italy and Japan, hyperinflation—during the years immediately following the war (see Table 6 and the related discussion above). A similar phenomenon can be witnessed during the economic troubles of the 1970s. As evidenced by the Italian experience, once a sovereign has reverted to this original sin situation, moving to a less risky structure of debt—long-term debt denominated in domestic currency and with a fixed interest rate—could take a number of years following the reduction in inflation (Box 2). While the evidence assembled here is

tentative and no causal relationship is implied, it appears to indicate that higher inflation is associated with a shortening of the maturity profile, making fiscal and debt management more risky and complicated over time.

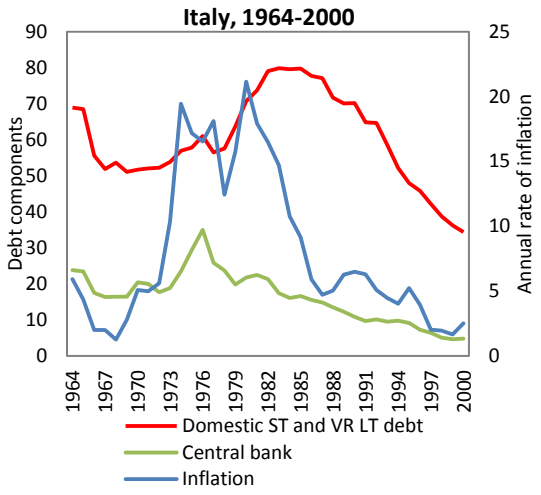
More generally, the data suggests that any policy involving high central bank holdings of government debt could have costs for debt structure. Figure 6 indicates that, on a PPPGDP-weighted basis, the average shares of domestic MLT debt and central bank holdings moved somewhat in tandem until the Great Depression. During this time, central banks largely kept out of government debt markets. A strong inverse relationship emerged in the late 1930s, when central banks began to hold more government debt. The relationship held until the 1990s. At that point, and also reflecting institutional changes such as the prohibition of monetary financing of government deficits and other measures to strengthen central bank independence, central bank holdings reached their lowest level as a share of total debt since 1938. Since then, the relationship between domestic MLT debt and central bank holdings appears to have resumed the positive correlation that held before the Great Depression. The recent spike in central bank holdings has thus far not had any permanent deleterious effects on the maturity profile of government debt, but it would be bold to presume that this would persist in the future.

Figure 6. Domestic MLT Debt and Central Bank Holdings, 1900-2011
(Percent of central government debt)



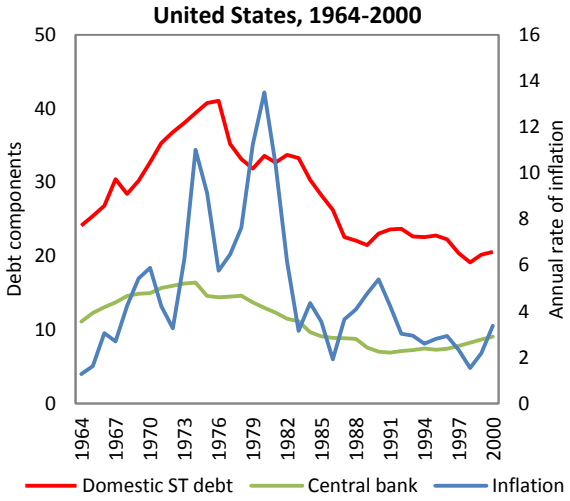
Source: Authors' calculations.

Box 2. Debt Structure, Inflation, and the Central Bank: A Tale of Two Countries



Italy is a good example of the interactions between inflation, debt structure, and central bank involvement in the government debt market. In the early 1970s, a large upward spike in inflation was correlated with an increase in the share of the central bank's holdings of debt. In 1976, it reached a post-World War II peak, and it is during this time that the "divorce" between the central bank and the treasury took place. Even though the central bank's share of sovereign debt subsequently declined, there was a long and quite painful adjustment period during which inflation fell. The combined share of domestic ST and variable rate LT debt, instruments that offer protection against inflation shocks, took even longer to decline. It was not until the late 1980s that inflation fell below 5 percent and not until the mid-1990s that the structural debt composition changes visible in other countries took hold.

It is noteworthy that a broadly similar story can be told about the U.S. over the same time period despite its comparatively more prudent history of debt management and less volatile macroeconomic environment. Although the share of central bank holdings increased at more gradual pace and peaked at a lower level (16.3 percent in 1973) than in Italy, it was nearly double the historical average of 8.4 percent and also associated with higher and more volatile inflation. Like Italy, the U.S. underwent a prolonged adjustment period after the central bank's share of sovereign debt began to decline in 1974: inflation only fell into the lower single digits in 1983, and a permanent decline in the share of domestic ST debt only materialized from the mid-1980s.



VI. Conclusion

This paper offers a broad historical perspective on changes in sovereign debt composition in a sample of advanced economies since 1900. The structural changes that have occurred in the composition of sovereign debt during this time are thrown into sharp relief, as are the various ways in which debt composition has responded—sometimes in dramatic ways—to debt accumulation and consolidation. In particular, we see that governments have resorted to two different sets of debt management strategies while reducing debts. The first involves raising the share of domestic MLT debt and that of debt in foreign currency and/or held by non-residents, whereas the second has relied more on financial repression, surprise inflation, and a more pronounced role for the central bank. Our preliminary analyses, drawn from historical data on hand, suggest that, while this second set of policies may be successful in reducing the overall debt stock, it may impose additional costs, including in the form of a riskier structure of debt and the potential fiscal risks associated with it.

Compared with past debt surges, debt composition changes during the Great Recession were overall minor in the advanced economies in our sample. It is tempting to conclude that financial innovation and financial globalization since the 1980s have made sovereign debt composition in advanced economies more resilient to shocks. However, a number of unknowns remain that preclude drawing firm conclusions on this issue while the recovery from the Great Recession is still ongoing. First, there is uncertainty about the consequences of the anticipated normalization of long-term interest rates. Second, the regulatory environment for banks continues to evolve, possibly in a direction that is less supportive of high demand by banks of sovereign debt globally. Third, there is little appetite overall for further advancing the financial innovation and globalization processes that contributed to important shifts in demand for sovereign debt during the Great Moderation.

The one notable change in debt composition during the Great Recession has been the increase in the share of central bank holdings in some countries. However, it is important to note that this increase, observed most notably in Japan, the U.K., and the U.S., has been a by-product of independent central bankers' attempts to prevent severe deflation, rather than to facilitate the task of ensuring fiscal sustainability. Sovereigns would, therefore, be ill-advised to rely on central banks' continued appetite for sovereign paper should economic conditions improve and warrant an off-loading of government securities from bloated central bank balance sheets. The fiscal challenge advanced economies face today is not driven by temporary factors—such as a war-time rise in military spending or a cyclical slowdown in growth—that self-unwind. Rather, it is driven by rising structural spending, stretched balance sheets, and unfavorable long-term growth prospects. It is the ability of governments to address these factors on a sustainable basis that will anchor the durability of the ongoing debt reductions. Reliance on favorable debt structure changes or unorthodox policies would fetch limited returns, and could even prove counterproductive under these circumstances.

Moving forward, more work remains to be done on the subject of sovereign debt structure. By focusing on economies that had the most readily available data over a longer period, our sample necessarily excludes developing economies, as well as some advanced economies that were greatly affected during the Great Recession. For these countries, data spanning a shorter period could be examined. Additionally, a more systematic statistical and econometric analysis of the links between sovereign debt composition and the factors influencing debt supply and demand, including yields, would provide more insights into optimal debt consolidation strategies, as well as interactions between debt composition and the broader macroeconomic environment. Further insights could also be gained from detailed country case studies of debt management policies over time and their impact on debt composition, and from an in-depth analysis of particular episodes. Another promising area for further research is that of the connection between debt composition and subsequent financial crisis, and its implications for fiscal risk management. An initial analysis based on the paper's data suggests that changes in the debt composition considered to increase exposure to crisis risk, such as maturity shortening, indeed could have these consequences. Finally, we hope that this paper will motivate officials, economic historians and statisticians worldwide to join efforts to improve our dataset, extend it to other countries and include more detailed information from national sources that are more challenging to access. This will go a long way in helping answer first-order questions about fiscal sustainability and sovereign debt management.

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Data Appendix

Data sources on total central government debt and on marketable/non-marketable data

Country	Central government debt	Marketable debt	Non-marketable debt
Australia	Butlin (1900-1940), UN (1914-1949), IFS (1952-1959), RBA (1950-2012)	IFS (1952-1959), RBA (1950-2012)	IFS (1952-1959), RBA (1950-2012)
Belgium	Statistical Yearbook and Government Accounts (1835-1914), UN (1914-1945), Ministry of Finance (1945-2011)	Ministry of Finance (1960-1980), OECD (1980-2010)	Ministry of Finance (1960-1980), OECD (1980-2010)
Canada	Statistics Canada/CANSIM (1867-2008), Department of Finance (2009-2011)	Statistics Canada/CANSIM (1867-2008), Department of Finance (2009-2011)	Statistics Canada/CANSIM (1867-2008), Department of Finance (2009-2011)
France	Statistical Yearbook (1880-1914), UN (1914-1945), Ministry of Finance (1945-2011)	Ministry of Finance (1952-2005), OECD (1980-2010)	Ministry of Finance (1952-2005), OECD (1980-2010)
Germany	Deutsches Geld- und Bankwesen in Zahlen (1877-1945), Bundesbank (1950-2011), Ministry of Finance (1961-2011)	Deutsches Geld- und Bankwesen in Zahlen (1877-1945), Bundesbank (1950-2011), Ministry of Finance (1961-2011)	Deutsches Geld- und Bankwesen in Zahlen (1877-1945), Bundesbank (1950-2011), Ministry of Finance (1961-2011)
Ireland	Finance Accounts (1923-89), National Treasury Management Agency (1990-2011)	OECD (1980-2010)	OECD (1980-2010)
Italy	Bank of Italy (1861-2011)	Bank of Italy (1861-2011)	Bank of Italy (1861-2011)
Japan	Ministry of Finance (1870-1979), OECD (1980-2009), Ministry of Finance Debt Management Report (2010-2011)	OECD (1980-2009), Ministry of Finance Debt Management Report (2010-2011)	OECD (1980-2009), Ministry of Finance Debt Management Report (2010-2011)
Netherlands	Centraal Bureau Statistiek (1900-2011) and Ministry of Finance (1951-2011)	Nederlandsche Bank (1900-2011), OECD (1980-2010)	Nederlandsche Bank (1900-2011), OECD (1980-2010)
Spain	Statistical Yearbook of Spain (1900-1985), Bank of Spain (1985-2011)	Bank of Spain (1900-1992, 2000-2011), OECD (1992-1999)	Bank of Spain (1900-1992, 2000-2011), OECD (1992-1999)
Sweden	UN (1914-1969), Statistics Sweden (1970-2011)	OECD (1980-2010), Statistics Sweden (2011)	OECD (1980-2010), Statistics Sweden (2011)
United Kingdom	Wormell (1892-1934), UN (1935-1976), Bank of England (1977-2003), Office of National Statistics (2004-2011)	Pember & Boyle (1900-1976), Bank of England (1977-2002), Office of National Statistics (2003-2011)	Pember & Boyle (1900-1976), Bank of England (1977-2002), Office of National Statistics (2003-2011)
United States	Historical Statistics of the United States (1853-1868), Department of Treasury (1869-1979), Historical Statistics of the United States (1980-2000), Department of Treasury (2001-2011)	Historical Statistics of the United States (1853-1868), Department of Treasury (1869-1979), Historical Statistics of the United States (1980-2000), Department of Treasury (2001-2011)	Historical Statistics of the United States (1853-1868), Department of Treasury (1869-1979), Historical Statistics of the United States (1980-2000), Department of Treasury (2001-2011)

Data sources on currency and maturity composition

Country	Foreign currency debt	Domestic MLT debt	Domestic ST debt
Australia	UN (1914-1974), Missale (1975-1995), Australian Office of Financial Management for general government data (1950-2012)	UN (1914-1974), Missale (1975-1995), Australian Office of Financial Management for general government data (1950-2012)	UN (1914-1974), Missale (1975-1995), Australian Office of Financial Management for general government data (1950-2012)
Belgium	Statistical Yearbook and Government Accounts (1835-1914), UN (1914-1945), Ministry of Finance (1945-2011)	Statistical Yearbook and Government Accounts (1835-1914), UN (1914-1945), Ministry of Finance (1945-2011)	Statistical Yearbook and Government Accounts (1835-1914), UN (1914-1945), Ministry of Finance (1945-2011)
Canada	UN (1914-1959), Missale (1960-1980), OECD (1981-2010), Statistics Canada/CANSIM (1867-2008), Department of Finance (2009-2011)	UN (1914-1959), Missale (1960-1980), OECD (1981-2010), Statistics Canada/CANSIM (1867-2008), Department of Finance (2009-2011)	UN (1914-1959), Missale (1960-1980), OECD (1981-2010), Statistics Canada/CANSIM (1867-2008), Department of Finance (2009-2011)
France	Statistical Yearbook (1880-1914), UN (1914-1945), Ministry of Finance (1945-2011)	Statistical Yearbook (1880-1914), UN (1914-1945), Ministry of Finance (1945-2011)	Statistical Yearbook (1880-1914), UN (1914-1945), Ministry of Finance (1945-2011)
Germany	Bundesbank (1877-2011)	Bundesbank (1877-2011)	Bundesbank (1877-2011)
Ireland	United Nations (1924-1959), Missale (1960-1967), National Treasury Management Agency (1968-2011)	United Nations (1924-1959), Missale (1969-1997), OECD (1998-2001), National Treasury Management Agency (2002-2011)	United Nations (1924-1959), Missale (1969-1997), OECD (1998-2001), National Treasury Management Agency (2002-2011)
Italy	Bank of Italy (1861-2011)	Bank of Italy (1861-2011)	Bank of Italy (1861-2011)
Japan	Ministry of Finance (1870-1979), OECD (1980-2009), Ministry of Finance Debt Management Report (2010-2011)	Ministry of Finance (1870-1979), OECD (1980-2009), Ministry of Finance Debt Management Report (2010-2011)	Ministry of Finance (1870-1979), OECD (1980-2009), Ministry of Finance Debt Management Report (2010-2011)
Netherlands	Centraal Bureau Statistiek (1900-2011) and Ministry of Finance (1951-2011)	Centraal Bureau Statistiek (1900-2011) and Ministry of Finance (1951-2011)	Centraal Bureau Statistiek (1900-2011) and Ministry of Finance (1951-2011)
Spain	Statistical Yearbook of Spain (1900-1985), Bank of Spain (1986-1991), OECD (1992-2000), Bank of Spain (2001-2010), Tesoro Público (2011)	Bank of Spain (1900-2010), Tesoro Público (2011)	Bank of Spain(1900-2011), Tesoro Público (2011)
Sweden	UN (1914-1969), Statistics Sweden (1970-2011)	UN (1914-1969), Statistics Sweden (1970-2011)	UN (1914-1969), Statistics Sweden (1970-2011)
United Kingdom	Wormell (1892-1934), UN (1935-1976), Bank of England (1977-2003), Office of National Statistics (2004-2011)	Wormell (1892-1934), UN (1935-1976), Bank of England (1977-2003), Office of National Statistics (2004-2011)	Wormell (1892-1934), UN (1935-1976), Bank of England (1977-2003), Office of National Statistics (2004-2011)
United States	Federal Reserve (1916-1938), Department of the Treasury (1939-2011)	Federal Reserve (1916-1938), Department of the Treasury (1939-2011)	Federal Reserve (1916-1938), Department of the Treasury (1939-2011)

Data sources on ownership

Country	Central bank	Domestic commercial banks	Non-residents
Australia	IFS (1935-1968), Reserve Bank of Australia (1950-2012)	IFS (1935-1968), Reserve Bank of Australia (1950-2012)	IFS (1935-1968), Reserve Bank of Australia (1950-2012)
Belgium	Belgian National Bank (1851-2011)	Belgian National Bank and Ministry of Finance (1957-2011)	Belgian National Bank and Ministry of Finance (1957-2011)
Canada	Bank of Canada (1946-2011)	Bank of Canada (1946-2011)	Bank of Canada (1946-2011)
France	IFS (1936--2011), Ministry of Finance (1945-2003)	IFS (1936-2011)	IFS (1936-2011), OECD (1987-1999)
Germany	Bundesbank (1950-2011)	Bundesbank (1950-2011)	Bundesbank (1950-2011)
Ireland	Missale (1969-1996), IFS (1997-2003), Arslanalp and Tsuda (2004-2011)	IFS (1936-2001), Andritzky (2002-2011)	OECD (1995-2006), Andritzky (2007-2011)
Italy	Bank of Italy (1861-2011)	Bank of Italy (1861-2011)	Bank of Italy (1861-2011)
Japan	Bank of Japan (1882-1964), IFS (1965-1999), Andritzky (2000-2011)	IFS (1953-1999), Andritzky (2000-2011)	OECD (1980-1999), Andritzky (2000-2011)
Netherlands	Nederlandsche Bank (1900-2011)	Nederlandsche Bank (1900-2011)	Nederlandsche Bank (1900-2011)
Spain	Bank of Spain (1987-2011)	Bank of Spain (1987-2011)	Bank of Spain (1987-2011)
Sweden	Fregert and Gustafsson (1860-1935), IFS (1936-2011)	IFS (1945-2011)	OECD (1995-2010), Statistics Sweden (2011)
United Kingdom	Sheppard (1900-1956, Pember and Boyle data used to scale the shares), Stone (1957-1961), Bank of England Bulletin (1961-1970), Bank of England statistics (1971-1996), ONS(1997-2011)	Sheppard (1900-1956, Pember and Boyle data used to scale the shares), Stone (1957-1961), Bank of England Bulletin (1961-1970), Bank of England statistics (1971-1996), ONS(1997-2011)	Sheppard (1900-1956, Pember and Boyle data used to scale the shares), Stone (1957-1961), Bank of England Bulletin (1961-1970), Bank of England statistics (1971-1996), ONS(1997-2011)
United States	Federal Reserve (1916-1938), Department of the Treasury (1939-2011)	Federal Reserve (1916-1938), Department of the Treasury (1939-2011)	Federal Reserve (1916-1938), Department of the Treasury (1939-2011)