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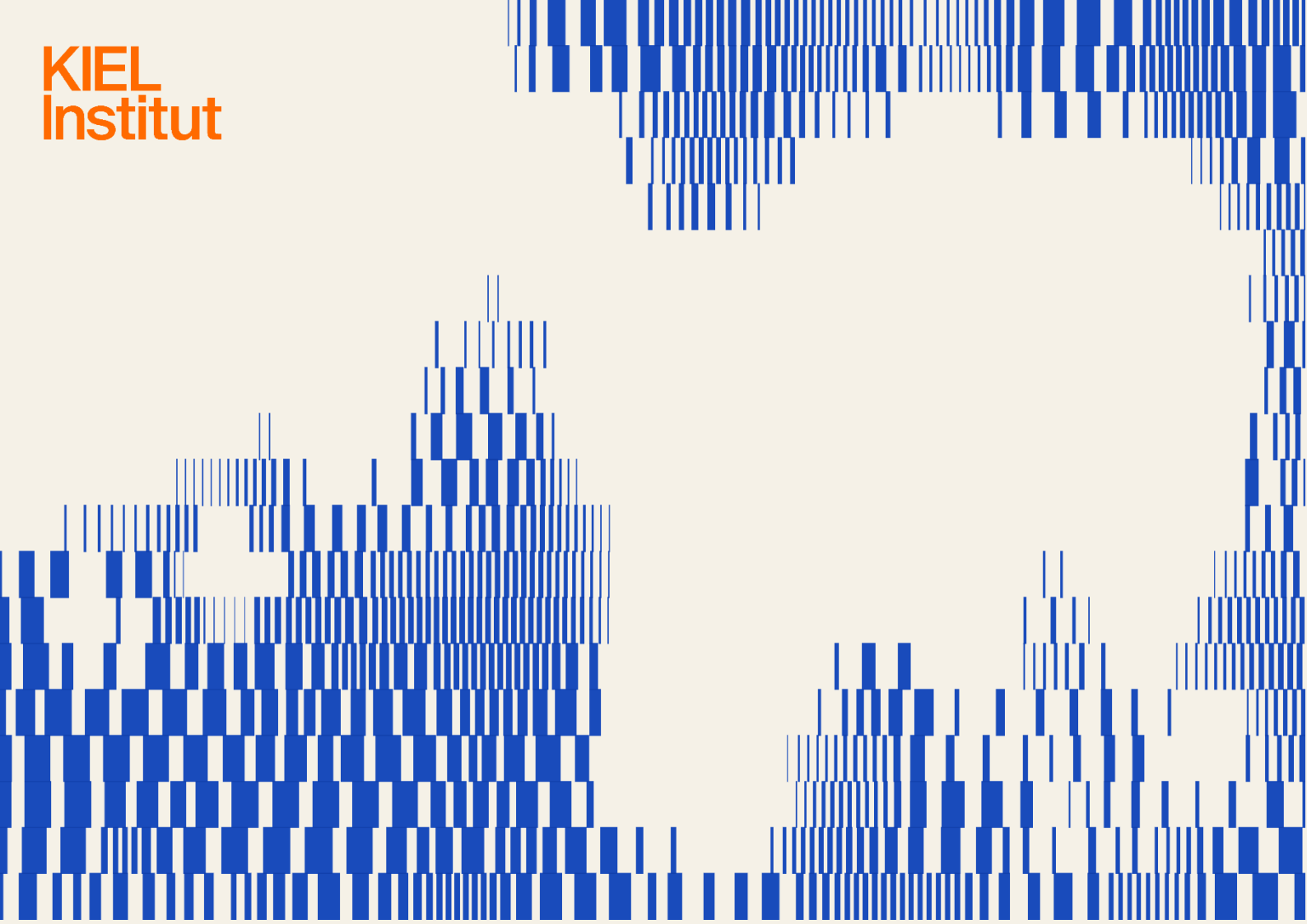

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Hidden Debt Revelations

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Abstract

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How reliable are public debt statistics? This paper quantifies the magnitude, characteristics, and timing of hidden debt by tracking ex post revisions to sovereign debt statistics. We assemble a comprehensive new database of 119 editions, or vintages, of League of Nations, United Nations, IMF, and World Bank debt statistics, covering up to 187 countries over more than a century. We show that public debt is systematically underreported, with upward revisions averaging roughly one percent of GDP across advanced and developing economies, external and domestic debt, and all reporting systems we examine. Hidden debt accumulates in good times and tends to be revealed in bad times, often during IMF programs and sovereign defaults. Over the past one hundred years, nearly half of all sovereign defaults have coincided with substantial upward revisions to reported public debt. We incorporate these patterns into a quantitative sovereign default model and show that hidden debt raises default risk and borrowing costs, and thereby contributes to debt intolerance. Differences in the reliability of debt data across countries account for roughly 20% of the observed gap in debt-carrying capacity between low and high-income economies.

Keywords: hidden debt, sovereign debt, sovereign default
JELs: F34, H63, G01

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1 Introduction

Public debt statistics are a cornerstone of macroeconomic analysis. Investors, taxpayers, policymakers, and academic researchers all have a keen interest in the level and composition of a country's public debt. However, these statistics are subject to major limitations and incomplete reporting (Reinhart and Rogoff, 2009; World Bank, 2021). Underreported debt, or "hidden" debt, poses a fundamental challenge for sovereign debt markets and economic surveillance. When governments underreport their liabilities, assessments of debt sustainability rest on incomplete information. As a consequence, sovereign risk assessments, sovereign bond prices, and borrowing decisions may be severely distorted. Hidden debt also weakens the ability of policymakers, international institutions, and researchers to monitor fiscal risks and respond to them. Yet, hidden debt is inherently difficult to measure, and little is known about its prevalence, drivers, and macroeconomic consequences.

This paper quantifies hidden debt by systematically tracking ex post revisions of debt figures across different editions, or "vintages", of major international public debt statistics. The key idea is simple: when previously unreported liabilities are incorporated into official statistics, past debt figures are revised. By systematically tracking the same debt series across successive vintages, we can therefore quantify the scale, characteristics, and timing of hidden debt accumulation and revelation.

We apply this approach to a newly assembled long-run dataset covering 119 historical vintages of sovereign debt statistics compiled by the League of Nations (1922–1945), the United Nations (1948–1979), the IMF (2004–2025), and the World Bank (1973–2025)—the authoritative international sources on sovereign debt statistics of their time. Most of these vintages had to be digitized from scanned reports, CD-ROMs, and hard-copy volumes recovered from institutional archives. To process the underlying material vintage-by-vintage and at scale, we develop an AI-assisted optical character recognition approach, combined with extensive manual verification. The resulting dataset spans both external and domestic public debt for up to 187 advanced and developing countries between 1912 and 2024 and thus allows us to systematically document the extent of underreporting in sovereign debt statistics over more than a century of global financial history.

Our key findings can be summarized as follows: First, underreporting of public debt is widespread and chronic, suggesting that uncertainty about true debt levels is a persistent feature of one of the world's largest financial markets. Debt data revisions are upward biased and have a pronounced right tail. On average, debts added to statistics only in hindsight amount to roughly one percent of GDP (or 3 percent of the debt stock). The estimate is a lower bound for the true magnitude of hidden debt, since not all unreported liabilities are eventually revealed in the statistical record. The pattern appears in external debt and in domestic debt, in advanced economies and in developing ones, from the interwar period to the Covid era, and in every reporting system we examine.

Second, the hidden debt problem is most severe where institutions are the weakest. In the cross-section of countries, both the average level and the dispersion of debt revisions are larger

in countries with weaker institutions and lower administrative capacity. This pattern suggests that weak institutions are associated not only with greater hidden debt on average, but also with greater uncertainty about the true level of public debt. Relatedly, underreporting of public debt is not confined to emerging market and developing economies—many advanced economies also exhibit systematic downward bias—but the uncertainty surrounding the true level of public debt is substantially larger in the developing world.

Third, hidden debt is procyclical and closely linked to sovereign debt crises. Hidden liabilities accumulate during economic booms and are revealed during downturns, most often in the context of IMF programs and sovereign defaults. Indeed, we find that hidden debt revelations are a recurring feature of sovereign debt crises. Across one hundred years of debt data, almost half of all domestic and external sovereign defaults coincide with substantial upward revisions to reported public debt.

Fiscal vulnerabilities are therefore often larger than they appear during good times: creditors, policymakers, and often even central fiscal authorities operate with incomplete information about the true scale and composition of public liabilities—consistent with the observation of Reinhart and Rogoff (2009) that excessive debt accumulation "often poses greater systemic risks than it seems during a boom." Across the century-long history studied in this paper—from the defaults of the Great Depression to those of the Covid-19 pandemic—contemporary observers repeatedly warned about incomplete and unreliable public debt data. During the syndicated lending boom of the 1970s, for example, staff of the United States Congress (1977) cautioned that banks were assessing sovereign risk on the basis of "false or inadequate data" and concluded that "the true magnitude of international debt … remains a mystery." On the debtor side, international institutions, such as the UN, observed that governments themselves often did not know exactly how much they had borrowed (UNCTAD, 2014). Each time, a better reporting infrastructure was seen as the solution, until the next crisis proved otherwise.

To translate these patterns into impacts on borrowing costs, debt-carrying capacity, and welfare, we incorporate our empirical findings into a quantitative model. The model builds on the standard sovereign default framework (Eaton and Gersovitz, 1981; Arellano, 2008; Aguiar and Gopinath, 2006) and adds three ingredients motivated by our evidence: hidden debt accumulation, asymmetric information about the true level of public liabilities, and endogenous information acquisition by investors. Hidden liabilities dilute recoveries on market debt in default giving lenders an incentive to monitor the sovereign's books. Monitoring reveals hidden debt and is most valuable when default risk is high, generating endogenous revelations of hidden debt in bad times, as we observe in the data.

We calibrate the model using our new data and find that asymmetric information about the true level of indebtedness has sizeable effects on equilibrium outcomes. Hidden debt raises default incentives and depresses sovereign bond prices: at any given level of reported debt, borrowers must compensate investors for the possibility that true liabilities are larger than they appear. This mechanism helps explain why some countries are "debt intolerant," defaulting at levels of reported debt that would seem manageable elsewhere (Reinhart et al., 2003). In the model, countries with larger and noisier hidden-debt processes face steeper spread schedules, lower

debt-carrying capacity, and default at lower reported debt-to-GDP ratios. In a counterfactual exercise calibrated to the difference in debt revisions between low- and high-income countries, the hidden-debt channel generates a 4 percentage point decline in the reported debt-to-GDP ratio at default and a 70 basis point increase in spreads. Cross-country differences in the reliability of debt data therefore account for roughly 20 percent of the observed gap in debt-carrying capacity and around one quarter of the differences in bond spreads between low- and high-income economies.

Related literature. Our findings shed new light on several well-documented empirical regularities in sovereign debt markets. Persistent uncertainty about true indebtedness—followed by large revelations of hidden debt during crises—helps to explain the phenomenon of debt intolerance in countries with weak institutions (Reinhart et al., 2003), deviations from optimal debt management and fiscal policy (Barro, 1979, 1999, 2003; Bigio et al., 2023), and the remarkably low cross-border capital inflows that developing countries have been able to attract (Lucas, 1990; Alfaro et al., 2008; Greenwood et al., 2010). The same mechanism also contributes to the well-documented procyclicality of macroeconomic outcomes in developing countries (see, e.g., Kaminsky et al., 2004; Reinhart and Reinhart, 2008; Alesina et al., 2008; Bianchi et al., 2023; Azzimonti and Mitra, 2023) and can help explain why lending booms often come with excessive optimism and end in widespread default (Reinhart and Rogoff, 2009; Reinhart et al., 2016; Horn et al., 2021, 2025).

Our paper also contributes to a large literature that studies the implications of asymmetric information and investor attention on asset prices and financial crises (for overviews see, e.g., Brunnermeier, 2001; Gorton and Ordonez, 2023; Veldkamp, 2011). In particular, our paper is closely related to a growing body of theoretical work that analyzes sovereign debt markets with asymmetric information and opaque borrowing (Kletzer, 1984; Alfaro and Kanczuk, 2022; Guler et al., 2025; Gamboa, 2023; Kondo et al., 2026; Gu and Stangebye, 2023), often with a focus on government reputation (D'Erasmo, 2011; Fourakis, 2021; Morelli and Moretti, 2023).[1] Our finding that hidden debt is often revealed during episodes of sovereign distress informs and is consistent with theories in which financial crises trigger state-contingent information acquisition (Gorton and Ordonez, 2014; Cole et al., 2022, 2024; Gu and Stangebye, 2023). We contribute to this literature by compiling novel evidence on hidden sovereign debt and using it to discipline an information-acquisition problem embedded in a quantitative sovereign debt and default model with asymmetric information about the government's true debt level.

Finally, our findings have direct implications for applied work, as debt statistics are essential input variables in a wide range of research designs and operational applications. Researchers should be wary of the fact that data downloads from different vintages of debt statistics can lead to materially different results and can therefore complicate the replication and updating of empirical work (also see Aruoba, 2008; Christensen and Miguel, 2018; Goes, 2024). Empirical applications in macroeconomic forecasting, debt sustainability, or asset pricing, in particular, need to take into account that debt figures tend to get upward revised after their initial pub-

[1] Related papers on unsecured consumer credit, default and asymmetric information include Chatterjee et al. (2023), Athreya et al. (2012), and Sanchez (2018).

lication (Frankel, 2011; Beaudry and Willems, 2022; Estefania-Flores et al., 2023; Akey et al., 2026).

Layout. The rest of this paper is structured as follows: Section 2 motivates our approach by presenting two recent case studies. Section 3 introduces our new database of debt data revisions and our measure of hidden debt revelations. We explain in detail how our measure of hidden debt should be interpreted and point out important caveats. Section 4 presents the main statistical properties of debt data revisions, and documents new stylized facts about the size, characteristics, and timing of hidden debt and its revelation. Section 5 shows that large hidden debt revelations have been a recurring feature of sovereign defaults and international adjustment programs over the past one hundred years. Section 6 incorporates the hidden-debt process documented in the data into a quantitative sovereign-default model with asymmetric information and investor monitoring, and uses it to quantify how unreliable debt statistics affect default incentives, borrowing costs, debt-carrying capacity, and welfare. Section 7 concludes. Our Online Appendices A–E provide detailed information on the data sources, construction, and validation; extensive historical evidence on a century of hidden debt accumulation and revelation; additional robustness analyses; and further details on the quantitative model.

2 Case studies

In this section, we present two recent case studies to motivate our approach and to illustrate the main idea of using debt data revisions as a measure of hidden debt. Section 2.1 focuses on Mozambique's 2016 hidden debt scandal and illustrates a case of underreporting of sovereign debt in a developing country, whereas Section 2.2 looks at the case of Greece, an instance of underreporting of sovereign debt in an advanced economy.

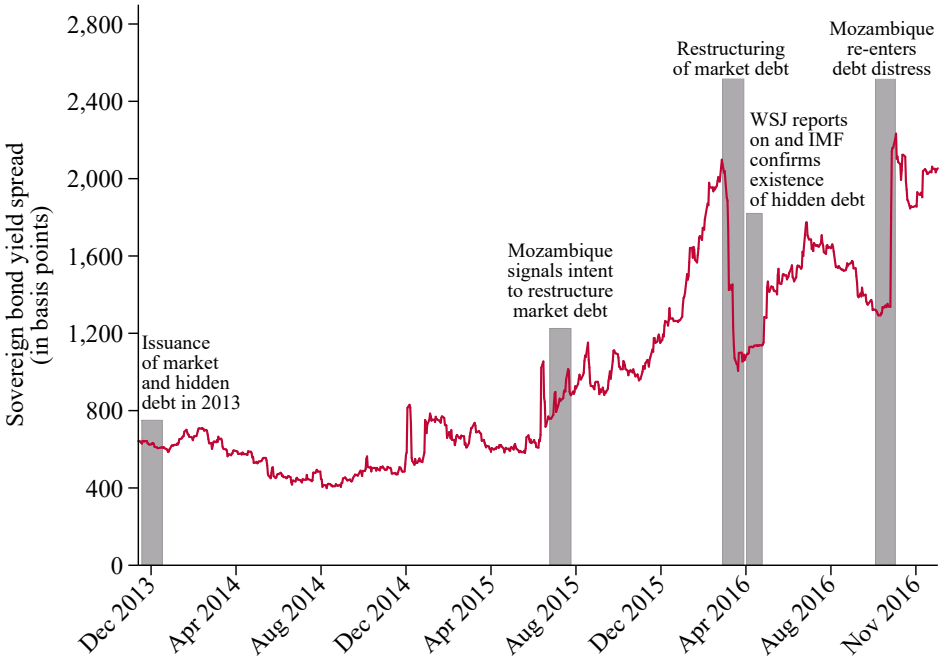
2.1 Mozambique's hidden debt scandal

In 2016, Mozambique made international headlines when an external audit discovered USD 1.2 billion in unreported sovereign debt liabilities. During the early 2010s, Mozambique was considered a development success story. The discovery of large natural gas deposits off the country's northern coastline was followed by a surge in foreign direct investment and years of high real GDP growth. In 2013, at the height of the boom, the country issued sovereign bonds worth USD 850 million in international capital markets to fund investments in a tuna boat fleet. In the same year and the year after, state-owned enterprises used government guarantees to borrow USD 1.2 billion from international banks Credit Suisse and VTB without disclosing these additional liabilities to bond investors and the public.[2]

Two years later, in 2015, Mozambique first started to experience debt servicing difficulties. The tuna fleet, funded with the USD 850 million bond issuance, pulled in less than five percent of the tuna that it had expected, and the government approached bondholders with a plan to

[2]See Financial Times (2017, June 25) *"State loans at heart of Mozambique debt scandal."*

Figure 1: Sovereign bond yields during Mozambique's hidden debt scandal



Sources: Wall Street Journal (2016, April 3) *"Tuna and Gunships: How $850 Million in Bonds Went Bad in Mozambique,"* Reuters (2016, April 23) *"IMF says Mozambique has over $1 bln of hidden debt,"* and Bloomberg L.P. (2022).
Notes: The figure plots the EMBI+ spread for Mozambique from December 2013 until December 2016 in basis points.

restructure the bond. After most bondholders had agreed to the restructuring in early 2016, rumors about large hidden debts started to emerge. In April 2016, the Wall Street Journal first reported the additional and previously undisclosed bank loans that Mozambican state-owned enterprises had borrowed and the state guarantees that they carried.[3]

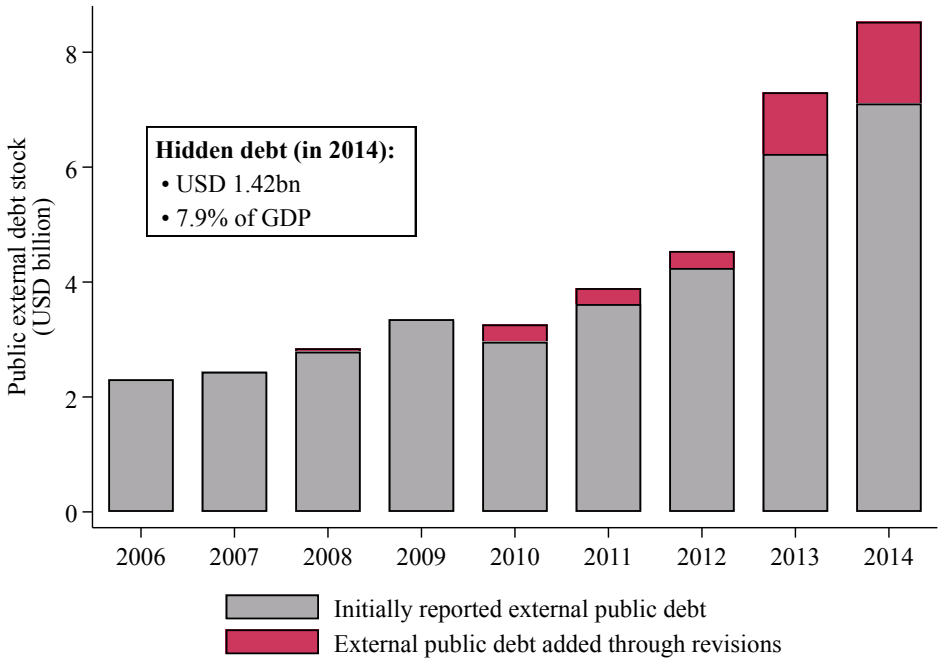
The rumors about hidden debt led to a surge in Mozambique's bond spreads (see Figure 1), with bond investors expressing concerns that the existence of undisclosed, additional liabilities would dilute the recovery value of their bonds in the event of a default, which ultimately happened in January 2017. Audits of Mozambique's debt through the IMF and international accounting firms followed.[4] They confirmed the existence of USD 1.2 billion in hidden liabilities (Cortez et al., 2021). Ultimately, it took four years to settle renegotiations with bondholders and the country has not accessed the international bond market ever since.

Mozambique's hidden debts and their revelation can be quantified by comparing the country's debt reports across different vintages of the World Bank's International Debt Statistics. When initially reported, the 2014 debt figure for Mozambique was USD 7.1 billion (see Figure 2). This figure was strongly upward revised in subsequent vintages as the previously undisclosed

[3]See Wall Street Journal (2016, April 3) *"Tuna and Gunships: How $850 Million in Bonds Went Bad in Mozambique."*

[4]See Reuters (2017, May 13) *"Mozambique receives Kroll audit into hidden debts"* and Reuters (2017, July 11) *"IMF team visits Mozambique after damning debt audit."*

Figure 2: Mozambique's hidden debt scandal, 2006 – 2014



Notes: The figure shows the initially and most recently reported public and publicly guaranteed debt stocks for Mozambique between 2006 and 2014 in USD billions. The grey bars show the initially reported debt stocks. The red bars show additional debt stocks added through revisions in subsequent reporting. The data are from our new database (see Section 3 and Appendix A).

loans became public knowledge. The latest debt figure for the year 2014 is USD 8.5 billion, an increase of USD 1.4 billion or 8 percent of GDP.

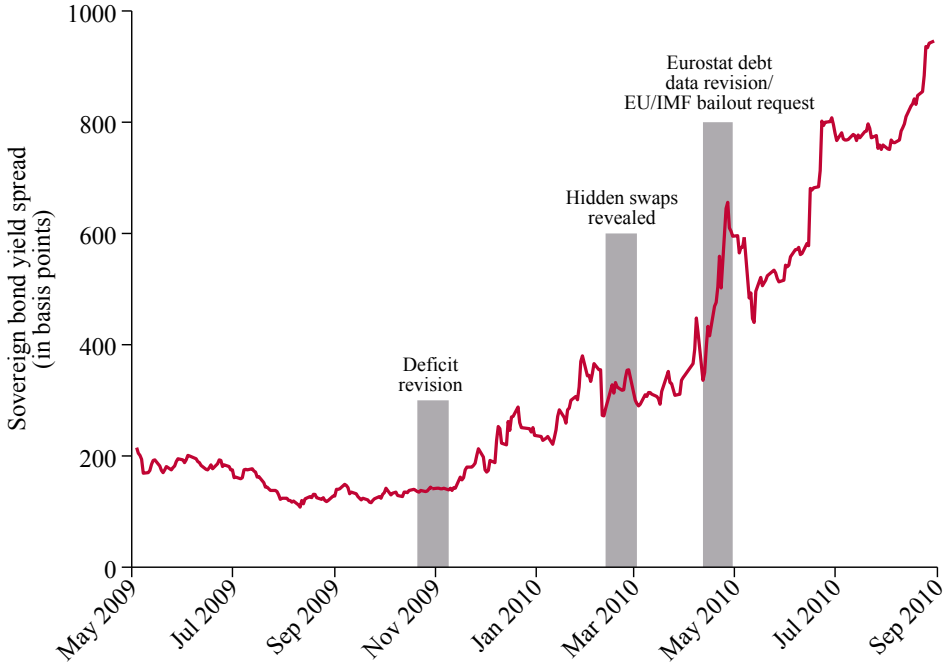
2.2 Greece's hidden debt revelation

Greece's sovereign debt crisis offers one of the most prominent examples of hidden debt accumulation and delayed disclosure within an advanced economy. During the 2000s, Greece reported its fiscal statistics to Eurostat under the rules of the European System of Accounts. However, repeated audits by the European Commission and Eurostat documented persistent deficiencies in the quality and reliability of these statistics, including misreported deficits, unrecorded liabilities, and off-budget activities (European Commission, 2010). Among the most notable practices were the misclassification of military expenditures, incomplete recording of hospital arrears and social security balances, as well as the use of complex financial instruments—most prominently currency swaps arranged with international banks—that allowed the government to obtain upfront financing while keeping part of the associated liabilities off its official balance sheet.[5]

The true extent of Greece's indebtedness began to surface in late 2009, when a newly elected government revised the reported fiscal deficit sharply upward and triggered a sequence of further statistical revisions. In the months that followed, Eurostat investigated Greece's sovereign

[5]See also Reuters (2010, February 22) *"Greece not alone in exploiting EU accounting flaws."*

Figure 3: Sovereign bond yields during Greece's hidden debt saga



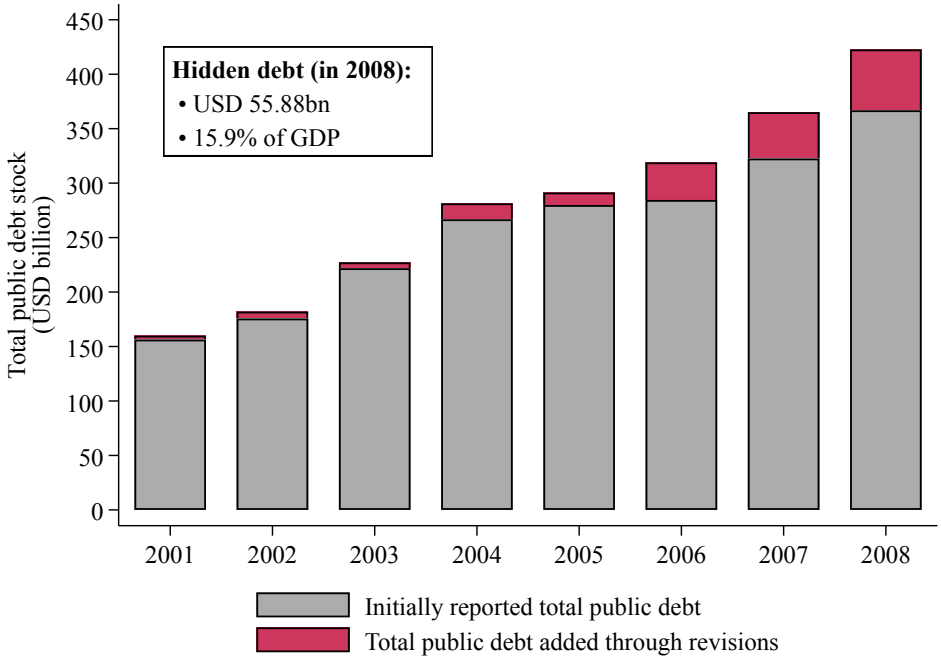
Sources: Financial Times (2010, January 12) *"Greece condemned for falsifying data,"* Reuters (2010, February 22) *"Goldman Sachs details 2001 Greek derivative trades,"* Reuters (2010, August 25) *"Euro zone debt crisis,"* Wall Street Journal (2010, April 23) *"EU Sees Wider Greek Deficit, Roiling Markets,"* and Eurostat (2025).
Notes: The figure plots the daily Greek 10-year government bond spread relative to Germany from May 2009 to September 2010. Spreads are reported in basis points.

debt statistics and uncovered substantive previously unreported or misclassified liabilities—discoveries that eventually translated into large ex post upward revisions of Greek debt numbers.

Financial markets reacted strongly to these disclosures. As shown in Figure 3, Greek sovereign bond spreads increased sharply during the period in which successive revisions and disclosures took place, particularly around key events such as the deficit revision in late 2009, the revelation of hidden swap transactions in early 2010, and the major Eurostat data revision in spring 2010. These announcements contributed to a collapse in investor confidence, a rapid increase in borrowing costs, and ultimately Greece's loss of market access and recourse to international financial assistance from the EU and IMF in May 2010.

Our new measurement approach quantifies Greece's hidden debts by comparing debt figures published by Greece across different vintages of the International Monetary Fund's Government Finance Statistics. While Greece's initially reported total public debt stock in 2008 was USD 367 billion, the same value is given as USD 423 billion in the latest vintage of the IMF's Government Finance Statistics (see Figure 4). The total upward revision for Greek debt levels in 2008 therefore amounts to USD 56 billion or roughly 16 percent of GDP.

Figure 4: Greece's hidden debt revelation



Notes: The figure shows the initially and most recently reported total public debt stock for Greece in USD billions. The gray bars show the initially reported debt stocks. The red bars show additional debt stocks added through revisions in subsequent reporting. The data are from our new database (see Section 3 and Appendix A).

3 A new database of debt data revisions

In this section, we introduce our new dataset of debt data revisions and explain how we quantify hidden debt and its revelation. Throughout this section, we focus on the main principles of data construction, measurement and interpretation, and refer interested readers to Appendix A for further details. Section 3.1 describes the data sources and coverage, Section 3.2 defines our measures of hidden debt and hidden debt revelations, and Section 3.3 discusses the interpretation and limitations of our new revision-based measurement approach.

3.1 Data sources and coverage

Hidden debt can arise in different parts of the public sector balance sheet. To understand where it may emerge and what our measurement can and *cannot* capture, it is useful to distinguish public debt along two dimensions: first, the institutional perimeter of the debtor, ranging from central government to general government and the broader public sector (including state-owned enterprises and public-private partnerships), and, second, the creditor side, distinguishing between external and domestic creditors. Because government debt data are notoriously elusive (Reinhart and Rogoff, 2009, 2011a), and no single reporting system covers all of these combinations consistently across countries and over time, measuring hidden debt at scale requires combining several complementary data sources.

To achieve broad coverage, we construct a new database that tracks debt statistics and their revisions across 187 countries from 1912 to 2024. The database compiles and harmonizes 119 historical editions, or "vintages," of the main international debt reporting systems of their time, including more than 80 vintages that we newly digitized from archival sources:[6]

- The *League of Nations Memoranda on Public Finance* and *Statistical Yearbooks* report central government debt, distinguishing domestic and external obligations, for the interwar era and World War II (1922–1945).
- The *United Nations Statistical Yearbook* extends this coverage into the postwar period, reporting central government debt separately for domestic and external obligations (1948–1979).
- The IMF's *Government Finance Statistics* provide modern coverage of central and general government debt, including both domestic and external debt, with particularly broad coverage of advanced economies (2004–2025).
- The World Bank's *World Debt Tables*, *Global Development Finance*, and *International Debt Statistics* provide the most detailed long-run coverage of external public and publicly guaranteed debt for developing and emerging market economies (1973–2025).

In addition to their central role as the main international debt data sources of their respective eras, these reporting systems share three features that make them particularly well suited for measuring hidden debt through data revisions.

- **Wide cross-country, sectoral and time coverage:** No single institution has produced continuous sovereign debt statistics over a full century, and each reporting system has coverage gaps. Taken together, however, our sources span more than a century, cover 187 advanced and developing countries, and capture both external and domestic public debt. Crucially, each source published updated debt statistics in regular annual editions, allowing us to reconstruct debt series as they were reported at the time and to systematically track changes across vintages.
- **Direct debtor reporting:** All four sources rely on debt statistics reported directly by debtor-country authorities, rather than on third-party estimates or creditor records. Since the underlying data originate with the debtor, subsequent upward revisions indicate that liabilities were previously omitted or mismeasured in the official reporting. These revisions therefore reflect improved disclosure by the debtor country, not updates to third-party estimates.
- **Consistent reporting guidelines:** Each source applies stable reporting rules over time. Revisions across vintages therefore do not reflect the evolution of reporting guidelines

[6] Throughout the paper we distinguish between the *vintage span* of a reporting system—the years in which new vintages were issued—and the *reporting span*—the historical years for which that system reports debt figures, which always extends further back than the vintage dates themselves, since each vintage reports a trailing time series. In the list, years in parentheses correspond to the *vintage span*.

but can be traced back to changes in compliance with a stable set of rules over time. World Bank IDS guidelines have remained essentially unchanged since 1973. IMF GFS has undergone methodological reforms historically, but the vintages we use all fall under the closely aligned GFSM 2001 and GFSM 2014 frameworks. The League of Nations and United Nations yearbooks similarly relied on stable public finance classifications within their respective eras. We provide detailed discussions of the few residual methodological breaks and how we treat them in Appendix Section A.

Digitization and validation: Our new database brings together 119 historical vintages of the main international sovereign debt data sources of their time. Recent vintages—particularly for the World Bank and the IMF—are available in machine-readable format from official online repositories. For the majority of historical editions, however, the underlying data had to be digitized from scanned PDFs, CD-ROMs or hard-copy reports obtained from institutional archives and libraries (see Appendix Section A.3 for details). Across all four sources, we applied a common digitization pipeline, enabled by recent advances in AI-based tools for digitizing historical documents (see, e.g., Carlson et al., 2024). We primarily relied on Google's Document AI to perform optical character recognition (OCR) of tabulated debt data, followed by systematic manual verification and correction to ensure accuracy. Only for a subset of older or low-quality sources—where automated OCR proved unreliable—did we resort to fully manual data entry.

After digitization, we conducted extensive consistency checks across vintages and sources. These included (i) verifying internal accounting identities (e.g., the consistency between totals and subcomponents or stocks and flows), (ii) tracking country-level series across successive vintages to identify implausible breaks or revisions, and (iii) standardizing country definitions, units, and currency conversions. We reconciled all discrepancies by manually revisiting the original sources before merging all series into a single harmonized data panel. Appendix A.3 describes the full pipeline.

Scope of the database. Our new database covers debt statistics for an unbalanced sample of 187 countries, including both advanced economies and developing and emerging market economies, from 1912 to 2024. Table 1 summarizes the scope and coverage of the database, while Appendix Figure A.1 lists all countries in the sample. In total, the database contains 476,809 observations drawn from 119 reporting vintages. Coverage is broadest for public external debt, which is available for 186 countries. The World Bank provides the largest number of observations for developing and emerging market economies, the IMF's *Government Finance Statistics* extends modern coverage to advanced economies, and the League of Nations and United Nations sources extend the historical record back to the early twentieth century. The multi-vintage structure of the database allows us to compare each debt statistic across successive reports and to measure ex post revisions systematically.

Key variables: Across our four sources, debt series are typically broken down by creditor type (external vs. domestic) and by the distinction between debt stocks and various flow series. In our core analysis, we focus on external public debt, which is available across all four sources with the broadest country and time coverage. Domestic debt is also economically important, but it is harder to measure consistently across countries and over long periods (Reinhart and

Table 1: New database of debt data revisions: Scope and coverage

	Number of vintages	Years covered	Number of countries	Number of data points
By type of debt				
Public external debt	119	1912 – 2024	186	336,268
Total public debt	66	1912 – 2020	169	24,898
Public domestic debt	66	1912 – 2020	168	15,733
Private debt	53	1970 – 2024	146	99,910
By variable				
Debt stocks	119	1912 – 2024	187	265,973
Debt commitments	57	1921 – 2024	154	107,025
Net flows	47	1970 – 2024	146	103,811
By source				
League of Nations	19	1912 – 1945	58	8,507
United Nations	31	1912 – 1978	59	20,777
International Monetary Fund	16	2000 – 2020	159	29,770
World Bank	53	1965 – 2024	146	417,755
Full database:	119	1912 – 2024	187	476,809

Notes: This table provides details on the scope and coverage of our new database on debt data revisions by type of debt, variable and source. The years covered by a data component exceed the number of vintages since each vintage reports data for more than one year.

Rogoff, 2011a). Compared with external debt, domestic debt series are available for a smaller sample and are more sensitive to differences in consolidation practices, the treatment of intra-government claims and arrears, and the classification of locally held instruments. We therefore use domestic and total public debt only as complementary measures in the analysis below. Additional breakdowns by instrument type (bonds vs. loans) and creditor subcategory (multilateral, bilateral, and commercial) are available for some sources and time periods and are used in case studies, consistency checks and supplementary analysis (see Appendix B.6).

Debt stocks - disbursed and outstanding obligations at a point in time - are the standard metric in macroeconomic research and policy analysis, and the only debt measure available across all four sources and over the full sample period. Flow variables, capturing borrowing and repayments, provide complementary information, but their definitions, coverage, and availability vary substantially across sources and over time (see Appendix A for details). Our core analysis therefore focuses on debt stocks, drawing on flow variables—new commitments in particular—where they are available and especially informative.

3.2 Measurement

By comparing debt statistics across vintages within the same reporting system, we construct two related measures. The first captures the amount of debt that was initially unreported for a given country and year. The second captures hidden debt *revelations*: the amount of previously

unreported debt that is incorporated into the statistical record in a given vintage. We define both measures formally below and construct them separately for debt stocks and debt flows.

First, we define "hidden debt" or the extent of underreporting for a given country, year and debt aggregate as follows:

$$HiddenDebt_{i,t,j} = Debt^{V}_{i,t,j} - Debt^{v_0}_{i,t,j} \tag{1}$$

where $Debt_j$ is either the debt stock ($j = stock$) or flow value ($j = flow$), reported in vintages V and v_0, with V being the most recent vintage and v_0 being the first vintage with a value for country i and year t. In other words, the amount of unreported or hidden debt in a given year is defined as the difference between the debt value when first published and the debt value in the most recently published vintage.

Second, we define hidden debt *revelations* as the amount of hidden debt uncovered in a given vintage. It is derived as the difference in reported debt between two consecutive vintages v and $v-1$, across all years that both vintages cover. The appropriate aggregation of data points for this measure differs between debt flows and debt stocks.

For flow variables, each observation refers to new borrowing (or net flows) in a particular year. Revisions to flow variables can therefore be summed across all years covered by two consecutive vintages without counting the same liability more than once. Formally,

$$HiddenDebtRevelation^{v}_{i,flow} = \sum_{t=t_0}^{T} \left(Debt^{v}_{i,t,flow} - Debt^{v-1}_{i,t,flow} \right) \tag{2}$$

where $Debt_{i,t,flow}$ is the debt flow value for country i in year t, with t_0 being the first year available in both vintages v and $v-1$, and T being the most recent year available in the same two vintages.

For debt stocks, by contrast, the ex post addition of a single previously unreported loan can revise the stock series in every year until the loan is repaid. Summing stock revisions across years would therefore double-count the same underlying liability. To measure a hidden debt revelation in the debt stock, we therefore use an alternative measure:

$$HiddenDebtRevelation^{v}_{i,stock} = \max_{t \in [t_0, T]} \left\{ Debt^{v}_{i,t,stock} - Debt^{v-1}_{i,t,stock} \right\} \tag{3}$$

where $Debt_{i,t,stock}$ is the debt stock value for country i in year t, with t_0 being the first year available in both vintages v and $v-1$, and T is the most recent year available in the same two vintages. Instead of summing all differences in the debt stock as we do for flows in equation (2), this measure records the largest upward revision in a country's debt stocks series that is introduced by vintage v. We use the maximum because it provides the closest available approximation to the full nominal value of the newly revealed liability. Revisions at other points in the stock series may reflect an arbitrary stage in the liability's life cycle, depending on its disbursement and repayment schedule.

Our measures of hidden debt and hidden debt revelations are based exclusively on comparisons across vintages *within* the same data source.[7] By restricting comparisons to vintages of the same source, we avoid confounding debt revisions with differences in definitions and coverage across sources.

3.3 Interpretation and limitations

Interpretation: Across all four reporting systems, the debt statistics we analyze are based on official government reporting under explicitly stated accounting and coverage frameworks. While institutional mandates, sectoral coverage, and instrument definitions differ across systems, each system exhibits a high degree of internal consistency over time. As a result, revisions reflect changes in information about the underlying loans and bonds portfolio, rather than changes in the underlying reporting framework itself.[8] Our measure of hidden debt therefore captures debt that should have been recorded under prevailing reporting standards but was incorporated into the statistical record only ex post. As we discuss in greater detail in Section 4.1, such omissions can arise from a range of sources, including accidental reporting errors, persistent gaps in debt recording and consolidation, or intentional concealment.

Distinction from contingent liability realizations: The debt data revisions that we document are *not* driven by contingent liability realizations, i.e., the government's assumption of private sector liabilities. In contrast to hidden debt as defined here, contingent liability realizations do not require ex post revisions to previously published debt data; rather, they only lead to increases in subsequent annual public debt burden indicators (see Appendix Section B.2 for a detailed discussion and an empirical analysis of this proposition). Nevertheless, contingent liability realizations share several of the properties of hidden debt revelations that we document in this paper. The government's assumption of private sector liabilities, most notably in the form of bailouts of domestic banks, tends to occur during times of distress and can lead to unanticipated jumps in the government's debt burden (Diaz-Alejandro, 1985; Campos et al., 2006; Reinhart and Rogoff, 2011b; Bova et al., 2016; Hur et al., 2021). In this sense, our measure of underreporting is a lower bound for the overall magnitude of "debt revelations" that bond investors endure during financial crises.

Validation and robustness: We conduct several robustness and validation exercises throughout the Appendix to rule out the possibility that debt data revisions are driven by alternative mechanisms. In particular, we verify that our revision patterns are not driven by foreign exchange rate effects (Section B.1), contingent liability realizations and reclassifications of liabilities (Section B.2), reporting lags (Section B.3), revisions to dated debt figures (Section B.4), or changes in debtor scope and coverage. We also show that cases of reporting rule violations documented by the IMF Board align with the debt data revisions in our dataset (Section B.5)

[7] For example, we are comparing the same data point across different vintages of the World Bank data but do not construct comparisons between World Bank and IMF data.

[8] This stands in contrast with real GDP growth and other macro variables that are also subject to frequent revisions (see, e.g., Aruoba, 2008; Johnson et al., 2013; Goes, 2024). Since these variables need to be estimated or can be revised in response to methodological refinements or updated assumptions, the nature of revisions in these variables is different from that of revisions in debt data reporting that we document here.

and that breakdowns of data revisions by instrument and creditor type align with differences in observability and relative transparency (Section B.6).

Limitations: We emphasize several limitations to our measure. First, loans that are initially missing from the four reporting systems may have been reported in other debt databases. Such instances would still constitute a violation of the prevailing reporting requirements but would imply less secrecy. Similarly, revelations within the reporting system may follow revelations through other sources with a lag (see, e.g., the Mozambique case study referenced in Section 2, where the hidden loans were added to the IDS after being revealed by an international audit). This issue warrants caution in regard to treating our debt data revisions as pure "news shocks" (Arezki et al., 2017).

Finally, our measure of hidden debt is a lower bound for the true level of unreported or hidden debt. It does not capture some varieties of hidden debt that have proven consequential in practice: off-balance-sheet central bank liabilities (e.g., foreign currency obligations through derivatives, as in Thailand and Korea during the 1997–98 Asian crisis) and sub-national domestic debt not consolidated into central or general government accounts (e.g., Puerto Rico) (Reinhart and Rogoff, 2011b). In both cases, these liabilities are absent from the selected reporting frameworks altogether. Beyond these structural omissions, our revision-based measure of hidden debt captures only instances in which initially unreported debt is eventually revealed. By definition, our measure does not capture the possibly large amount of unreported debt that remains unreported, and that is never incorporated into these debt statistics.

4 Empirical Patterns of Hidden Debt

This section establishes three new stylized facts about hidden debt, based on the full distribution of debt data revisions across our new database. First, public debt statistics are systematically underreported across all regions, eras, and reporting systems (Section 4.1). Second, underreporting is particularly severe in countries with weaker institutions, where revisions are both larger on average and more dispersed (Section 4.2). Third, debt data revisions are markedly procyclical: hidden debt accumulates in economic booms and is revealed during downturns (Section 4.3).

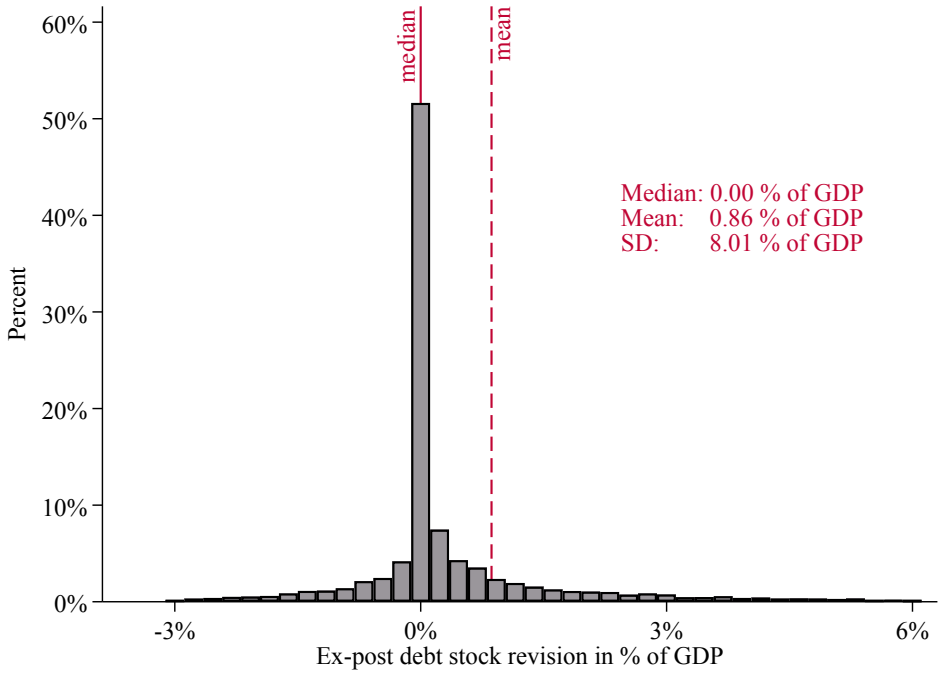
4.1 Systematic Underreporting of Sovereign Debt

Figure 5 shows the distribution of ex post revisions to external debt stocks (Panel A) and debt flows (Panel B) across all reporting systems and 119 vintages. The focus is on *external* debt—our preferred measure, as explained in Section 3—which provides the most consistent coverage across all four sources and the full century of data. All revisions are expressed in percent of GDP, where GDP is always taken from the most recent vintage or from a single external data source, so that our results are not mechanically affected by GDP data revisions.

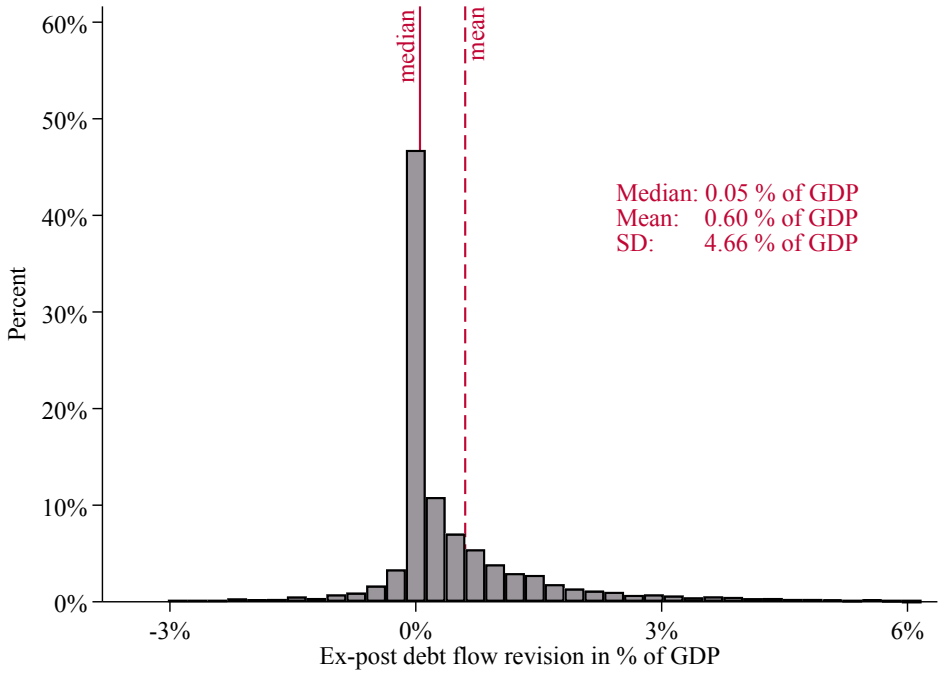
Two results stand out. First, there is large uncertainty about the true level of external indebtedness. Debt data are frequently revised, both upward and downward, with large dispersion in

Figure 5: External public debt is systematically underreported, 1920-2024

Panel A: Revisions to external debt stocks in percent of GDP



Panel B: Revisions to external debt flows in percent of GDP



Notes: The figure shows the distribution of external debt data revisions, as defined in equation (1), in percent of GDP. The horizontal axes are truncated for readability but all observations are retained in the calculations. The Figure includes all external debt data from the League of Nations, the United Nations, the World Bank International Debt Statistics, and the IMF Government Finance Statistics. Panel A focuses on debt stocks, whereas Panel B focuses on debt flows. The solid vertical lines show the median and the dashed vertical lines show the mean. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions.

both stock and flow measures. Approximately 56 percent of all external debt stock statistics and 59 percent of all external debt flow statistics in our combined database are revised at least once after their initial publication. Standard deviations are also large at 8.0 percent of GDP for stock revisions and 4.7 percent of GDP for flow revisions. Real-time debt data are a noisy signal of true sovereign indebtedness.

Second, external debt data are systematically underreported. Under a well-behaved statistical process, revisions would be approximately symmetric and centered around zero (Aruoba, 2008). Instead, the distribution is heavily skewed to the right. While the median debt stock revision is close to zero, the average revision is positive and large at approximately 0.9 percent of GDP, and a one-sided large-sample skewness test rejects zero skewness in favor of right skewness at the one percent significance level. The flow measure confirms this finding: unreported new borrowing has a positive mean of 0.6 percent of GDP and upward flow revisions are four times as likely as downward revisions. These patterns are inconsistent with a well-behaved revision process and point to systematic underreporting of sovereign debt.

The observed shape of the revision distribution can be decomposed into two latent components. The first is routine reporting noise, including accidental errors, administrative updates, and other small corrections that can generate both positive and negative revisions and should be roughly symmetric around zero. The second is systematic underreporting: a persistent upward bias reflecting chronic gaps in debt recording and consolidation or even cases of outright concealment of liabilities. Appendix D.1 formalizes this distinction using an empirical Bayesian mixture model. The model assigns each revision a posterior probability of belonging to the systematic-underreporting component. The two components are identified from the asymmetry of the revision distribution: there are 1.78 upward debt-stock revisions for every downward revision, and this imbalance becomes increasingly pronounced at larger revision magnitudes. Such patterns cannot be generated by reporting noise alone. The results show that both components matter. Most revisions are small and appear to reflect routine reporting noise, but the systematic-underreporting component accounts for the bulk of hidden debt stocks: only 12 percent of revisions are classified as systematic underreporting, yet these observations account for nearly 80 percent of the total size of upward revisions in percent of GDP.

Table 2 shows that underreporting is a general feature of sovereign debt statistics, not a phenomenon confined to a particular subset of the data. Upward bias appears not only in external public debt, but also in domestic public debt, total public debt, and private external debt.[9] The pattern holds across all four reporting systems and across the full century of data—from the interwar period to the Covid-19 pandemic—with no clearly discernible long-run trend. Underreporting is also pervasive across countries and income groups, including in advanced economies.

The magnitude of hidden debt is also economically meaningful when expressed as a share of reported debt. Across the full database, around 3 percent of reported external public debt is added to the statistics only in subsequent data vintages, with domestic and total public debt

[9]While all debt components are systematically underreported, the relative differences across aggregates in Table 2 are hard to interpret directly, as they reflect different country, source, and time samples. In Appendix Section D.10, we provide a clean comparison of the susceptibility of external and domestic public debt to underreporting and find no robust evidence of systematic differences in the corresponding revision distributions.

Table 2: Systematic underreporting of debt across sources, eras, and country groups

	N	Mean	Median	Std. Dev.	Skew	Hidden debt in % of total debt
By type of debt						
Public external debt	9,668	0.86***	0.00	8.01	28.16***	3.26
Total public debt	4,036	1.16***	0.00	12.59	23.67***	2.53
Public domestic debt	2,530	0.48**	0.00	6.26	14.68***	2.26
Private debt	6,159	1.20***	0.00	10.39	14.32***	19.34
By source						
League of Nations	1,970	1.10**	0.00	19.17	19.71***	2.35
United Nations	3,186	0.72**	0.00	10.52	16.04***	4.16
International Monetary Fund	4,526	0.68***	0.00	4.37	2.00***	2.39
World Bank	12,711	1.11***	0.00	8.23	14.81***	10.26
By era						
Interwar (1918 - 1939)	1,874	1.07*	0.00	19.70	19.09***	4.02
Bretton Woods (1944 - 1971)	3,064	0.75***	0.00	10.25	17.83***	3.98
Modern era (1972 - present)	16,973	1.00***	0.00	7.47	14.98***	4.55
By region						
Africa	5,091	1.74***	0.00	13.19	12.96***	8.41
Americas	5,795	1.14***	0.00	11.72	29.46***	4.39
Asia	4,659	0.40***	0.00	5.02	6.24***	2.94
Europe	4,724	0.78***	0.00	5.96	6.15***	3.66
Middle East & North Africa	2,124	0.29	0.00	4.92	8.10***	3.76
By income						
Low income	2,850	1.70***	0.00	13.43	13.51***	6.87
Lower middle income	6,435	1.21***	0.00	13.08	23.13***	4.87
Upper middle income	6,978	0.69***	0.00	5.33	8.13***	4.15
High income	6,130	0.68***	0.00	5.84	2.16***	3.73

Notes: The table reports summary statistics for debt data revisions, as well as the share of hidden debt in percent of total debt. Statistics are presented across different types of debt, sources, regions, eras, and income groups. Mean, median, standard deviation and skew are expressed as percentages of GDP. Asterisks in the Mean column indicate significance from tests of the null hypothesis that the mean revision is zero, using Newey–West heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987). Asterisks in the Skew column indicate significance from a one-sided large-sample skewness z-test of the hypothesis of zero skewness against the alternative of right skewness. ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively.

in the same order of magnitude. For private external debt, which is available only in the World Bank debt statistics and therefore covers a different sample of mostly developing countries, underreporting is particularly pronounced: close to 20 percent of reported private external debt is added ex post.

While underreporting is close to universal in incidence, it is highly uneven in magnitude. Table 2 suggests that the magnitude of hidden debt differs sharply across countries. Upward revisions are especially large in low-income countries and in Africa, whereas high-income countries exhibit smaller average revisions and lower dispersion. We explore this cross-country heterogeneity in the next subsection.

4.2 Institutional Determinants of Hidden Debt

Not all sovereigns underreport to the same extent. Both the level and the dispersion of debt revisions vary systematically with institutional strength: countries with weaker institutions exhibit larger average revisions and greater dispersion, meaning investors face a noisier signal of true indebtedness. As before, the main analysis focuses on external public debt (see Appendix A.2 for a discussion of domestic debt data).

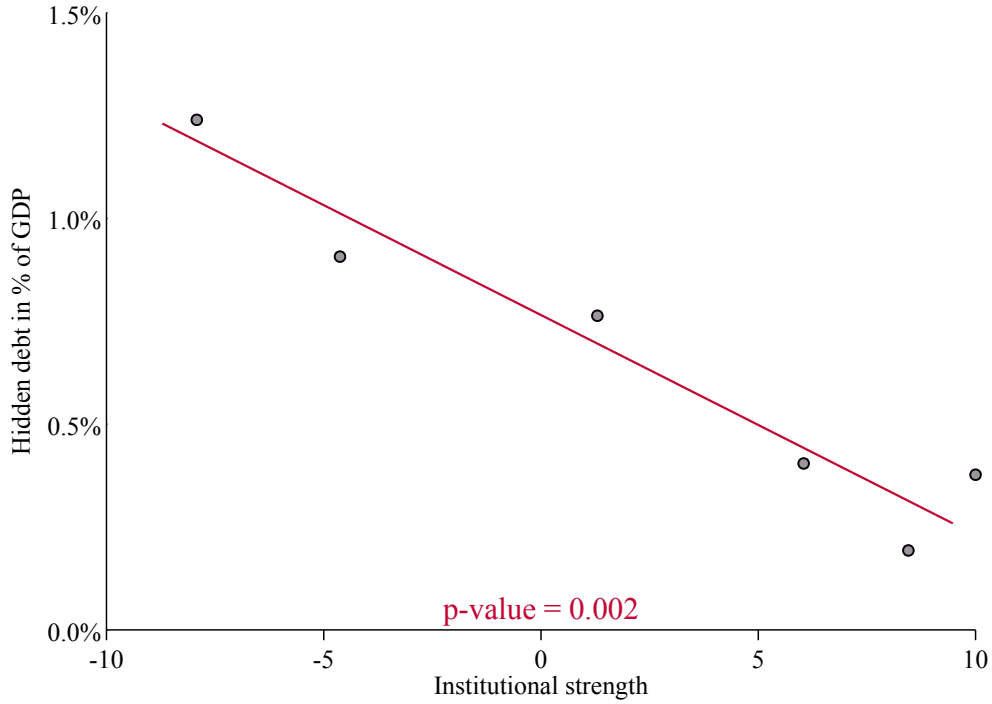
Figure 6 documents the relationship between hidden debt and institutional quality using the Polity project's democracy-autocracy score, which is available for a wide range of countries and years (Marshall and Gurr, 2020). Panel A focuses on the *bias* in debt reporting: it plots mean revisions against institutional strength, using the optimal binscatter approach of Cattaneo et al. (2024). We group country–year-source observations into equally sized bins based on the distribution of the Polity5 score and plot the average value of underreporting (as defined in Section 3.2) within each bin. The corresponding regression table is presented in Appendix D.2. The downward-sloping pattern indicates that stronger institutional environments are associated with weaker upward bias in debt data revisions and therefore lower average levels of hidden debt.

Panel B turns from bias to *precision* in debt reporting across institutional environments. It uses whisker plots to show the distribution of revisions by quartile of institutional strength and documents that weak institutional environments feature substantially more volatile revisions, a wider interquartile range and more extreme tail realizations. While even the countries with the strongest institutions in our sample exhibit significant underreporting bias (Panel A), their debt statistics are reported with considerably higher precision (Panel B).

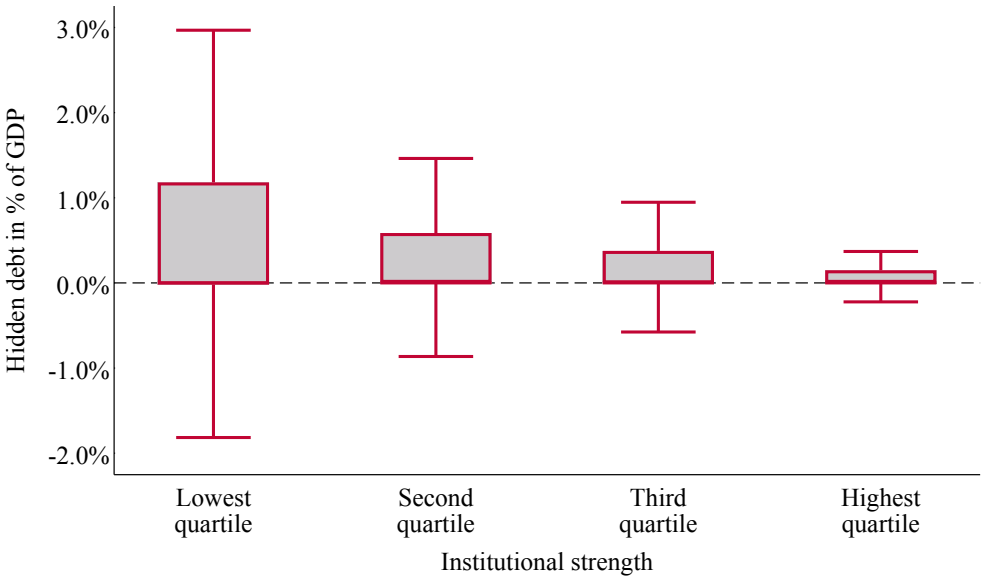
Taken together, Figure 6 shows that institutional differences shape both the bias and the reliability of reported public debt. In weak institutional environments, reported debt is more downward biased and subject to greater uncertainty. Investors and policymakers therefore face a particularly noisy signal of true sovereign indebtedness. In Section 6, we incorporate this empirical pattern into a quantitative model of hidden debt and investor monitoring and assess how differences in debt-data reliability affect borrowing costs, default risk, and debt-carrying capacity across countries. This allows us to quantify the extent to which hidden debt can account for the phenomenon of "debt intolerance" (Reinhart et al., 2003; Kraay and Nehru, 2006).

Figure 6: Hidden debt and institutional strength

Panel A: Reporting *bias* and institutional strength



Panel B: Reporting *noise* and institutional strength



Notes: The figure relates revisions to external public debt stocks, defined in equation (1) and expressed as a percentage of GDP, to institutional strength measured by the Polity5 democracy–autocracy score. Panel A presents a binned scatter plot, where the number of bins is derived using the optimal binning procedure of Cattaneo et al. (2024). The red line and the p-value are obtained from a bivariate regression of the binned data with standard errors clustered by country. Panel B uses whisker plots to show the distribution of debt revisions across quartiles of institutional strength. The boxes span the interquartile range, while the whiskers extend to the most extreme observations within 1.5 times the interquartile range. The median revision is zero in each quartile and therefore coincides with the lower edge of the box. The sample combines all four data sources over the full sample period. Gaps in the Polity5 series are filled by linear interpolation.

4.3 Hidden Debt over the Business Cycle

We next examine the cyclical patterns of hidden debt accumulation and revelation. A key advantage of our vintage-by-vintage data structure is that it allows to distinguish between the timing of unreported borrowing (when hidden debt is incurred) and the timing of revelation (when previously hidden debt is disclosed). As before, the main text focuses on *external public debt*. However, the analysis uses debt *flow* rather than stock revisions, as flows exhibit substantially stronger cyclical variation than the stock series, which displays significant autocorrelation.

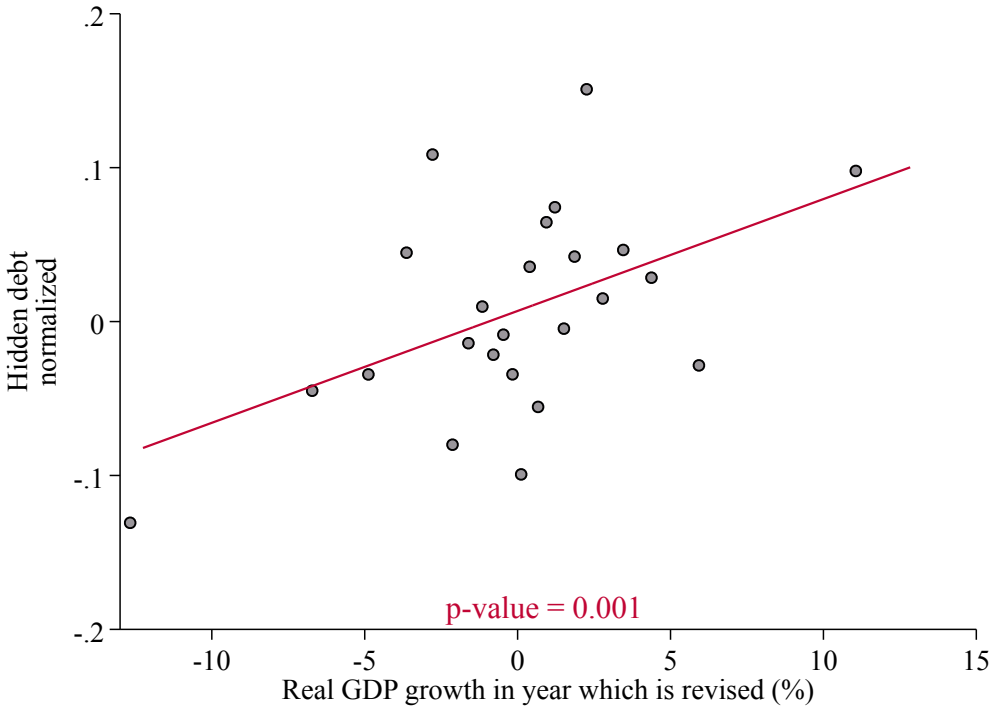
Figure 7 exploits this distinction by plotting two separate relationships. Panel A shows the relationship between hidden debt and real GDP growth *in the year that is later being revised*. Panel B shows the relationship between real GDP growth and hidden debt *revelations*. That is, we focus on those years (or vintages) in which hidden debt is revealed and added to the statistics.

More precisely, Figure 7 presents binscatter plots following the optimal binning approach of Cattaneo et al. (2024). The unit of observation is a country–year–source observation. We group observations into equally sized bins based on the distribution of real GDP growth and plot the average value of hidden debt or hidden debt revelations within each bin. The reported relationships are based on residualized variables: both real GDP growth and our measures of normalized hidden debt are adjusted for country, year or vintage, and source fixed effects, and GDP is detrended using an HP filter to isolate cyclical variation. The corresponding regression specifications and tables are presented in Appendix D.3.

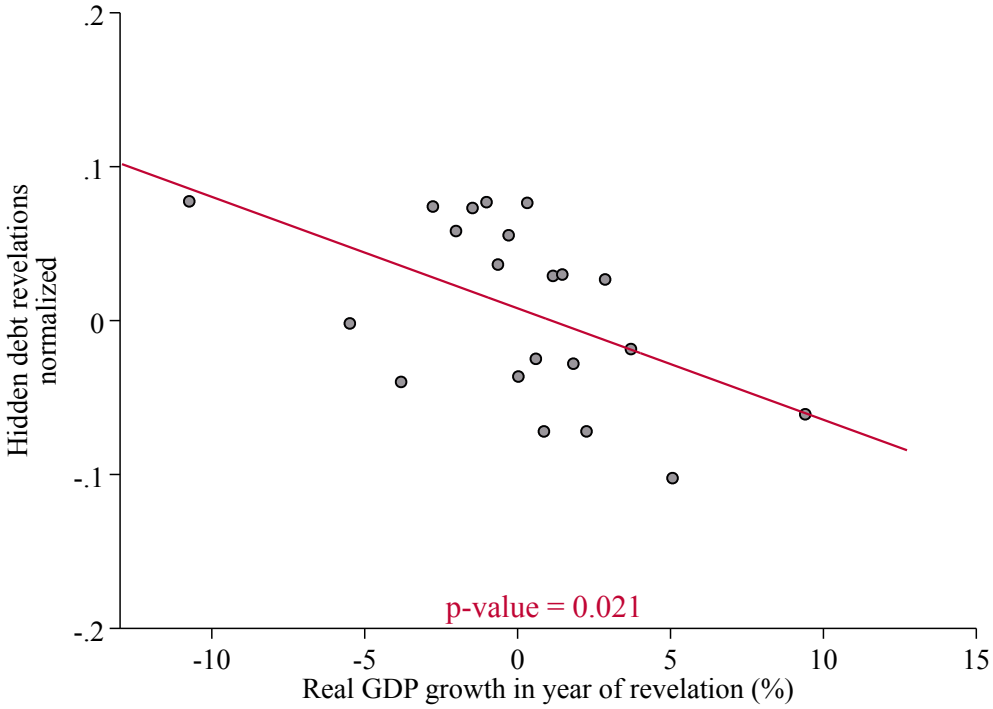
Panel A documents a strong positive correlation between hidden debt *accumulation* and GDP growth: boom years are subject to systematically higher upward revisions, indicating that unreported borrowing occurs disproportionately in good times. Panel B shows a strong negative association: Hidden debt *revelations* are much larger when real GDP growth is low, that is during the bust. Taken together, the two panels reveal a clear boom-bust pattern. Hidden liabilities accumulate in good times and are revealed in bad times.

Figure 7: The procyclical nature of hidden debt

Panel A: Which years are being revised?



Panel B: When do revelations happen?



Notes: Panel A shows the association between hidden debt and GDP growth in the year that is being revised. Panel B shows the association between hidden debt revelations and GDP growth in the vintage that introduces the revision. The vertical axes show normalized hidden debt flows and their revelations, as defined in equations (1) and (2) respectively. We normalize the series and winsorize at the 1^{st} and 99^{th} percentiles to account for outliers and to ease interpretation. Horizontal axes show detrended growth rates. Trends were computed using the Hodrick-Prescott filter with a smoothing parameter of 100. Bins are constructed following the optimal binning approach of Cattaneo et al. (2024). P-values and regression lines were obtained from panel regression in which we control for year, country and source fixed effects with standard errors clustered at the country level.

5 Hidden debt and Sovereign Default, 1922–2020

This section moves from the full distribution of debt data revisions to the upper tail of hidden debt revelations. We focus on episodes in which large amounts of previously unreported debt are incorporated into the statistical record. This episode-based perspective reveals a striking empirical regularity: Across 187 countries and more than a century of data, almost half of all sovereign defaults in our sample coincide with large hidden debt revelation episodes.

5.1 Defining *large* revelation episodes

To distinguish economically meaningful revelations from routine statistical noise, we identify *large* hidden debt revelation episodes in the upper tail of the revelation distribution. This approach follows an established tradition in macroeconomics of identifying tail events from continuous data, including credit booms (Schularick and Taylor, 2012), hyperinflation episodes (Cagan, 1956; Fischer et al., 2002; Reinhart and Rogoff, 2009), and macroeconomic disasters (Barro, 2006; Barro and Ursúa, 2008).

We define a hidden debt revelation episode as a country-year in which hidden debt revelations, as defined in equation (3), fall in the top decile of the revelation distribution. Episodes are assumed to last two years. This reflects the institutional process through which newly disclosed liabilities are incorporated into revised statistics and avoids treating successive revisions as separate events. Our findings are robust to alternative size thresholds, country- and source-specific thresholds, variation in episode duration, and classification based on a Bayesian latent mixture model (Appendix D.4).

Our baseline definition identifies 531 large hidden debt revelation episodes in 154 different countries over the past century, with an average revelation size of 4.98 percent of GDP. 428 episodes—or roughly 80 percent—involve revelations of hidden *external* public debt; the remainder reveal previously unreported *domestic* public debt.[10] Appendix Figures C.5–C.9 plot the full chronology of revelation episodes by country and year, while Table 3 reports selected episodes over the past century. The resulting chronology recovers well-known cases, including the hidden debt scandals in Greece and Mozambique discussed in Section 2, but also uncovers many episodes that have received little systematic attention. Appendix Section C documents many of these episodes in detail through the accounts of contemporary policymakers and observers. These historical accounts underscore the recurring limitations of public debt statistics and point to a systematic pattern: large hidden debt revelations cluster around episodes of sovereign debt distress. We systematically analyze this pattern in the next subsection.

[10] This difference should not be interpreted as evidence that domestic debt is less susceptible to underreporting. It reflects the much more comprehensive data coverage for external debt as well as sample selection effects. See Appendix D.10 for a detailed comparison.

Table 3: Hidden Debt Revelation Episodes: Selected Cases

Historical period	Country	Year	Revelation size	
			% of GDP	% of reported Debt
The Great Depression	Argentina	1932	7	8
	Chile	1933	13	13
	Germany	1933	2	33
	Egypt	1935	6	11
	Hungary	1935	2	9
Bretton Woods	Brazil	1951	2	32
	Turkey	1956	4	28
	Ghana	1966	9	53
1980s Debt Crises	Bolivia	1980	11	21
	Ecuador	1982	4	21
	Malaysia	1982	2	7
	Nigeria	1983	2	21
	Turkey	1983	3	11
	Morocco	1986	4	5
Eurozone Crisis	Greece	2011	20	11
	Ireland	2011	5	4
	Portugal	2011	8	7
Covid Pandemic	Angola	2021	18	26
	Congo	2022	6	14
	Pakistan	2022	2	8
	Zambia	2023	12	21

Notes: This table reports selected episodes of hidden debt revelations occurring during periods of sovereign distress. See the text for the episode definition. Revelation magnitudes are expressed in percent of contemporaneous debtor-country GDP and reported debt. Reported debt is the latest available value of the same debt aggregate and reporting system to which the revision applies.

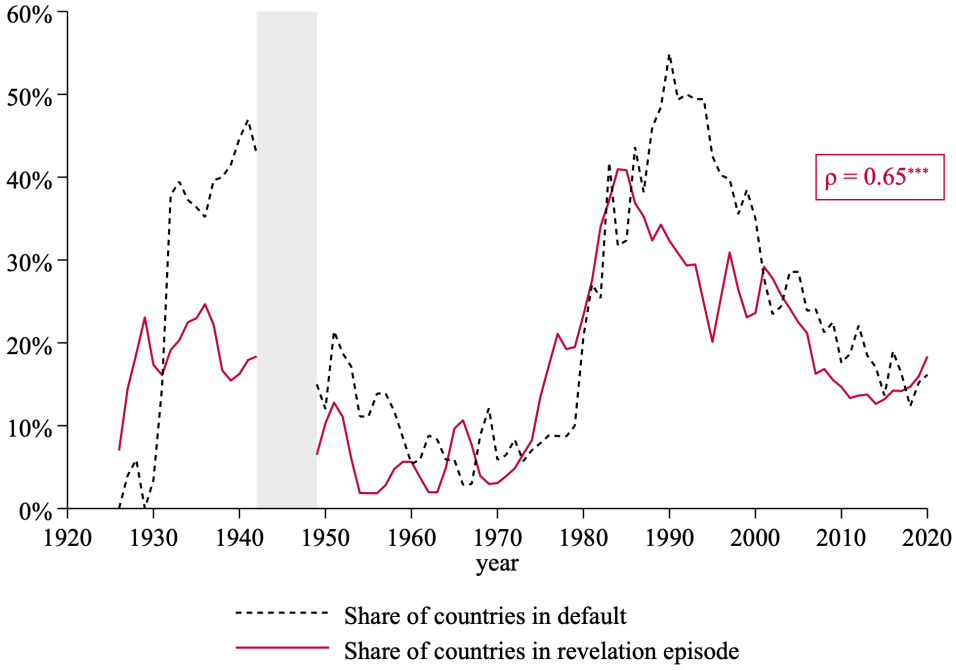
5.2 Hidden Debt Revelations and Sovereign Default

Hidden debt revelation episodes and sovereign defaults coincide with striking empirical regularity. Over the past 100 years, 46 percent of all sovereign defaults events in the chronology of Reinhart and Rogoff (2009) have coincided with a hidden debt revelation episode.

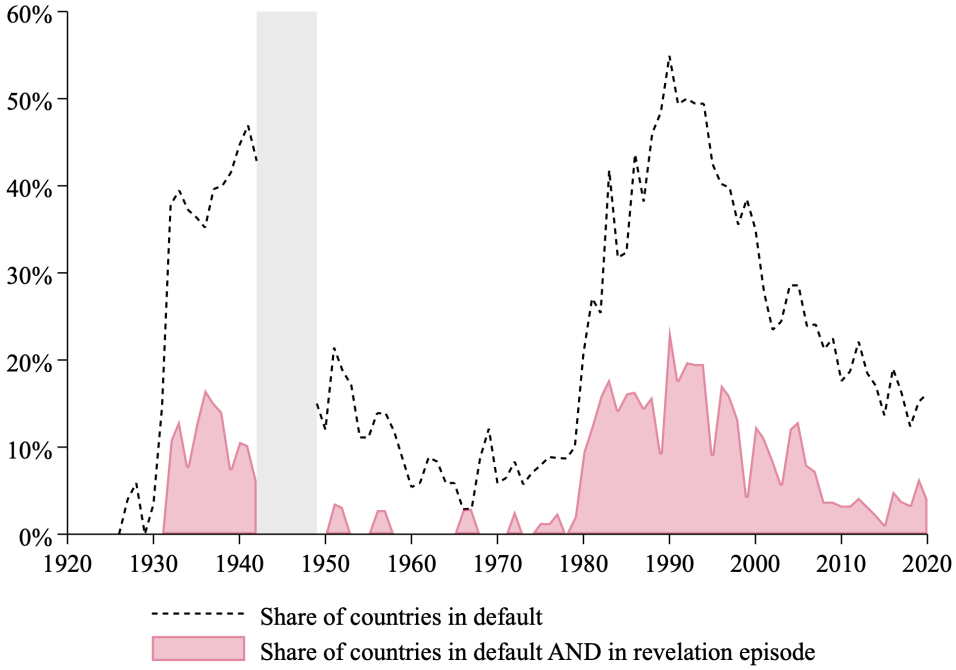
Figure 8 traces both series over the 1922–2020 sample. Panel A documents that the share of countries experiencing hidden debt revelation episodes closely tracks the share of countries in sovereign default, with a correlation coefficient of 0.65. Major international debt crises have repeatedly gone hand in hand with large revisions to public domestic and external debt levels. While the hidden debt revelations during the defaults of the Covid era and the Eurozone Crisis of the 2010s are comparatively well known, the large hidden debt surprises of the 1930s and 1980s have largely been forgotten. Our new data reveal that the international lending booms of the 1920s and 1970s were followed by widespread upward revisions in public debt statistics,

Figure 8: Hidden debt revelations and sovereign default, 1922-2020

Panel A: Comovement of hidden debt revelation and sovereign default episodes



Panel B: Share of defaulters that experience hidden debt revelations



Notes: This figure visualizes the relationship of large hidden debt revelation episodes, as defined in Section 5.1, and sovereign default. Panel A plots the three-year moving average of the share of countries experiencing a large hidden debt revelation episode and the share of countries in default. Panel B shows the share of countries in default together with the share of countries in default that simultaneously experience a large hidden debt revelation episode. Shares are computed over country-years with non-missing revelation data. Defaults include domestic and external sovereign defaults, and significant and persistent arrears vis-a-vis official creditors (as defined in Reinhart and Trebesch (2016)). The shaded area marks years with no data.

once booms had turned into busts. The 1930s, for example, saw widespread upward revisions in the League of Nations Statistical Yearbooks across eleven different Latin American borrowers, while the 1980s crisis came with hidden debt revelation episodes in 61 different EMDEs in Sub-Saharan Africa, Asia, and Latin America. Panel B provides a complementary perspective and confirms the pattern at the country level: among sovereigns in default, nearly one in two experience a large hidden debt revelation during the default episode.

Table 4 estimates linear probability models with a rich set of fixed effects. The regressions confirm the tight link between hidden debt revelations and sovereign default over the full 100-year sample, even when controlling for country, year, and source fixed effects, as well as other drivers of data revisions such as the Polity5 measure. Our models show that sovereign default events are associated with an 8 percentage point higher probability of experiencing a hidden debt revelation episode. The regression framework also allows us to shed further light on the mechanism linking the two phenomena. We show that revelation episodes are particularly likely during international adjustment programs, such as those carried out by the International Monetary Fund. International adjustment programs are associated with an increase in the probability of a large revelation episode by an additional 4 percentage points.

Table 4: Hidden debt revelation episodes and sovereign default

	Dep. var.: Hidden debt revelation episode			
	(1)	(2)	(3)	(4)
Sovereign default	0.18***	0.14***	0.08***	0.08***
	(0.02)	(0.02)	(0.02)	(0.03)
IMF/LoN program	0.05***	0.04***	0.04***	0.04***
	(0.02)	(0.02)	(0.02)	(0.02)
Observations	6,118	6,117	6,117	6,117
R-squared	0.046	0.128	0.182	0.182
Controls	✓	✓	✓	✓
Country FE		✓	✓	✓
Year FE			✓	✓
Source FE				✓

Notes: The table reports coefficients from estimating linear probability models where the dependent variables are hidden debt revelation episodes, as defined in Section 5.1. "Sovereign default" refers to domestic and/or external sovereign default. IMF/LoN program captures the first year of an adjustment program by the IMF or, during the interwar period, by the League of Nations. All regressions control for the type of debt, the standardized cyclical component of real GDP growth and institutional strength. Columns (2) to (4) subsequently add country, year and source fixed effects. Standard errors are clustered at the country level. Asterisks ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

These findings point to external monitoring as a key driver of hidden debt revelations. Periods of crisis—such as sovereign defaults and IMF programs—trigger heightened scrutiny of government accounts and lead to the disclosure of previously unreported liabilities. IMF programs require detailed debt data for sustainability assessments and creditors have a strong incentive to reconcile their records during restructurings. The sovereign's debt records may also be vetted by advisors and international audit firms (see for example the Mozambique and Greece case studies in Section 2).[11]

[11] An alternative hypothesis is that governments strategically reveal hidden debts for political gain, for example after coming to power or after elections. In Appendix Section D.5, we test whether domestic political factors can

At the same time, the causality between the two phenomena is likely to run both ways. Undisclosed debt may itself contribute to financial fragility by leaving market participants and other observers with an incomplete picture of debt sustainability and crisis risk. Our observational data alone, however, cannot cleanly separate these mechanisms. The next section, therefore, turns from the empirical co-movements to an equilibrium framework that allows us to study the effects of hidden debt on borrowing terms, default incentives, and debt-carrying capacity.

6 Quantitative Model

We incorporate the empirical hidden-debt process documented above in a quantitative model of sovereign debt and default. The model rationalizes the co-movement between hidden debt revelations and sovereign risk, and quantifies the implications for borrowing terms, welfare, and the *debt intolerance* puzzle—the fact that emerging economies default at levels of *reported* debt that advanced economies routinely sustain (Reinhart et al., 2003).

The model builds on the workhorse framework of external debt and default developed by Eaton and Gersovitz (1981), Arellano (2008), and Aguiar and Gopinath (2006), with long-maturity debt (as in Hatchondo and Martinez, 2009 and Chatterjee and Eyigungor, 2012), and is augmented with three ingredients motivated by our evidence: (i) a hidden-debt process whose mean and dispersion are estimated directly from the revisions data; (ii) costly monitoring by risk-averse international lenders that may reveal hidden debt; and (iii) an endogenous recovery rate through which hidden debt dilutes the recovery value of market debt during default. We summarize the main ingredients and quantitative results here. The full recursive environment, the agents' problem, the equilibrium definition, and additional quantitative exercises are reported in Appendix E.

The model is best interpreted as that of an economy in which the central government has limited control over the creation and credible reporting of liabilities issued by other parts of the broader public sector (state-owned enterprises, sub-national governments, off-balance-sheet vehicles, etc.). Hidden debt accumulation is therefore modeled as exogenous rather than as a strategic choice.[12] The interpretation matches the empirical patterns documented in Section 4: hidden debt is largest and noisiest in lower-income economies with weak institutions.

6.1 Environment

A small open economy receives a stochastic endowment y and issues long-duration bonds b to an international pool of risk-averse investors.[13] A bond issued at t promises coupons that decay geometrically at rate δ. Crucially, the government cannot commit to future repayment,

explain revelations of hidden debt. We do not find any evidence that governments strategically reveal previously unreported debt or that hidden debt revelations vary systematically across the political cycle.

[12] Appendix E.8 relaxes this assumption, allowing the government to strategically suppress information about hidden debt at a cost.

[13] Although the model is written in terms of external market debt and bond investors, the underlying information problem is broader and extends to other sovereign lending relationships. Previously undisclosed liabilities can dilute the claims of bank and bond investors, private and official creditors, and domestic creditors alike, and

and in each period, it decides whether to repay or to default. A default triggers a temporary exclusion from international markets and an output cost $\phi(y)$. Upon re-entry, defaulted claims are restructured into new market debt b_D, with positive recovery.

In addition, the country carries hidden debt h. Hidden debt has the same coupon structure as market debt and must be serviced in repayment states, but it is unobservable to lenders unless a revelation occurs. Between revelations, hidden debt evolves as

$$h' = (1-\delta)\, h + \varepsilon, \qquad \varepsilon \sim \mathcal{N}(\mu_\varepsilon, \sigma_\varepsilon^2)\,, \tag{4}$$

where ε represents the *innovations* to the hidden debt process and is assumed to be i.i.d. across periods and independent of all other shocks. The distribution of ε is common knowledge, but its realization is observed only by the government.[14]

Lenders are short-lived and arrive in overlapping generations. Each generation enters with a common prior over hidden debt implied by the public state and the hidden-debt process.[15] Within a lending round, however, lenders update their prior using all available information: reported debt b, income y, time since the last revelation τ, and the government's borrowing choice, b'. The explicit Bayes' rule update is reported in Appendix E. Longer spells without revelations (as measured by state variable τ) imply both more expected hidden debt and higher uncertainty about it. When a revelation occurs, the stock of hidden debt becomes observable and is incorporated into reported debt, and both h and τ are reset to zero.

Revelations occur in two ways. First, lenders can pay a monitoring cost to verify the sovereign's accounts. Second, a default triggers a revelation. The latter assumption matches the data: hidden debt is revealed disproportionately often in periods of sovereign distress, when creditors and international institutions scrutinize public accounts more intensively (see Section 5). Monitoring is valuable because hidden debt affects both repayment incentives and recovery values. In repayment states, hidden debt absorbs resources just like reported debt. In default, and in line with the empirical evidence in Appendix D.6, hidden claims dilute the recovery value of market debt. Specifically, market creditors' recovery rate is

$$\omega^b(b,h,y) = \frac{b_D - \psi\,\tilde{h}}{b}\,,$$

can therefore affect pricing, lending, and restructuring decisions whenever the sovereign's true debt position is uncertain.

[14] The government itself cannot credibly communicate its hidden debt stock since self-reported government claims about hidden debt are not verifiable (see Appendix E for details). While we assume that the government knows the true level of hidden debt and lenders can only infer it from observables, the main implications regarding default risk and welfare also emerge in a simpler environment where both the government and the lenders are equally surprised by hidden debt revelations. See Appendix C for a discussion of many such cases.

[15] The overlapping-generations structure captures imperfect information transmission across investor cohorts, consistent with the recurring "this time is different" narratives emphasized by Reinhart and Rogoff (2009) and with the repeated comovement of crises and hidden debt revelations documented in Section 5 and Appendix C.

where $\tilde{h} = \max\{0, h\}$ and $\psi \in [0, 1]$ is the effective recovery on hidden claims. Larger hidden debt therefore lowers the recovery rate on market debt and gives lenders an incentive to monitor the sovereign's books.[16]

6.2 Hidden Debt and Sovereign Risk

A central empirical finding from Section 5 is that hidden debt revelations and sovereign defaults occur together. The model generates this comovement through government default incentives, pricing of sovereign risk, and endogenous information acquisition by the investors. First, hidden debt increases default incentives by increasing the resources required to remain current on all liabilities. Second, uncertainty about hidden debt raises spreads and tightens borrowing opportunities even before any revelation occurs. Third, monitoring provides an endogenous information channel: when default risk is high, information becomes more valuable, so lenders have greater incentives to monitor, thereby making revelations in bad states more likely.

We start by describing how hidden debt increases the sovereign's default incentives. For any reported market debt b, a larger hidden-debt burden raises the liabilities the sovereign must service and lowers the relative value of staying current on debt obligations. Default probabilities, therefore, rise with hidden debt. Panel A of Figure 9 illustrates this result through an *income default threshold*: the income level $\tilde{y}$ below which the default probability exceeds 50%, holding all other state variables fixed. The threshold shifts up with hidden debt. A sovereign carrying more hidden liabilities enters the default region at higher income levels, so the same reported debt ratio is riskier than it appears.

Hidden debt also affects bond prices before it becomes visible. Lenders understand that, in case of default, hidden claims will dilute the recovery value of market debt. Because lenders do not observe h absent a revelation, bond prices depend on the posterior distribution of hidden debt. Since a longer spell without a revelation raises both the prior mean and prior uncertainty that discipline lenders' posterior beliefs, higher values of τ worsen the borrowing opportunities for the sovereign. Panel B of Figure 9 illustrates this effect: the spread-debt menu shifts up and steepens as time passes since the last revelation. Thus, longer no-revelation spells worsen borrowing terms by raising both expected hidden liabilities and uncertainty about their level.

The monitoring decision adds an endogenous information-acquisition margin. Lenders monitor when the benefit of removing uncertainty about hidden debt exceeds the monitoring cost. Because hidden debt dilutes the recovery value of market debt in default, monitoring is most valuable when default risk is high or beliefs about hidden debt are especially dispersed. The model thus generates hidden debt revelations in bad states even before default occurs, while

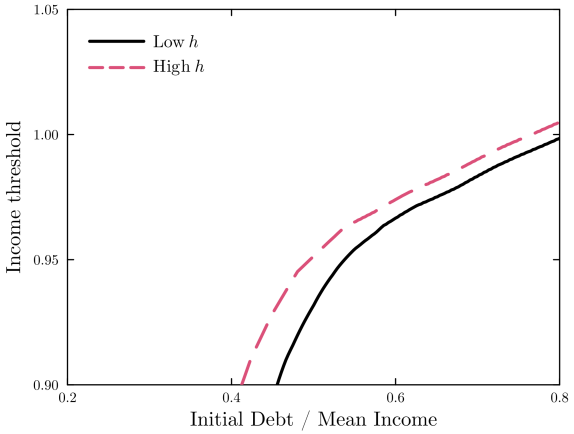
[16] Appendix E.7 extends the model by introducing a third source of revelations: exogenous third-party revelations. This extension captures the fact that hidden liabilities may also become public through independent external scrutiny, for example in the form of IMF programs or World Bank technical assistance missions. The benchmark model is nested as the case in which the probability of such third-party revelations is zero. Allowing for this additional information channel reduces uncertainty and improves borrowing terms, but it does not eliminate the value of creditor monitoring or the central quantitative implications of hidden debt for spreads, default risk, and debt-carrying capacity.

default itself triggers a revelation mechanically. This mechanism helps rationalize why hidden debt revelations cluster around sovereign defaults and adjustment programs in the data.

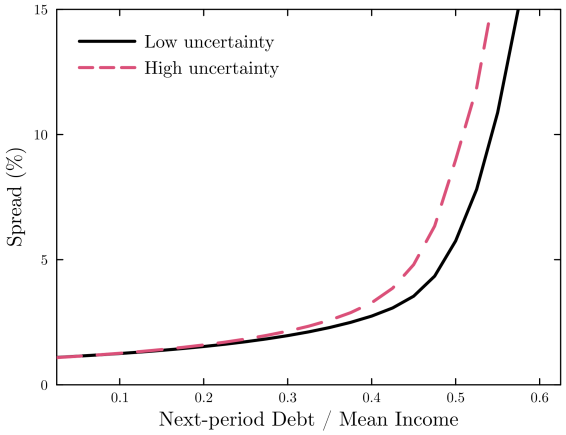
Taken together, these results provide a model-based interpretation of the evidence in Sections 4.3 and 5. The model shows how, as hidden liabilities accumulate and uncertainty widens, the sovereign becomes more vulnerable to bad income shocks and tighter borrowing conditions. As default risk rises, monitoring becomes more valuable, and hidden debt is more likely to be revealed. The model therefore speaks directly to the pattern emphasized by Reinhart and Rogoff (2011b): debt problems often look manageable before a crash, only for the crisis itself to reveal a larger debt burden than contemporaneous statistics suggested.

Figure 9: Hidden debt, sovereign risk, and bond pricing

Panel A: Default thresholds



Panel B: Uncertainty about hidden debt



Notes: Panel A plots the income level below which the ex ante default probability exceeds 50%, for low and high initial hidden debt, setting ε to its mean and $\tau = 5$ (the simulated median). Panel B plots the combinations of next-period market debt and sovereign spreads under low and high ex ante uncertainty about h, corresponding to $\tau = 1$ and $\tau = 10$ (the simulated 75th percentile), respectively. Spreads are computed from no-monitoring bond prices, with income 5% below its mean and initial market debt at 45% of GDP (the simulated median).

6.3 Hidden Debt and Debt Intolerance

The previous subsection shows how our model can rationalize the time-series comovement between hidden debt revelations and sovereign risk. We now turn to the cross-section of countries and ask to what extent differences in debt-data reliability can account for *debt intolerance*. Reinhart et al. (2003) document that emerging economies default at levels of reported external debt that advanced economies routinely sustain. Consistent with this pattern, low- and lower-middle income economies in our sample enter default at mean debt-to-GDP ratios about 20 percentage points below those of high income economies and face average spreads roughly 250 basis points higher (see Appendix D.11 for details).

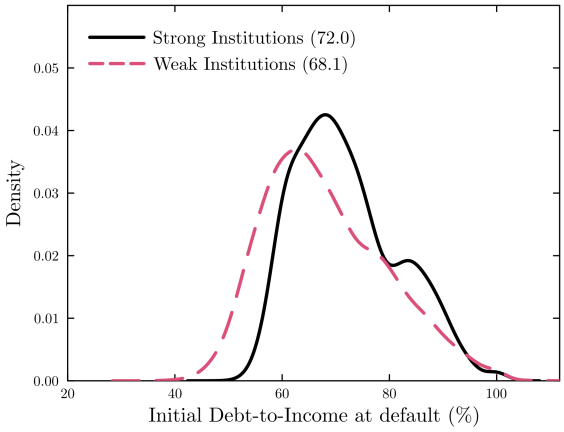
Section 4 documents large cross-country differences in the reliability of sovereign debt statistics. In countries with weak institutions, the same reported debt level b implies a larger expected true liability burden, *and* a wider distribution around it. Through the default-incentive, recovery-

dilution, and monitoring channels of the previous subsection, this translates into higher default risk and lower bond prices at every reported debt level. The same forces that make hidden debt revelations and defaults co-move in the time series, therefore also generate the classic debt-intolerance pattern in the cross-section: developing countries exhibit higher spreads and higher default risk at levels of *reported* debt that seem modest to most advanced economies.

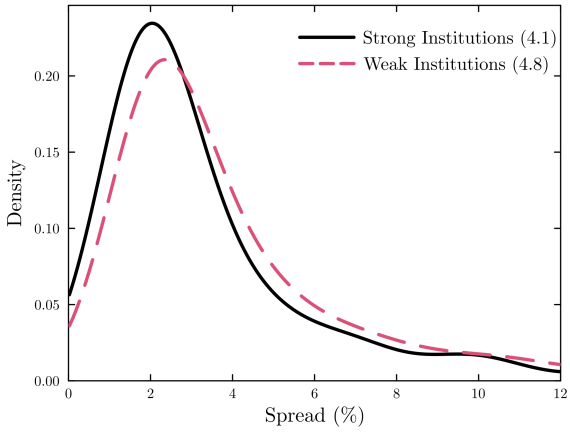
To quantify the channel, we solve the model under two calibrations of the hidden-debt process, holding every other parameter at its benchmark value: a *weak-institutions* economy with $(\mu_\varepsilon, \sigma_\varepsilon) = (1.17\%, 4.5\%)$, estimated from revisions in low- and lower-middle-income countries, and a *strong-institutions* economy with $(\mu_\varepsilon, \sigma_\varepsilon) = (0.16\%, 1.50\%)$, estimated from high-income countries (see Appendix D.11 for details). The two economies differ *only* in the hidden-debt process; other explanations for debt intolerance such as preferences, technologies, default costs, and the income process are held constant (Reinhart et al., 2003; Hatchondo et al., 2009; Meyersson, 2006; Catão and Kapur, 2006; Chamon and Roldán, 2025). Any difference in equilibrium debt and spread behavior can therefore be attributed to differences in the hidden debt process.

Figure 10: Debt intolerance: simulated outcomes

Panel A: Debt ratios at default



Panel B: Sovereign spreads



Notes: The figure compares two model economies that differ only in the hidden-debt process, using long simulations of each. Panel A plots the distribution of the market debt-to-GDP ratio at the moment of default. Panel B plots the distribution of sovereign spreads in non-exclusion periods. Legend values report the corresponding group means. See text and Appendix Section D.11 for details on the Weak- and Strong-Institutions economies.

The quantitative implications are economically meaningful. Figure 10 plots the simulated outcome distributions of the two economies. Using model-simulated time series, the average debt-to-GDP ratio at default falls from 72% in the strong-institutions economy to 68.1% in the weak-institutions economy—a gap of 4 percentage points of GDP, with the entire distribution of debt at default shifting left (Panel A). The average sovereign spread increases from about 4.1% in the strong-institutions economy to 4.8% in the weak-institutions economy—a gap of roughly 70 basis points, and the simulated spread distribution shifts correspondingly to the right (Panel B). In the data, the corresponding differences between the two country groups are about 20 percentage points of debt at default and 250 basis points of spreads. The hidden-debt channel alone, therefore, accounts for roughly a fifth of the observed debt-carrying-capacity gap and about one quarter of the observed spread differential.

The group averages mask even larger effects among the world's most opaque sovereign borrowers. In an additional calibration based on the top decile of countries by mean underreporting—among them Myanmar, the Republic of Congo, and Laos—the hidden-debt process has a mean innovation of 5.6% of GDP and a standard deviation of 12.6%. Relative to the strong-institutions economy, the average debt-to-GDP ratio at default falls by about 13 percentage points and mean spreads increase by roughly 400 basis points. For such highly opaque countries, hidden debt becomes a first-order constraint on sovereign borrowing and debt-carrying capacity.[17]

The welfare costs are also sizeable. At the common state $(b = 0, h = 0, y = 1, \varepsilon = 0, \tau = 5)$, moving from weak to strong institutions yields a welfare gain of 0.25% of permanent consumption, while eliminating hidden debt adds only 0.05%. Roughly four-fifths of the welfare cost therefore comes from the *size and dispersion* of the process, not from its mere existence. Countries with weak institutions therefore stand to benefit the most from policies that reduce the magnitude and volatility of unreported liabilities.

7 Conclusion

This paper provides the first systematic, long-run measurement of public debt underreporting. By tracking ex post revisions across 187 countries and more than a century of debt data, we show that hidden debt is a widespread and chronic feature of sovereign debt markets. Debt figures are systematically underreported, averaging roughly one percent of GDP across different reporting systems, time periods, and country groups. Time and again, previously hidden debts have come to light during economic downturns and periods of sovereign distress: almost one in two sovereign defaults over the past century has coincided with substantial upward revisions to reported public debt.

This pattern has meaningful macroeconomic consequences, particularly for developing countries with weak institutions, where the hidden debt problem is most severe. Their liabilities are not only extensively underreported, but also surrounded by greater uncertainty, making sovereign risk harder to assess and price. The lack of reliable debt statistics comes with significantly increased default incentives, less favorable borrowing terms, and strongly reduced debt-carrying capacity. These countries therefore stand to gain the most from increased debt transparency.

Our results have important implications for practitioners, policymakers and academic researchers alike. Analysts engaged in debt sustainability assessments, sovereign risk pricing, and macroeconomic surveillance should account for the fact that reported debt figures tend to rise after their initial publication, and that debt data are least reliable precisely where debt distress looms largest. For policymakers, the century-long underreporting record is sobering: despite repeated efforts to resolve the reporting issues exposed by past crises, the hidden-debt problem has persisted across every reporting system and historical period we examine. These striking patterns open exciting new avenues for researchers, who can use our new data to study information acquisition and verification, expectation formation, as well as strategic concealment in sovereign debt markets.

[17] Appendix D.11 details the additional calibration, and Appendix E.6.3 presents the results.

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Online Appendix

A Constructing the new database of debt data revisions

This project assembles a new multi-source, multi-vintage database of sovereign debt statistics, covering an unbalanced sample of 187 countries from 1912 to 2024 and containing 476,809 individual debt data observations. The database integrates four major international reporting systems produced by the leading multilateral institutions of their time:

- **League of Nations (LoN):**
  Memoranda on Public Finance (1922-1938) and *Statistical Yearbook* (1927–1945);
- **United Nations (UN):**
  Statistical Yearbook (1948–1979);
- **International Monetary Fund (IMF):**
  Government Finance Statistics (GFS) Yearbook (2004–2025);
- **World Bank (WB):**
  World Debt Tables (1973–1996), *Global Development Finance* (1997–2012), *International Debt Statistics* (2012–2022) and *International Debt Report* (2022–2025).

This appendix section documents in detail how we have selected, digitized and harmonized the underlying sources and how we calculated debt data revisions from each. Section A.1 explains the criteria used to evaluate candidate data sources and why the four debt reporting systems satisfy them. Section A.2 describes the coverage, scope, and key series of the resulting database. Section A.3 presents the full digitization, harmonization, and cleaning pipeline, together with source-specific processing decisions. Finally, Section A.4 documents all auxiliary variables used in the empirical analysis.

A.1 Data source selection criteria and source characteristics

Numerous national and international institutions have published sovereign debt statistics over the past century, but not all of these statistics are equally suitable for our analysis. We therefore begin by identifying those reporting systems that are suited best for measuring hidden debt through revisions across vintages. More specifically, we evaluate candidate sources against three main selection criteria:

1. **Wide cross-country, sectoral, and time coverage.** The source should provide harmonized sovereign debt statistics for a broad set of countries and years and contain sufficient information on the debtor perimeter and composition of debt to permit a meaningful interpretation of revisions. Furthermore, given the effort required to digitize and harmonize historical debt publications, we require each reporting system to contain a sufficiently large number of overlapping vintages to justify systematic reconstruction. More precisely, we focus on reporting systems that provide at least 15 annual published vintages with sufficiently long time series.

2. **Direct debtor reporting.** The underlying debt figures should be reported by national authorities at the time of publication, rather than being reconstructed from creditor records or third-party estimates. Only under this reporting structure can subsequent upward revisions be interpreted as liabilities that were previously omitted or mismeasured in the official data submitted by the debtor country.

3. **Consistent reporting guidelines.** The source should be produced under a documented statistical framework whose definitions and reporting rules remain sufficiently stable across the vintages included in our analysis. This allows revisions to be interpreted as changes in the reported liabilities under a common reporting standard rather than as mechanical consequences of major methodological reforms.[18]

In total, we evaluated nine candidate debt datasets, namely the League of Nations' publications on public finance (i.e. the *Memoranda on Public Finance* (MoPF) and the *Statistical Yearbooks* (SYB)), the United Nations *Statistical Yearbooks* (SYB), the World Bank's *International Debt Report* (IDR) and its predecessor publications (i.e. the *World Debt Tables* (WDT), *Global Development Finance* reports (GDF) and *International Debt Statistics* (IDS)), the IMF *Government Finance Statistics* (GFS), the IMF *World Economic Outlook* (WEO), the World Bank's *Quarterly Public Sector Debt* (QPSD), the IMF-WB's *Quarterly External Debt Statistics* (QEDS), the IMF *Global Debt Database*, and Eurostat's *Excessive Deficit Procedure* (EDP). Table A.1 lists these candidate datasets evaluated against the three criteria and reports whether each dataset meets each criterion.

Table A.1: Assessment of candidate debt datasets against selection criteria

Dataset	(1) Scope	(2) Debtor reporting	(3) Guidelines
League of Nations *(MoPF, SYB)*	Y	Y	Y
United Nations *(SYB)*	Y	Y	Y
IMF *(GFS)*	Y	Y	Y
WB *(IDR, WDT, GDF, IDS)*	Y	Y	Y
IMF *(WEO)*	Y	P	N
WB *(QPSD)*	N	Y	Y
WB/IMF *(QEDS)*	N	Y	Y
IMF Global Debt Database	N	P	P
Eurostat *(EDP)*	N	Y	Y

Notes: The table reports how nine candidate datasets were assessed against three necessary criteria for inclusion in our new database. Columns (1)–(3) denote, respectively: global cross-country coverage with a sufficiently long vintage history; contemporaneous submissions of data by debtor-country official authorities; clear and stable statistical reporting guidelines. Entries indicate whether each dataset satisfies the corresponding criterion: "Y" denotes yes, "P" partial satisfaction, and "N" no.

Only four datasets satisfy all three criteria. The other five were excluded for the following reasons:

[18] Reporting guidelines differ strongly *across* reporting systems. This is not an issue for our analysis, since we are only deriving revisions *within* the same reporting system.

- The IMF *World Economic Outlook* publishes long and frequently updated series for general government debt, but it is not produced under a statistical reporting framework, combines authority submissions with IMF staff estimates.
- The World Bank's *Quarterly Public Sector Debt* database provides rich sectoral and instrumental detail and strong institutional coordination, but its historical depth is limited and no systematic archive of past vintages exists, preventing reconstruction of long-run reporting revisions.
- The IMF-WB's *Quarterly External Debt Statistics* similarly offers timely quarterly information on external debt positions, but its short time span and limited number of archived vintages fall short of the minimum vintage requirement.
- The IMF *Global Debt Database* consolidates debt series from multiple underlying sources into a single historical panel, but lacks a publicly available multi-vintage archive and does not consistently distinguish between authority-reported data and reconstructed estimates.
- Eurostat's *Excessive Deficit Procedure* notification tables are central to EU fiscal surveillance and provide detailed public debt breakdowns, but are regionally limited, and while a large number of vintages are available, each typically provides only two years of actual figures, and therefore limited overlap across vintages.

Beyond meeting all of the described selection criteria, each of the four included sources contributes distinct features to the database.

League of Nations (1922–1945). The League's public finance statistics were grounded in direct, questionnaire-based reporting by national authorities. The *Questionnaire on Public Finance* issued in 1922 required governments to complete detailed uniform tables covering public debt stocks with explicit breakdowns between domestic and foreign debt, consolidated and floating instruments, interest payments, and amortization (League of Nations, 1922a). Authorities were instructed to report figures drawn from closed accounts or parliamentary-approved budgets. This makes the League publications the earliest systematic cross-country debt statistics based on standardized official submissions. Cross-country comparability remained limited relative to later sources, reflecting the absence of fully harmonized statistical standards, but the questionnaire-based structure provides a consistent reporting template within the source. The League's contribution was primarily one of consolidation and dissemination: providing a centralized and accessible vehicle through which national-level public debt information could be presented to an international audience.

United Nations (1948–1979). The United Nations continued the League's tradition after World War II. An early milestone was the UN Department of Economic Affairs' retrospective publication of *Public Debt 1914–1946* (1948), which compiled historical public debt figures for 51 countries from World War I through World War II. Thereafter, the UN coordinated, collected and disseminated official government submissions through the annual publication of its *Statistical Yearbook*. Similar to the League of Nations, the UN's role was one of coordination rather than data creation, relying on national authority submissions to provide a consistent

cross-country record of central government debt through the postwar decades. By the early 1980s, the *Statistical Yearbook* ceased updating its global public debt series, closing a continuous record since the mid-1940s, before being succeeded by IMF and World Bank publications.

IMF Government Finance Statistics (2004–2025). The GFS is governed by the IMF's *Government Finance Statistics Manual (GFSM)*, which defines the concepts, classifications, accounting rules, valuation principles, and institutional coverage used in compiling government finance statistics. Data are submitted directly by national authorities and reviewed by the IMF Statistics Department. The IMF has published Government Finance Statistics since the late 1970s. We begin our vintage analysis in 2004 because earlier editions were produced under reporting frameworks that underwent substantial and repeated changes, limiting the comparability of revisions across vintages. All vintages in our database fall under the GFSM 2001 and GFSM 2014 frameworks, which share a common conceptual structure based on accrual accounting and a comprehensive balance sheet approach to government liabilities.[19] For EU member states, GFS reporting is closely aligned with Eurostat's ESA framework, ensuring additional cross-country consistency. GFS is particularly valuable for its broad coverage of advanced economies and domestic debt, which are absent from the World Bank's International Debt Statistics.

World Bank IDS (1973–2025). The World Bank's debt statistics are built on the Debtor Reporting System (DRS), established in 1951 and now the principal international reporting system for the external debt of developing and emerging market economies. Countries with outstanding World Bank obligations are required to report detailed information on their long-term external public and publicly guaranteed debt, typically through the ministry of finance, central bank, or national debt-management office. Reporting takes place at the level of individual loans and bonds and includes information on the debtor and creditor, commitment and maturity dates, currency and face value, repayment terms, annual disbursements and debt-service flows, and amounts outstanding. The World Bank reviews these submissions for internal consistency, and aggregates the records for annual publication—initially in the *World Debt Tables*, and subsequently in *Global Development Finance*, the *International Debt Statistics*, and most recently in the *International Debt Report*.

The World Bank's reporting obligations for its debtors create strong compliance incentives and broad participation among developing and emerging market economies. Crucially for our identification, the core definitions underpinning DRS reporting—of external debt, long-term debt, and the public sector—have remained stable across the four reporting manuals published between 1962 and 2000 (see Table A.2). The only substantive change was a 1980 refinement to the definition of external debt, shifting from an issuance-location basis to a residency basis.[20] This stability supports the interpretation of IDS revisions as changes in disclosure under a consistent reporting framework rather than definitional shifts.

[19] The 2014 manual introduced refinements to align with other international macroeconomic statistical standards while retaining the core GFSM 2001 structure.

[20] All our results are robust to excluding the 1980 vintage that implemented this change or all vintages that preceded the 1980 vintage.

Table A.2: Debtor Reporting System Manuals' Definitions over Time

	1962	1980	1989	2000
Definition of **external** debt:	Debt owed to foreigners and, in the case of publicly-issued loan capital, all bonds issued in foreign markets, including bonds later repatriated. All such debts should be treated as external debt, whether the medium of payment is foreign currency, local currency goods or services.	Debt owed by residents of the reporting country to non-residents thereof. The term non-residents includes, besides non-resident individuals, all foreign public bodies, foreign corporations (except branches thereof in the reporting country), and international organizations; in short, any individual or organization that is not physically located in the reporting country.		
Definition of **long-term** debt:	Long-term debt for purposes of DRS reporting is that with an original contractual or extended maturity of more than one year, measured from the date of signing the loan agreement (commitment date) to the date on which the last payment is due.			
Definition of **public and publicly guaranteed** debt:	Public and publicly guaranteed debt consists of all debt of the public sector together with debt of the private sector with a public-sector guarantee in the borrowing. For purposes of the DRS, the public sector consists of the following types of institutions: (a) Central governments and their departments; (b) Political subdivisions such as states, provinces and municipalities; (c) Central banks; (d) Autonomous institutions, such as financial and non-financial corporations, commercial and development banks, railways, utilities, etc., where: (i) The budget of the institution is subject to the approval of the government of the reporting country; or (ii) The government owns more than 50% of the voting stock or more than half of the members of the board of directors are government representatives; or (iii) In case of default, the state would become liable for the debt of the institution.			

Sources: IBRD (1962) and World Bank (1980, 1989, 2000).

A.2 Coverage of debt instruments, institutional sectors, and key series

A central motivation for extending the database beyond any single source is that sovereign indebtedness takes several forms that are not equally well covered across datasets or historical periods. Governments may borrow both domestically and externally, and the relative importance of these forms has shifted over time. A database built on one source alone would therefore risk capturing only part of the hidden debt problem.

Our unified database addresses this by combining complementary sources. External public debt is reported across all four sources. The League of Nations and United Nations publications provide historical coverage of domestic public debt, while the IMF GFS extends coverage of domestic and total public debt into the modern era. The World Bank IDS offers the most comprehensive data on external public and private debt, although only for emerging market and developing countries. Table A.3 summarizes these differences in coverage across sources.

Table A.3: Coverage of debt types across sources

	Domestic public debt	External public debt	External private debt	Advanced economies?
League of Nations *(MoPF, SYB)*	Y	Y	N	Y
United Nations *(SYB)*	Y	Y	N	Y
IMF *(GFS)*	Y	Y	N	Y
World Bank *(IDS)*	N	Y	Y	N

Notes: The table summarizes whether each source contains information on the indicated debt category. "Y" denotes coverage and "N" denotes no coverage. MoPF refers to the League of Nations *Memorandum on Public Finance*, SYB to the *Statistical Yearbook*, GFS to the IMF *Government Finance Statistics*, and IDS to the World Bank *International Debt Statistics*. The final column indicates whether the source covers advanced economies in the relevant debt series.

Table A.4 summarizes the scope of the unified multi-source database. The database combines 119 distinct vintages from four institutions, covers up to 187 countries, spans more than a century of data (1912–2024), and contains over 470,000 individual data points. Coverage is broadest for public external debt, available for 186 countries across all sources. The World Bank provides the largest number of observations, predominantly for developing and emerging market economies, while the IMF GFS extends coverage to advanced economies. The League of Nations and United Nations extend the historical record back to 1912.

Table A.4: New database of debt data revisions: Scope and coverage

	Number of vintages	Years covered	Number of countries	Number of data points
By type of debt				
Public external debt	119	1912 – 2024	186	336,268
Total public debt	66	1912 – 2020	169	24,898
Public domestic debt	66	1912 – 2020	168	15,733
Private debt	53	1970 – 2024	146	99,910
By variable				
Debt stocks	119	1912 – 2024	187	265,973
Debt commitments	57	1921 – 2024	154	107,025
Net flows	47	1970 – 2024	146	103,811
By source				
League of Nations	19	1912 – 1945	58	8,507
United Nations	31	1912 – 1978	59	20,777
International Monetary Fund	16	2000 – 2020	159	29,770
World Bank	53	1965 – 2024	146	417,755
Full database:	119	1912 – 2024	187	476,809

Notes: This table provides details on the scope and coverage of our new database on debt data revisions by type of debt, variable and source. The years covered by a data component exceed the number of vintages since each vintage reports data for more than one year.

Key concepts: stocks, flows, and creditor breakdowns

All four sources report **outstanding debt stocks**, but differ in their institutional perimeter and methodological framework. The League of Nations' *Memoranda on Public Finance* and *Statistical Yearbooks*, as well as the United Nations' *Statistical Yearbooks*, typically report debt stocks for the central government. The IMF's *Government Finance Statistics* provide balance-sheet data on debt liabilities for the budgetary central government and, where available, other government subsectors, following the GFSM 2001 and GFSM 2014 frameworks. The World Bank's *International Debt Statistics* report external public and publicly guaranteed debt disbursed and outstanding (series code DT.DOD.DPPG.CD). This measure comprises the long-term external obligations of public debtors, together with those of private debtors carrying a public guarantee. Figure A.1, presented at the end of this section, provides an overview of the debt-stock measures available for each country over the full period covered by the database.

Debt-flow measures are less consistently available across the reporting systems. The World Bank IDS reports commitments, disbursements, and net flows to public and publicly guaranteed borrowers (series codes DT.COM.DPPG.CD, DT.DIS.DPPG.CD, and DT.NFL.DPPG.CD, respectively). Commitments are defined as the total value of long-term loan agreements signed in a given year. Additional commitment data can be derived from a subset of the League of Nations' *Memoranda on Public Finance*, which contain loan-level or otherwise disaggregated information from which commitment amounts can be extracted. By contrast, the United Nations'

Statistical Yearbook and the IMF *Government Finance Statistics* do not provide flow measures comparable to new commitments, so stock revisions are the primary object of analysis for these sources. Overall, coverage of debt-flow revisions is substantially more limited than coverage of debt-stock revisions across the four reporting systems. Table A.5 summarizes the main stock and flow series we use from each source.

Table A.5: Key stock and flow series by source

	League of Nations	United Nations	IMF GFS	World Bank IDS
Debt stocks	Total public debt (CG)	Total public debt (CG)	Balance-sheet liabilities; (budgetary CG & GG)	External public debt (PPG)
Debt flows	New borrowings from selected loan-level-data vintages	—	—	Commitments, disbursements, and net flows
Creditor composition	Domestic & external	Domestic & external	Domestic & external	External only; decomposed by type

Notes: CG = central government; GG = general government; PPG = public and publicly guaranteed.

With respect to **creditor residence and creditor type**, the League of Nations, the United Nations, and the IMF GFS distinguish between domestic and external public debt. The precise definitions differ across sources, however. The IMF GFS classifies debt according to the creditor's residence. By contrast, the historical League of Nations and United Nations publications did not impose a uniform definition on reporting countries. Their distinction between domestic and external debt may therefore reflect the currency of denomination, creditor ownership, creditor residence, or a combination of these criteria, and can vary across countries and vintages.

The World Bank IDS covers only *external* public debt stocks and flows (based on a residency definition), but provides a more detailed decomposition by creditor type. It distinguishes between official and private creditors; within official creditors, between bilateral and multilateral lenders; and within private creditors, between bondholders, commercial banks, and other private lenders. These breakdowns are available from the 1977 vintage onward, while the current private-creditor subcategories—including bondholders, commercial banks, and other private creditors—are available from 1989.[21] As shown in Figure B.4, upward revisions are largest for bilateral and non-bond private lending, whereas revisions to World Bank loans and privately held bonds are comparatively small. Because variable names and series codes have changed across vintages, Table A.6 provides the complete historical mapping.

[21] Earlier vintages divided private creditors into "financial markets" and "suppliers."

Preferred measures: In the main text, our core analysis focuses on external public debt, which provides the broadest and most consistent country and time coverage across the four reporting systems. External public debt is available across 119 vintages, 186 countries, and more than 330,000 individual observations. By comparison, domestic public debt is available in only 66 vintages, for 168 countries and around 16,000 observations. Figure A.1 illustrates this difference: external-debt series generally form longer and more continuous country-level histories, whereas domestic and total public-debt series are patchy or entirely absent, especially for developing economies in recent decades.

Domestic public debt is also more difficult to measure consistently across countries and over long periods. Its coverage is particularly sensitive to differences in consolidation practices, the treatment of intra-government claims and arrears, and the classification of locally held instruments. We therefore treat external public debt as our preferred measure and use domestic and total public debt as complementary measures wherever coverage permits.

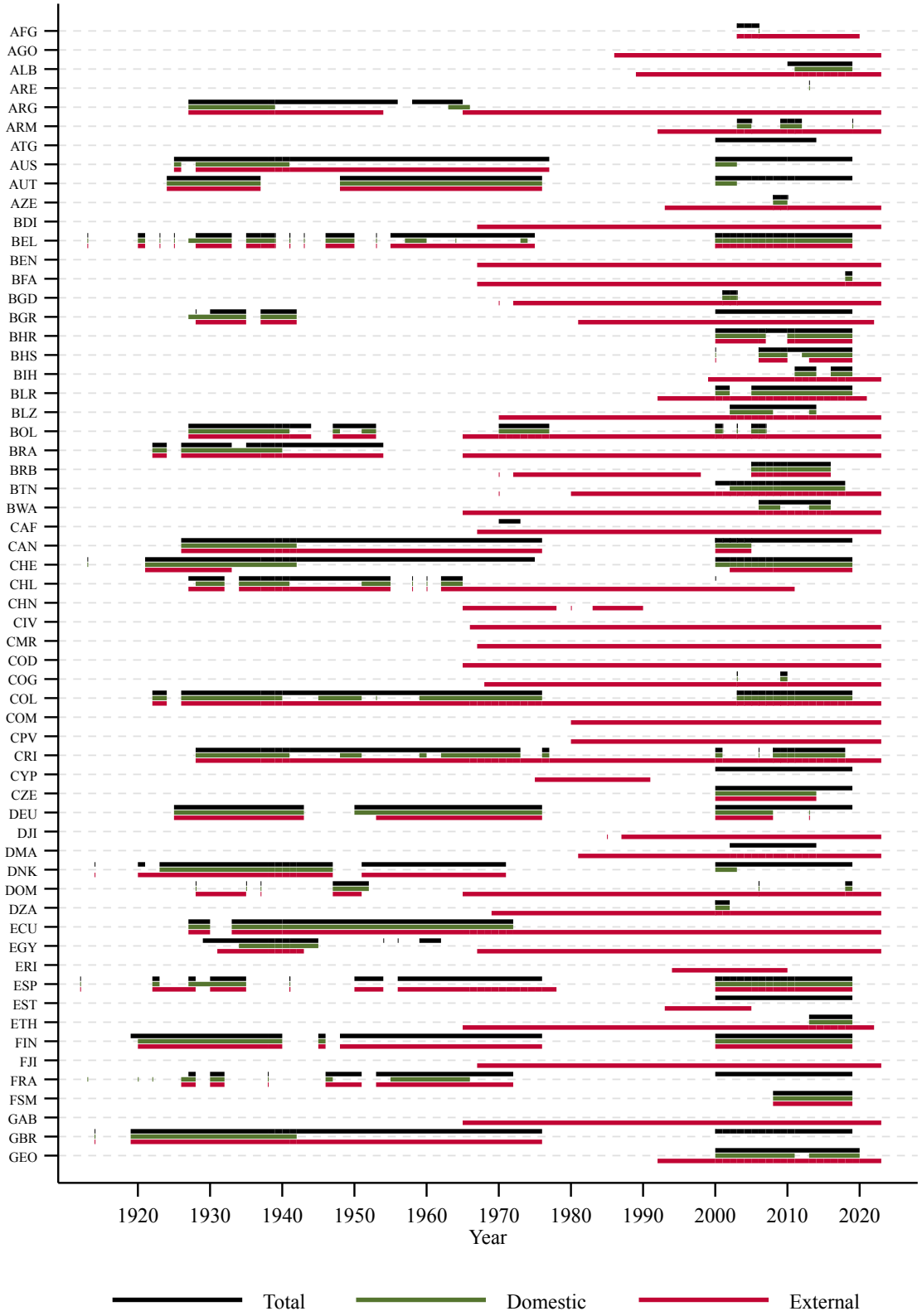
For debt flows, our preferred measure is *commitments* to public and publicly guaranteed borrowers. In our core analysis of debt flows in the main text, e.g. in Panel B of Figure 5 and in Section 4.3, we focus on commitment data for two reasons. First, commitments capture the act of borrowing and are therefore particularly well suited for studying co-movement with cyclical variables such as GDP growth. Second, they are the most consistently available measure of new borrowing across the World Bank IDS and selected historical League of Nations publications. In Appendix Sections D.3 and D.8, we show that all results are robust to using disbursements and net flows instead of commitment data.

Table A.6: Mapping series codes and variable names across World Bank vintages

Description	1973-1974	1975-1976	1977-1980	1981-1988	1989-1993	1994-2004	Modern seriescode (2005 onwards)
Panel A: Public and publicly guaranteed (DPPG)							
Debt outstanding and disbursed	Debt Outstanding beginning of period: Disbursed only	TOTAL EXTERNAL PUBLIC DEBT: OUTSTANDING (DISBURSED ONLY)	TOTAL ALL LENDERS: OUTSTANDING (DISBURSED ONLY)	Debt Outstanding & Disbursed (DOD)	DEBT OUTSTANDING (LDOD)		DT.DOD.DPPG.CD
Commitments	Transactions during period: Commitments	TOTAL EXTERNAL PUBLIC DEBT: COMMITMENTS	TOTAL ALL LENDERS: COMMITMENTS	Commitments		Memorandum Items: Commitments	DT.COM.DPPG.CD
Disbursements	Transactions during period: Disbursements	TOTAL EXTERNAL PUBLIC DEBT: DISBURSEMENTS	TOTAL ALL LENDERS: DISBURSEMENTS	Disbursements			DT.DIS.DPPG.CD
Principal repayments	Transactions during period: Service Payments: Principal	TOTAL EXTERNAL PUBLIC DEBT: PRINCIPAL PAYMENTS	TOTAL ALL LENDERS: PRINCIPAL REPAYMENTS	Principal Repayments			DT.AMT.DPPG.CD
Panel B: Creditor categories							
Official creditors			TOTAL OFFICIAL LENDERS	Official Creditors			DT.DOD.OFFT.CD
Multilateral	Loans from International Organizations	INTERNATIONAL ORGANIZATIONS		Multilateral			DT.DOD.MLAT.CD
of which: IBRD				IBRD			DT.DOD.MIBR.CD
of which: IDA				IDA			DT.DOD.MIDA.CD
Bilateral	Loans from DAC Governments Loans from East Bloc Governments Loans from Other Governments	DAC GOVERNMENTS EAST BLOC GOVERNMENTS OTHER GOVERNMENTS	GOVERNMENT LENDERS	Bilateral			DT.DOD.BLAT.CD
Private creditors			TOTAL PRIVATE LENDERS	Private Creditors			DT.DOD.PRVT.CD
of which: Bonds					Bonds		DT.DOD.PBND.CD
of which: Commercial banks	Credits from Private Banks	PRIVATE BANKS			Commercial banks		DT.DOD.PCBK.CD
of which: Other private creditors	Credits from Other Private Creditors	OTHER PRIVATE CREDITORS	OTHER PRIVATE LENDERS		Other private		DT.DOD.PROP.CD

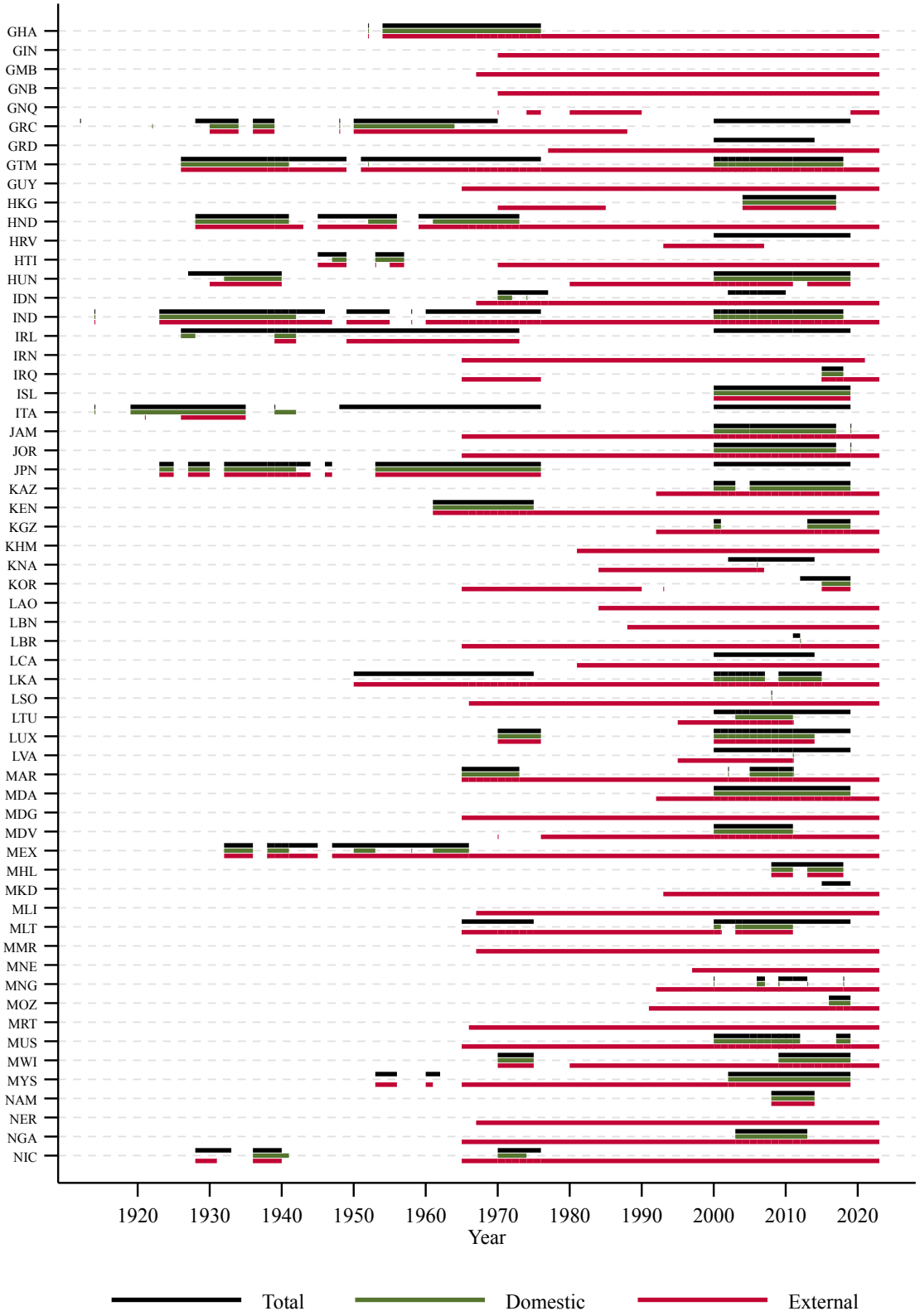
Notes: The table shows the mapping of modern series codes to variable names and codes in vintages 1973–2004. Panel A covers stock and flow measures; Panel B covers creditor categories. Grey shaded areas indicate that the variable is not available in a given vintage.

Figure A.1: Debt stock data availability by country and debt aggregate



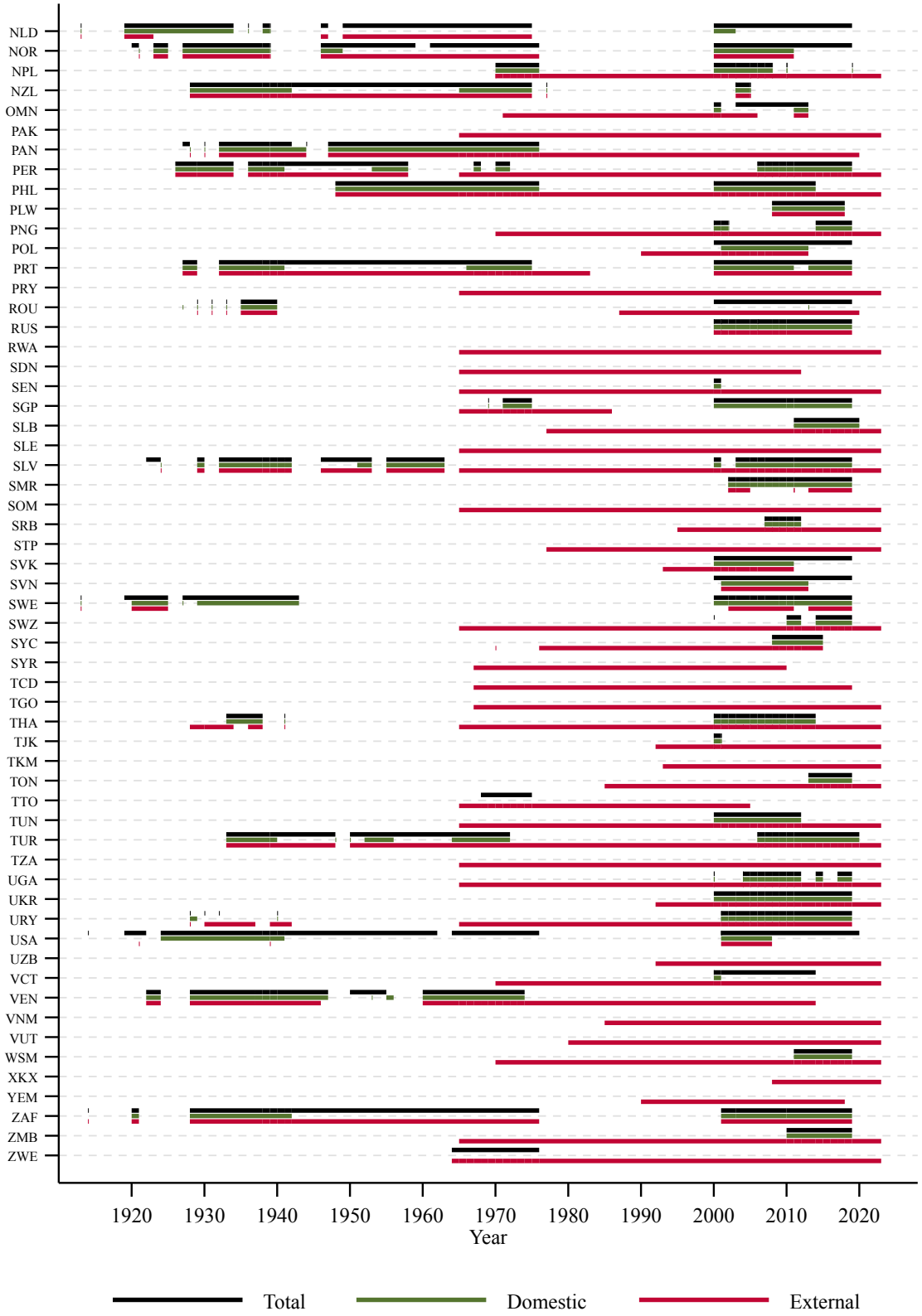
Notes: The figure shows debt stock data availability by debt type for each country in our database. Black bars indicate availability of data on the total public debt stock, green bars indicate availability of data on the domestic public debt stock and red bars indicate availability of data on the external public debt stock. The figure excludes all observations from the underlying reporting systems that are marked as preliminary or estimated.

Figure A.1: Debt stock data availability by country and debt aggregate, continued



Notes: The figure shows debt stock data availability by debt type for each country in our database. Black bars indicate availability of data on the total public debt stock, green bars indicate availability of data on the domestic public debt stock and red bars indicate availability of data on the external public debt stock. The figure excludes all observations from the underlying reporting systems that are marked as preliminary or estimated.

Figure A.1: Debt stock data availability by country and debt aggregate, continued



Notes: The figure shows debt stock data availability by debt type for each country in our database. Black bars indicate availability of data on the total public debt stock, green bars indicate availability of data on the domestic public debt stock and red bars indicate availability of data on the external public debt stock. The figure excludes all observations from the underlying reporting systems that are marked as preliminary or estimated.

A.3 Data processing and cleaning pipeline

This section describes how we transform historical debt publications into a harmonized multi-source, multi-vintage panel. The underlying primary sources range from machine-readable files and CD-ROMs to scanned PDFs and hard-copy volumes. Digitizing and processing these data at scale is challenging because the structure, terminology, and quality of the reported tables vary considerably across institutions and vintages. We therefore apply a common processing framework while retaining source-specific procedures where necessary. The processing pipeline consists of six stages:

1. Assembling the raw inputs (Appendix Section A.3.1)
2. Extracting the tabulated data, including through AI-assisted optical character recognition (Appendix Section A.3.2)
3. Mapping the observations into a common taxonomy and metadata structure (Appendix Section A.3.3)
4. Conducting automated and manual quality checks (Appendix Section A.3.4)
5. Applying adjustments for units, currencies, and reporting conventions (Appendix Section A.3.5)
6. And, finally, merging the cleaned source files into the final analysis dataset (Appendix Section A.3.6).

Throughout the process, we preserve source and vintage identifiers so that each observation remains traceable to its original publication and revisions are constructed only between comparable observations within the same reporting system.

A.3.1 The inputs

Our database comprises 119 distinct vintages from four institutions, spanning 1922–2025. Inputs enter the workflow in three formats: (i) machine-readable online extracts (recent IMF and World Bank vintages), (ii) scanned PDFs obtained from institutional archives and libraries (primarily for historical League of Nations and UN editions as well as early World Bank publications), and (iii) CD-ROM releases (IMF Government Finance Statistics, 2004–2014).[22]

We collect 23 League of Nations vintages (1922–1945), all of which were obtained as scanned PDFs from institutional archives and library collections.[23] No machine-readable versions of these

[22] Earlier GFS vintages, available only in print, are excluded because they predate the GFSM 2001 framework, which introduced accrual-based reporting and a more comprehensive balance sheet approach, making them incomparable with the vintages we use.

[23] The National Library of Scotland provides all Statistical Yearbooks of the League of Nations as PDFs (see /https://digital.nls.uk/league-of-nations/archive/190788539), while the Memoranda on Public Finance can be obtained from the website of the archives of the United Nations (see e.g. /https://archives.ungeneva.org/memorandum-on-public-finance-4)

publications exist. The United Nations Statistical Yearbook contributes a further 31 vintages published between 1948 and 1979, which are likewise available only as scanned PDFs.[24] For the IMF Government Finance Statistics, we use 17 vintages (2004–2025), of which 10 are CD-ROM releases (2004–2014) and 7 are online database vintages (2014–2025).[25] The online-based vintages were primarily obtained from the IMF's legacy data website.[26] The most recent extract was retrieved via the SDMX 2.1 API.[27] Finally, the World Bank series comprises 23 World Debt Tables (1973–1996), 16 Global Development Finance editions (1997–2012), 10 International Debt Statistics vintages (2013–2022), and 4 International Debt Reports (2022–2025), totaling 53 vintages. WDT and GDF availability up to 2004 varies between PDFs and hard copies, which we digitized ourselves, while editions from 2005 onward are retrieved from online database versions; IDS and IDR, on the other hand, are fully digital releases. A complete overview of all vintages used is provided in Table A.7.

Table A.7: Comprehensive Overview of All Data Sources

Title	Shortform	Availability	Notes
Memorandum on Public Finance 1921	MoPF21	PDF	–
Memorandum on Public Finance 1922	MoPF22	PDF	–
Memorandum on Public Finance 1922-1926	MoPF22-26	PDF	–
International Statistical Year-Book 1926	LoN-1926	PDF	–
Memorandum on Public Finance 1926-1928	MoPF26-28	PDF	–
International Statistical Year-Book 1927	LoN-1927	PDF	–
International Statistical Year-Book 1928	LoN-1928	PDF	–
International Statistical Year-Book 1929	LoN-1929	PDF	–
Statistical Year-Book of the League of Nations 1930/31	LoN-1930	PDF	–
Statistical Year-Book of the League of Nations 1931/32	LoN-1931	PDF	–
Statistical Year-Book of the League of Nations 1932/33	LoN-1932	PDF	–
Statistical Year-Book of the League of Nations 1933/34	LoN-1933	PDF	–
Statistical Year-Book of the League of Nations 1934/35	LoN-1934	PDF	–

[24] PDFs are available from the United Nations *iLibrary*: /https://www.un-ilibrary.org/content/periodicals/24121436?pageSize=80.

[25] In our final database we consider the two overlapping CD-ROM and online vintages of 2014 as one vintage.

[26] The legacy data portal /https://extauth.imf.org/maintenance/LegacyDataPortalRetired.html, retired on November 5, 2025.

[27] IMF SDMX API documentation: /https://data.imf.org/en/Resource-Pages/IMF-API. Accessed December 5, 2025.

Title	Shortform	Availability	Notes
Statistical Year-Book of the League of Nations 1935/36	LoN-1935	PDF	–
Public Finance 1928-1935	MoPF28-35	PDF	–
Statistical Year-Book of the League of Nations 1936/37	LoN-1936	PDF	–
Public Finance 1928-1937	MoPF28-37	PDF	–
Statistical Year-Book of the League of Nations 1937/38	LoN-1937	PDF	–
Statistical Year-Book of the League of Nations 1938/39	LoN-1938	PDF	–
Statistical Year-Book of the League of Nations 1939/40	LoN-1939	PDF	–
Statistical Year-Book of the League of Nations 1940/41	LoN-1940	PDF	–
Statistical Year-Book of the League of Nations 1941/42	LoN-1941	PDF	–
Statistical Year-Book of the League of Nations 1942/44	LoN-1942	PDF	–
Statistical Yearbook 1948	UN1948	PDF	–
Statistical Yearbook 1949-50	UN1949	PDF	–
Statistical Yearbook 1951	UN1951	PDF	–
Statistical Yearbook 1952	UN1952	PDF	–
Statistical Yearbook 1953	UN1953	PDF	–
Statistical Yearbook 1954	UN1954	PDF	–
Statistical Yearbook 1955	UN1955	PDF	–
Statistical Yearbook 1956	UN1956	PDF	–
Statistical Yearbook 1957	UN1957	PDF	–
Statistical Yearbook 1958	UN1958	PDF	–
Statistical Yearbook 1959	UN1959	PDF	–
Statistical Yearbook 1960	UN1960	PDF	–
Statistical Yearbook 1961	UN1961	PDF	–
Statistical Yearbook 1962	UN1962	PDF	–
Statistical Yearbook 1963	UN1963	PDF	–
Statistical Yearbook 1964	UN1964	PDF	–
Statistical Yearbook 1965	UN1965	PDF	–
Statistical Yearbook 1966	UN1966	PDF	–
Statistical Yearbook 1967	UN1967	PDF	–
Statistical Yearbook 1968	UN1968	PDF	–
Statistical Yearbook 1969	UN1969	PDF	–
Statistical Yearbook 1970	UN1970	PDF	–

Title	Shortform	Availability	Notes
Statistical Yearbook 1971	UN1971	PDF	–
Statistical Yearbook 1972	UN1972	PDF	–
Statistical Yearbook 1973	UN1973	PDF	–
Statistical Yearbook 1974	UN1974	PDF	–
Statistical Yearbook 1975	UN1975	PDF	–
Statistical Yearbook 1976	UN1976	PDF	–
Statistical Yearbook 1977	UN1977	PDF	–
Statistical Yearbook 1978	UN1978	PDF	–
Government Finance Statistics 2004	GFS2004	CD-ROM	–
Government Finance Statistics 2005	GFS2005	CD-ROM	–
Government Finance Statistics 2006	GFS2006	CD-ROM	–
Government Finance Statistics 2007	GFS2007	CD-ROM	–
Government Finance Statistics 2008	GFS2008	CD-ROM	–
Government Finance Statistics 2009	GFS2009	CD-ROM	–
Government Finance Statistics 2010	GFS2010	CD-ROM	–
Government Finance Statistics 2012	GFS2012	CD-ROM	–
Government Finance Statistics 2013	GFS2013	CD-ROM	–
Government Finance Statistics 2014	GFS2014	CD-ROM and online	–
Government Finance Statistics 2015	GFS2015	Online	–
Government Finance Statistics 2016	GFS2016	Online	–
Government Finance Statistics 2017	GFS2017	Online	–
Government Finance Statistics 2019	GFS2019	Online	–
Government Finance Statistics 2020	GFS2020	Online	–
Government Finance Statistics (current extract)	GFS2025	Online	IMF SDMX API; retrieved 05.12.2025
World Debt Tables 1973	WDT1973	PDF only	–
World Debt Tables 1974	WDT1974	Hard copy	–
World Debt Tables 1975	WDT1975	PDF only	–
World Debt Tables 1976	WDT1976	Hard copy	–
World Debt Tables 1977	WDT1977	Hard copy	–
World Debt Tables 1978	WDT1978	Hard copy	–
World Debt Tables 1979	WDT1979	PDF only	–
World Debt Tables 1980	WDT1980	Hard copy	–
World Debt Tables 1981	WDT1981	PDF only	–
World Debt Tables 1982-83	WDT1982-83	PDF only	–
World Debt Tables 1983-84	WDT1983-84	Hard copy	–

Title	Shortform	Availability	Notes
World Debt Tables 1984-85	WDT1984-85	PDF only	–
World Debt Tables 1985-86	WDT1985-86	Hard copy	–
World Debt Tables 1986-87	WDT1986-87	Hard copy	–
World Debt Tables 1987-88	WDT1987-88	Hard copy	–
World Debt Tables 1988-89	WDT1988-89	PDF only	–
World Debt Tables 1989-90	WDT1989-90	PDF only	–
World Debt Tables 1990-91	WDT1990-91	Hard copy	–
World Debt Tables 1991-92	WDT1991-92	PDF only	–
World Debt Tables 1992-93	WDT1992-93	PDF only	–
World Debt Tables 1993-94	WDT1993-94	PDF only	–
World Debt Tables 1994-95	WDT1994-95	PDF only	–
World Debt Tables 1996	WDT1996	PDF only	–
Global Development Finance 1997	GDF1997	PDF only	–
Global Development Finance 1998	GDF1998	PDF only	–
Global Development Finance 1999	GDF1999	PDF only	–
Global Development Finance 2000	GDF2000	PDF only	–
Global Development Finance 2001	GDF2001	PDF only	–
Global Development Finance 2002	GDF2002	PDF only	–
Global Development Finance 2003	GDF2003	PDF only	–
Global Development Finance 2004	GDF2004	PDF only	–
Global Development Finance 2005	GDF2005	Online	Apr. 2005 version used
Global Development Finance 2006	GDF2006	Online	Nov. 2005 version used
Global Development Finance 2007	GDF2007	Online	Dec. 2006 version used
Global Development Finance 2008	GDF2008	Online	Nov. 2007 version used

Title	Shortform	Availability	Notes
Global Development Finance 2009	GDF2009	Online	Dec. 2008 version used
Global Development Finance 2010	GDF2010	Online	Feb. 2010 version used
Global Development Finance 2011	GDF2011	Online	Dec. 2010 version used
Global Development Finance 2012	GDF2012	Online	Dec. 2011 version used
International Debt Statistics 2013	IDS2013	Online	–
International Debt Statistics 2014	IDS2014	Online	–
International Debt Statistics 2015	IDS2015	Online	–
International Debt Statistics 2016	IDS2016	Online	–
International Debt Statistics 2017	IDS2017	Online	–
International Debt Statistics 2018	IDS2018	Online	–
International Debt Statistics 2019	IDS2019	Online	–
International Debt Statistics 2020	IDS2020	Online	–
International Debt Statistics 2021	IDS2021	Online	–
International Debt Statistics 2022	IDS2022	Online	–
International Debt Report 2022	IDR2022	Online	–
International Debt Report 2023	IDR2023	Online	–
International Debt Report 2024	IDR2024	Online	–
International Debt Report 2025	IDR2025	Online	–

Notes: The table shows all vintages from all four sources that enter our final database. Availability "online" indicates availability in machine-readable format on the respective institution's website, and "PDF only" indicates availability as downloadable PDF from websites as mentioned in the text. Vintages labeled "hard copy" are vintages which we obtained from different libraries and scanned ourselves. For the World Bank vintages 2005–2011, there is more than one version per vintage available. The column "Notes" indicates which version enters our database.

A.3.2 OCR-Based Extraction with AI-Enabled Processing

The historical volumes of the League of Nations and United Nations, as well as parts of the World Bank's historical publications prior to 2005, are available only as scanned PDFs. We either downloaded these from the respective institution's website (see Section A.3.1 above) or scanned them from the original hard copies we obtained from different libraries and archives. While we digitized the raw material from the World Bank via a combination of Optical Character Recognition (OCR) software and manual coding, we digitized the League of Nations and United Nations raw material using a customized implementation of Google Cloud Document AI's Custom Extractor.[28] This processor identifies and extracts entities from documents through a combination of foundation model zero-shot prediction and supervised fine-tuning

[28]IMF GFS data do not require digitization from printed or scanned materials. Instead, we construct the GFS vintages from three source types: historical CD-ROM releases, followed by archived online releases, and the latest available version of the IMF GFS database.

on labeled training data. The processor is configured with a defined schema of target fields and annotated training documents. After fine-tuning, the extracted entities undergo rule-based geometric reconstruction and subsequent harmonization steps to produce structured, machine-readable panel datasets.

For each source, a set of pages containing the relevant tables was randomly selected and manually annotated at the cell level: 37 pages for the League of Nations (split into 19 training and 18 validation pages) and 29 pages for the United Nations (split into 24 training and five validation pages). In both cases, annotations capture table values, including numeric debt figures, country names, currency units, and dates, as well as column headers required for matching values to their respective categories. The two sources differ in their annotation structure: the UN tables use a flat single-row header where debt categories are encoded in row labels, permitting a primarily semantic labeling approach. The League of Nations tables, by contrast, feature hierarchically nested multi-level column headers, where correctly assigning a cell to its category requires coordinate-based geometric resolution across multiple header rows. The final model is obtained by fine-tuning Google's *pretrained-foundation-model-v1.4-2025-02-05* on the labeled corpus. An example of the annotation output of the League of Nations Statistical Report is shown in Figure A.2.

Each page is processed through the fine-tuned Document AI processor and stored as a JSON file containing all extracted entities, their label type, recognized text, confidence scores, and normalized bounding polygons. For reconstruction, each entity is augmented with geometric features derived from its bounding polygon, including its centroid (x_i, y_i). The two sources differ in how the table structure is recovered. For the League of Nations tables, the multi-level header layout is resolved geometrically: entities are clustered by vertical position y_i into row groups and by horizontal position x_i into column groups defined by the centroids of the corresponding column header labels, yielding a grid structure to which each value is assigned within a tolerance band. For the UN tables, the flat header structure allows a simpler reconstruction: debt values are assigned to the nearest country label above them, while year entities define column boundaries used to map each value to a reporting year by its x_i position. In both cases, the final output is a panel dataset with one row per vintage-country-year observation, containing numeric debt components and associated currency units.

The reconstructed page-level datasets are cleaned and harmonized prior to stacking into the final panel. Text strings are standardized by removing line breaks and common OCR artefacts (e.g., stray punctuation or currency symbols). Numeric fields are cleaned by converting OCR decimal commas to dots and replacing empty strings with missing values. Country names and currency labels are harmonized through deterministic renaming to ensure a consistent identifier across spelling variants and vintages. Finally, all digitized outputs are systematically cross-validated against the original PDF tables to correct residual OCR and assignment errors, including misread digits, shifted columns, dropped decimal separators, and misplaced headers.

Figure A.2: Annotation in Document AI: League of Nations Statistical Report (1937)

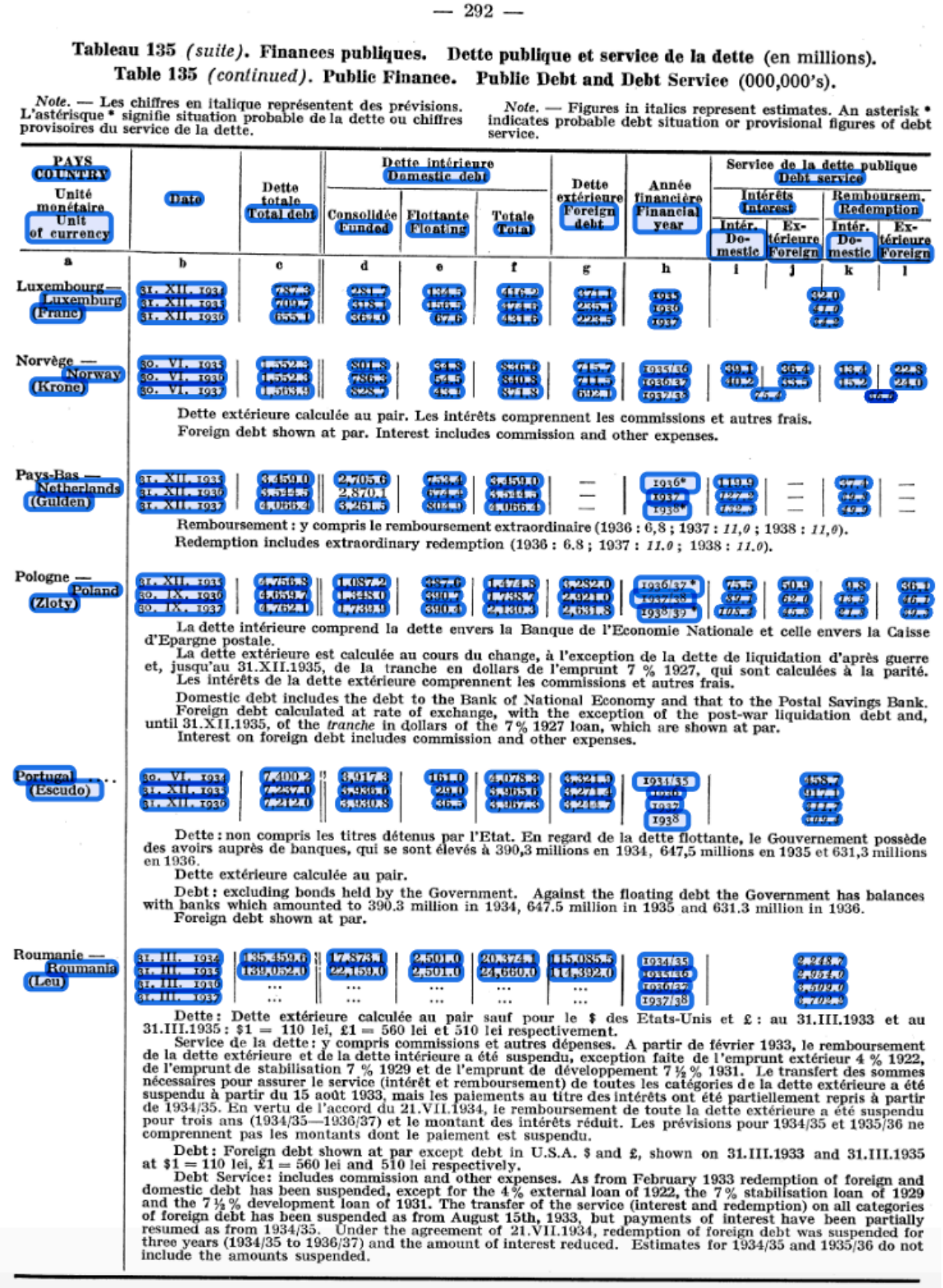


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Tableau 135 *(suite)*. **Finances publiques. Dette publique et service de la dette** (en millions).
Table 135 *(continued)*. **Public Finance. Public Debt and Debt Service** (000,000's).

Note. — Les chiffres en italique représentent des prévisions. L'astérisque * signifie situation probable de la dette ou chiffres provisoires du service de la dette.

Note. — Figures in italics represent estimates. An asterisk * indicates probable debt situation or provisional figures of debt service.

PAYS COUNTRY / Unité monétaire Unit of currency	Date	Dette totale Total debt	Dette intérieure Domestic debt: Consolidée Funded	Flottante Floating	Totale Total	Dette extérieure Foreign debt	Année financière Financial year	Service de la dette publique Debt service: Intérêts Interest: Intér. Domestic	Intérêts Interest: Extérieure Foreign	Remboursem. Redemption: Intér. Domestic	Remboursem. Redemption: Extérieure Foreign
a	b	c	d	e	f	g	h	i	j	k	l
Luxembourg — Luxemburg (Franc)	31. XII. 1934 31. XII. 1935 31. XII. 1936	787.3 709.7 655.1	281.7 318.1 361.0	134.5 156.5 67.6	416.2 474.6 428.5	371.1 235.1 226.5	1935 1936 1937			32.0	
Norvège — Norway (Krone)	30. VI. 1935 30. VI. 1936 30. VI. 1937	1 552.3 1 552.3 1 608.3	801.3 736.3 829.7	34.3 54.5 43.1	835.6 840.8 872.8	716.7 711.5 692.1	1935/36 1936/37 1937/38	39.1 40.2	36.4 48.4	13.1 15.2	22.3 25.0

Dette extérieure calculée au pair. Les intérêts comprennent les commissions et autres frais.
Foreign debt shown at par. Interest includes commission and other expenses.

Pays-Bas — Netherlands (Gulden)	31. XII. 1935 31. XII. 1936 31. XII. 1937	3 459.0 3 [illegible] 4 [illegible]	2,705.6 2,870.1 3,261.8	753.4 [illegible] 304.0	3 459.0 3 [illegible] 4 [illegible]	—	1936* 1937* 1938*	114.9	—	37.1	—

Remboursement : y compris le remboursement extraordinaire (1936 : 6,8 ; 1937 : *11,0* ; 1938 : *11,0*).
Redemption includes extraordinary redemption (1936 : 6.8 ; 1937 : *11.0* ; 1938 : *11.0*).

Pologne — Poland (Zloty)	31. XII. 1935 30. IX. 1936 30. IX. 1937	4 756.8 [illegible] [illegible]	1,087.2 [illegible] [illegible]	387.6 390.7 390.1	1 474.8 [illegible] [illegible]	3 282.0 2 [illegible] 2 [illegible]	1936/37 * [illegible] 1938/39 *	75.7 [illegible]	50.9 62.0 [illegible]	0.8 [illegible]	30.1 [illegible]

La dette intérieure comprend la dette envers la Banque de l'Economie Nationale et celle envers la Caisse d'Epargne postale.
La dette extérieure est calculée au cours du change, à l'exception de la dette de liquidation d'après guerre et, jusqu'au 31.XII.1935, de la tranche en dollars de l'emprunt 7 % 1927, qui sont calculées à la parité. Les intérêts de la dette extérieure comprennent les commissions et autres frais.
Domestic debt includes the debt to the Bank of National Economy and that to the Postal Savings Bank. Foreign debt calculated at rate of exchange, with the exception of the post-war liquidation debt and, until 31.XII.1935, of the *tranche* in dollars of the 7 % 1927 loan, which are shown at par.
Interest on foreign debt includes commission and other expenses.

Portugal .... (Escudo)	30. VI. 1934 31. XII. 1935 31. XII. 1936	7 400.2 [illegible] [illegible]	3 917.3 [illegible] [illegible]	161.0 29.0 36.5	4 078.3 [illegible] [illegible]	3 321.9 [illegible] [illegible]	1934/35 1936 1937 1938			158.7 [illegible]	

Dette : non compris les titres détenus par l'Etat. En regard de la dette flottante, le Gouvernement possède des avoirs auprès de banques, qui se sont élevés à 390,3 millions en 1934, 647,5 millions en 1935 et 631,3 millions en 1936.
Dette extérieure calculée au pair.
Debt : excluding bonds held by the Government. Against the floating debt the Government has balances with banks which amounted to 390.3 million in 1934, 647.5 million in 1935 and 631.3 million in 1936.
Foreign debt shown at par.

Roumanie — Roumania (Leu)	31. III. 1934 31. III. 1935 31. III. 1936 31. III. 1937	185 459.0 189 052.0 ...	17 873.1 22,159.0 ...	2 501.0 2,501.0 ...	20 374.1 24,660.0 ...	115 085.5 114,392.0 ...	1934/35 1935/36 1936/37 1937/38			24 248.7 [illegible] [illegible] [illegible]	

Dette : Dette extérieure calculée au pair sauf pour le $ des Etats-Unis et £ : au 31.III.1933 et au 31.III.1935 : $1 = 110 lei, £1 = 560 lei et 510 lei respectivement.
Service de la dette : y compris commissions et autres dépenses. A partir de février 1933, le remboursement de la dette extérieure et de la dette intérieure a été suspendu, exception faite de l'emprunt extérieur 4 % 1922, de l'emprunt de stabilisation 7 % 1929 et de l'emprunt de développement 7 ½ % 1931. Le transfert des sommes nécessaires pour assurer le service (intérêt et remboursement) de toutes les catégories de la dette extérieure a été suspendu à partir du 15 août 1933, mais les paiements au titre des intérêts ont été partiellement repris à partir de 1934/35. En vertu de l'accord du 21.VII.1934, le remboursement de toute la dette extérieure a été suspendu pour trois ans (1934/35—1936/37) et le montant des intérêts réduit. Les prévisions pour 1934/35 et 1935/36 ne comprennent pas les montants dont le paiement est suspendu.
Debt : Foreign debt shown at par except debt in U.S.A. $ and £, shown on 31.III.1933 and 31.III.1935 at $1 = 110 lei, £1 = 560 lei and 510 lei respectively.
Debt Service : includes commission and other expenses. As from February 1933 redemption of foreign and domestic debt has been suspended, except for the 4 % external loan of 1922, the 7 % stabilisation loan of 1929 and the 7 ½ % development loan of 1931. The transfer of the service (interest and redemption) on all categories of foreign debt has been suspended as from August 15th, 1933, but payments of interest have been partially resumed as from 1934/35. Under the agreement of 21.VII.1934, redemption of foreign debt was suspended for three years (1934/35 to 1936/37) and the amount of interest reduced. Estimates for 1934/35 and 1935/36 do not include the amounts suspended.

Notes: This figure shows a screenshot from Google Cloud Document AI console with the annotated page 292 of the League of Nations Statistical Report (1937). Entities in the header (from *Country* to *Debt service: Redemption: Foreign*) are labeled as *x_position* to enable a structured reassembly of the multilevel header. All values below are labeled *value* and are mapped to the corresponding header in a subsequent step.

A.3.3 Data harmonization

After extraction, we harmonize series across vintages and sources. Because naming conventions and category structures differ across publications, we map raw variables into a unified taxonomy covering: (i) harmonization of historical country names into consistent ISO coding; (ii) reconciliation of fiscal-year versus calendar-year reporting into a standardized reporting-year variable; (iii) residency or location dimension (domestic versus external); (iv) stock and flow concepts; and (v) instrument or creditor categories where available.

For the League of Nations, since the *Statistical Yearbooks* often identified the *Memoranda on Public Finance* as a primary source, we use same-year *Statistical Yearbooks* to supplement missing entries in the corresponding *Memoranda on Public Finance*, so that the League of Nations series contains only one vintage per publication year.[29]

Where reporting conventions differ across vintages, we also convert magnitudes to common units (e.g., millions), harmonize currency changes, and standardize the treatment of zeros versus missing values to prevent artificial revisions driven solely by coding differences.

A.3.4 Automated and manual data-quality checks

We apply a combination of automated consistency checks and targeted manual reviews to detect and correct digitization errors and internal inconsistencies.

Across-vintage consistency checks: We exploit the fact that due to the multi-vintage structure, each underlying statistic typically appears in multiple annual editions. For each country–year–series, we flag potential digitization errors when the value differs from both the preceding and subsequent vintage in ways that are inconsistent with surrounding vintages (e.g., an isolated jump that immediately reverses). We resolve flagged cases by returning to the original source tables and correcting any OCR or transcription errors.

Within-vintage accounting checks: Within each vintage, we test accounting identities that must hold whenever sub-components are reported. Examples include: (i) total public debt equals the sum of domestic and external components, (ii) totals equal the sum of instrument or creditor subcategories where provided (see equations A.1–A.3 below for IDS examples), and (iii) analogous identities for flow variables when available. Any violation triggers manual verification against the original pages.

$$DPPG^{v}_{i,t} = OFFT^{v}_{i,t} + PRVT^{v}_{i,t} \tag{A.1}$$

$$OFFT^{v}_{i,t} = BLAT^{v}_{i,t} + MLAT^{v}_{i,t} \tag{A.2}$$

$$PRVT^{v}_{i,t} = PBND^{v}_{i,t} + PCBK^{v}_{i,t} + PROP^{v}_{i,t} \tag{A.3}$$

where total public and publicly guaranteed debt ($DPPG$) of country i in year t from vintage v equals the sum of debt to official ($OFFT$) and private ($PRVT$) creditors; official creditors

[29] A total of four *Statistical Yearbooks* get thereby absorbed by the *Memoranda on Public Finance*.

decompose into bilateral ($BLAT$) and multilateral ($MLAT$); and private creditors decompose into bondholders ($PBND$), commercial banks ($PCBK$), and other private creditors ($PROP$).

Outlier screening: We screen for extreme outliers in both debt levels and revision magnitudes. Flagged observations are manually verified against the original source tables to distinguish genuine reporting changes from transcription or OCR errors.

Scaling corrections: For the LoN, UN, and GFS data, values are reported in local currency units and occasionally exhibit inconsistent scaling across vintages. We implement systematic scaling corrections by comparing each observation both across and within vintages, using the next available non-missing future-vintage observation as an anchor. We identify and correct three types of inconsistencies. The first is a transition to an entirely new currency, in which the revision ratio approximates the official conversion rate. The second is a currency redenomination: a deliberate government decision to cut a fixed number of digits from the currency (e.g., removing three zeros), rather than a reporting mistake, where the revision ratio approximates a round power of ten consistent with the announced redenomination factor. The third is a pure decimal-point or unit error, where a similar power-of-ten ratio reflects a transcription or scaling mistake rather than an actual change to the currency. After rescaling, we verify stock-flow coherence and component aggregation, rescaling individual components by powers of ten where necessary to restore consistency.

A.3.5 Adjustments

Where publications explicitly identify entries as estimated, provisional, or otherwise not final authority-reported values, we exclude these observations to avoid diluting our revision-based measures. Identification criteria for such entries differ by source. For the **League of Nations**, estimates and preliminary data are flagged through table conventions: footnote-based identification in vintages through 1930–31, and asterisks or italics from vintage 1931–32 onward. For the **United Nations**, estimated or preliminary observations are identified in the yearbook notes. We exclude any such flagged observation from our database. The **IMF GFS** does not flag estimated or preliminary observations separately within its reporting framework; we therefore treat observations from GFS as final authority-reported values. For the **World Bank IDS**, each country-vintage observation carries a debtor reporting status: "actual" or "as reported", "preliminary", or "estimate". We retain only observations classified as actual and/or as reported, while discarding preliminary or estimated observations.[30]

A.3.6 Merging and construction of the final dataset

To express debt data revisions in economically meaningful terms, we merge each debt observation with nominal GDP. In this process, nominal GDP data are drawn from a single (typically

[30] In a few cases, the reporting status is contradicted in the country notes section of a specific IDS vintage. For example, the IDS 2021 reporting status for Guinea is classified as "actual," but the country notes state that long-term PPG debt for 2016 is a World Bank staff estimate. In such cases, we overrule the classification and drop the observation.

the most recent) vintage of national accounts statistics. Where nominal GDP is unavailable—primarily for observations from the interwar period—we infer it from debt-to-GDP ratios compiled by Müller et al. (2025), whenever possible. Using a common GDP benchmark ensures that changes in debt-to-GDP ratios reflect revisions to reported debt rather than revisions to the denominator.

Finally, we merge all observations across the four reporting systems into a single harmonized database with explicit source and vintage identifiers. The resulting dataset preserves the original vintage structure and can therefore be used for reconstructing contemporaneous debt series, for identifying the latest reported values and for measuring ex post data revisions over more than a century.

A.4 Data sources for control variables

Variable	Description	Source
Mozambique EMBI+ spread	J.P. Morgan Mozambique sovereign spread series from Bloomberg, using ticker JPSSGMZB.	Bloomberg L.P. (2022)
Greek bond spread	Difference between Greek and German 10-year government bond yields, constructed as Greece minus Germany using Eurostat daily long-term interest-rate series.	Eurostat (2025)
Income groups	World Bank income classification based on GNI per capita, calculated using the Atlas method.	World Bank (2025)
Nominal GDP	GDP in current USD. GDP in current LCU.	World Bank (2025) Müller et al. (2025)
Institutional strength	Polity5 score measuring regime authority characteristics, scaled to range from -10, strongly autocratic, to +10, strongly democratic. Missing Polity values are filled by linear interpolation within each country's observed range, then extrapolated outside that range — forward to 2025 and backward to the start of the panel — using last-observation-carried-forward/backward.	Marshall and Gurr (2020)
Real GDP	Real GDP, used to calculate real GDP growth rates.	Müller et al. (2025)
External sov. default	Indicator for years in external sovereign default or restructuring.	Reinhart and Rogoff (2009); Farah-Yacoub et al. (2024)
Domestic sov. default	Indicator for years with default or restructuring episodes involving domestic sovereign debts.	Reinhart and Rogoff (2009); Erce et al. (2022)
IMF programs	Indicator for the first year of an IMF-supported official lending program.	Horn et al. (2026)
LoN programs	Indicator for the first year of a League of Nations financial assistance or stabilization program.	Pauly (1996)
Consumption	Final consumption expenditure in constant LCU.	World Bank (2025)
Exchange rates	Official conversion factors used for currency changes; euro-area rates fixed euro conversion rates, while Madagascar uses the official conversion factor of 1 ariary = 5 Malagasy francs.	Council of the European Union (1998); Banque Centrale de Madagascar (2011)
Contingent liability realizations	Realizations of contingent liabilities, including fiscal costs from financial-sector support, state-owned enterprises, public-private partnerships, and other off-balance-sheet obligations.	Bova et al. (2016)
IMF reporting violations	Cases involving IMF remedial action or noncomplying purchases linked to misreporting of economic data.	IMF (2021); IMF (2006)
Presidential elections	Indicator for years in which a presidential election takes place.	Cruz et al. (2021)
Legislative elections	Indicator for years in which a legislative election takes place.	Cruz et al. (2021)
Regular change in leadership	Indicator for leadership transitions occurring through regular or constitutional procedures.	Goemans et al. (2009)
Irregular change in leadership	Indicator for leadership transitions occurring through irregular means, such as coups, revolts, forced resignations, or other non-constitutional removals.	Goemans et al. (2009)
Net-present-value haircuts	Net-present-value creditor losses in sovereign debt restructurings.	Graf von Luckner et al. (2024)
Default duration	Length of sovereign default measured as the number of calendar years from the year of default to the corresponding year of restructuring.	Graf von Luckner et al. (2024)

B Data validation

To validate our measure of hidden debt and its interpretation, we conduct a series of empirical tests and validation exercises. We first rule out the possibility that the observed revisions are driven by ex post valuation effects, such as revisions to exchange rates. We then show that the results cannot be explained by contingent liability realizations or routine reporting lags, and confirm that the systematic upward bias in debt data revisions is also present when the analysis is restricted to revisions of the most recently reported debt observations. Finally, we compare our hidden-debt measure with prominent cases of data misreporting discussed by the IMF Executive Board and show that the pattern of revisions across creditor groups is consistent with well-documented differences in instrument observability and reporting transparency.

B.1 Accounting for exchange-rate effects

Ex post revisions to reported debt stocks could in principle also reflect ex post changes in valuation rather than the incorporation of previously unreported liabilities. Most of the statistics analyzed in this paper, however, record debt instruments at their nominal or face values rather than at secondary market prices. Changes in the market value of outstanding debt therefore do not mechanically generate revisions to the reported debt stock.

Exchange-rate valuation effects require closer investigation. When foreign-currency debt, for example, is reported in a common or domestic currency, movements in exchange rates change its converted value. Ordinary contemporaneous exchange-rate fluctuations do not pose a problem for our interpretation: they affect the value reported for a given year within each vintage. They would generate ex post revisions only if the historical exchange rates used for conversion, or the underlying conversion conventions, were themselves revised across data vintages.

We assess this possibility in two distinct ways for the different reporting systems covered in our database:

World Bank International Debt Statistics: The exchange-rate conversions used in the IDS draw on the IMF's International Financial Statistics (IFS). Because several archived vintages of the IFS are available online, we can directly compare year-on-year revisions to exchange rate series with the documented debt data revisions. Average revisions to end-of-period exchange rates range from -0.00396 to 0.00130 percent across different vintages. The largest of these average revisions in absolute value is therefore below 0.004 percent. Exchange-rate revisions in the available IFS vintages are thus orders of magnitude smaller than the debt-stock revisions documented for the World Bank International Debt Statistics and cannot account for their magnitude.

Historical debt statistics: The historical League of Nations and United Nations sources require additional care. These publications generally report foreign debt after conversion into domestic currency, but they do not always state the precise exchange rate used. Reassuringly, the League of Nations reporting instructions specify that "foreign debt represents the amounts converted into the home currency at the rates of exchange obtaining on the dates given" (e.g.

League of Nations, 1938). This convention implies that exchange-rate movements affect the contemporaneously reported value of foreign debt but should not lead to retrospective revaluation in subsequent vintages.

Our detailed assessment of the League of Nations statistical reports, however, identified three cases in which footnotes to the historical debt tables explicitly state that, following a change in the currency or exchange-rate regime, earlier foreign-debt observations were retrospectively converted using a different exchange rate.[31] Such revisions represent ex post valuation changes and are therefore conceptually distinct from the incorporation of previously unreported liabilities. Given that strong swings in foreign exchange rates and breaks in exchange regimes are likely to correlate with sovereign distress, episodes of this type could be severe confounders for the identified patterns in the main text. We therefore conduct an additional robustness exercise that excludes observations around major breaks in national currency regimes.

Specifically, we use data from Reinhart and Rogoff (2009) to construct an indicator for country-years in which at least one of the following events occurs: (i) the country enters or leaves the gold standard; (ii) the currency depreciates or is devalued by more than 25 percent; (iii) the country introduces a new currency; or (iv) the country redenominates its currency. We then exclude all debt-stock revisions whose revelation year coincides with one of these currency-regime breaks. Table B.1 reports the resulting summary statistics.

Table B.1: Underreporting bias: robustness to FX breaks

	Baseline		Excl. FX breaks	
	Mean	p-value	Mean	p-value
Combined	0.864***	0.001	0.794***	0.001
League of Nations	1.088**	0.044	0.811**	0.028
United Nations	0.722**	0.010	0.785***	0.009

Notes: The table reports summary statistics for debt-stock revisions after excluding country-years with major breaks in the national currency regime. A currency-regime break is defined as a country-year in which the country enters or leaves the gold standard, experiences a depreciation or devaluation exceeding 25 percent, or introduces a new currency. Revisions are defined as in equation (1), expressed as a percentage of GDP. The p-value refers to a test of the null hypothesis that the mean revision is zero and is calculated using Newey–West heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987). GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions.

The mean debt-stock revisions for both the League of Nations and the United Nations remain positive and highly statistically significant after observations with breaks in the foreign exchange regime are removed. The systematic upward bias in debt-stock revisions is therefore not driven by retrospective exchange-rate changes. Together, the direct evidence from modern IFS vintages and the robustness exercise for the historical sample indicate that valuation changes can account for isolated revisions but not for the broader underreporting pattern documented in the paper.

[31] All results are robust to removing these three cases.

B.2 Treatment and impact of contingent liability realization

One alternative explanation for the observed debt revisions is the realization of contingent liabilities. During economic downturns, governments may be required to bail out private-sector entities, such as banks or public-private partnerships, and assume their liabilities (see, e.g., Bova et al., 2016). Such events could potentially generate the cyclical patterns documented in the data without implying that debt had been underreported before the liabilities were assumed.

We address this competing interpretation in two ways. First, we consulted the World Bank debt data team to clarify how liability assumptions are recorded in the IDS. We were informed that the assumption of a liability does *not* require revisions to debt stocks reported for earlier years, because the liability becomes part of public debt only when the government assumes it. A contingent-liability realization should therefore appear as a discrete increase in the debt stock between consecutive years within the same vintage, rather than as an ex post revision to previously reported debt figures.

Using data on implicit and explicit contingent liability realizations compiled by Bova et al. (2016), we also test this distinction empirically. We merge our debt-revision data with their dataset of 180 episodes of contingent liability realizations between 1990 and 2014, which allows us to test whether such realizations are associated with larger average hidden debt revelations.[32]

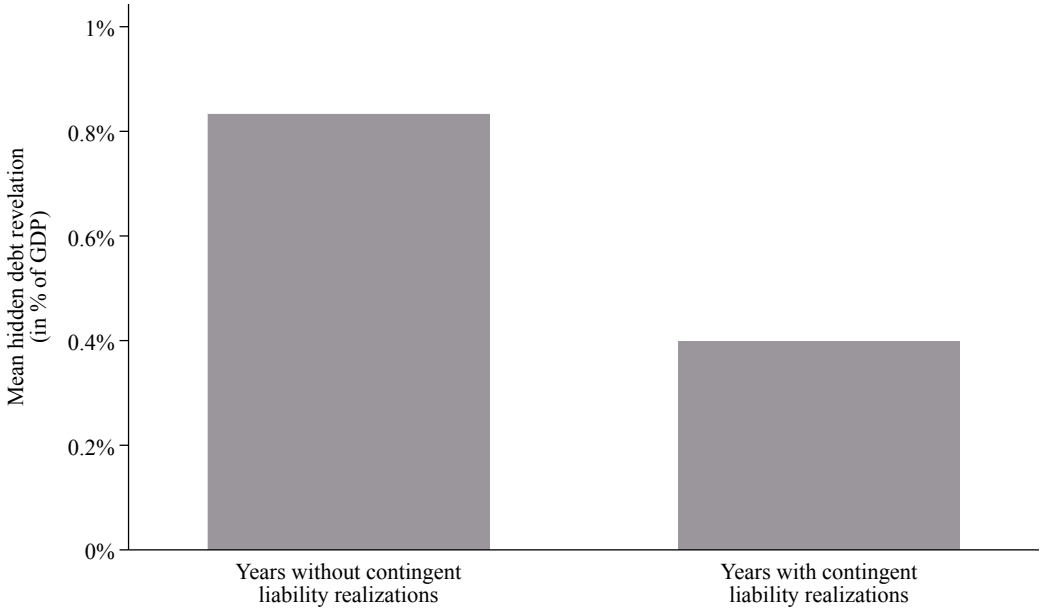
We first compare hidden debt revelations in years with and without contingent-liability realizations. Panel A of Figure B.1 shows no evidence of larger revelations in realization years. If anything, average revelations are lower, although the difference in means is not statistically significant. Panel B confirms this result in an event-study specification: contingent-liability realizations are not followed by a statistically significant increase in hidden debt revelations.

Additional evidence comes from revisions to total external debt stocks—which combine the liabilities of public and private borrowers—and to private non-guaranteed external debt stocks, which capture obligations owed by private borrowers. If upward revisions to public debt primarily reflected the reclassification of previously recorded private liabilities following contingent-liability realizations, we would expect corresponding downward revisions to private external debt, while total external debt should remain broadly unchanged. Table B.2 shows that neither pattern is present. Revisions to both total external debt and private non-guaranteed external debt are significantly positive and strongly right-skewed, closely resembling the revision pattern observed for public external debt. This evidence is difficult to reconcile with the view that the upward revisions in public debt are driven primarily by liabilities being transferred from private to public balance sheets.

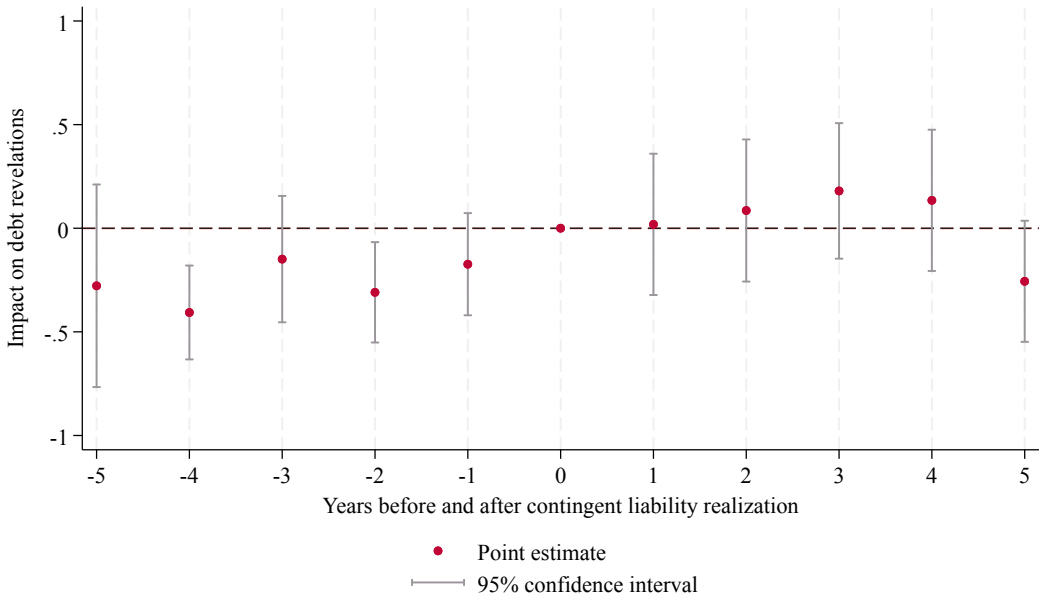
[32] As before, we restrict the main analysis to external public debt. Extensions with domestic and total public debt yield the same results.

Figure B.1: Contingent liability realizations and hidden debt revelations

Panel A: Mean comparison



Panel B: Hidden debt revelations before and after contingent liability realizations



Notes: Panel A compares the mean revelation of the maximum external debt revision in percent of GDP for years with and without contingent liability realizations between 1990 and 2014. Panel B shows point estimates and 95 percent confidence intervals obtained from regressing standardized hidden debt revelations on a set of year and country fixed effects and lags and leads for contingent liability realization events. Data on contingent liability realizations is from Bova et al. (2016), hidden debt revelations are defined as in Section 3.2.

Table B.2: Revisions to total external and private non-guaranteed debt stocks

	N	Mean	Median	Std. Dev.	p-value
In percent of GDP					
Total long-term debt (DOD)	6,100	2.11	0.08	11.72	0.000
Private nonguaranteed debt (DOD)	6,159	1.20	0.00	10.39	0.000
In mn. USD amounts					
Total long-term debt (DOD)	6,100	818.41	5.00	6,188.07	0.000
Private nonguaranteed debt (DOD)	6,159	640.75	0.00	5,754.13	0.000

Notes: The table reports summary statistics and p-values for revisions of total external and private non-guaranteed external debt stocks, defined analogously to equation (1), both in percent of GDP and in millions of nominal USD. GDP data are taken from a single vintage of World Bank (2025) and are therefore not subject to revisions. The reported p-values test the null hypothesis that the mean revision is zero, using Newey–West heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987).

B.3 Accounting for the possibility of reporting lags

This subsection tests whether the underreporting bias could be driven by routine reporting lags. A loan contracted by a state-owned enterprise in year t, for example, could enter the international reporting system with a one-year delay due to differences between corporate reporting cycles and fiscal years. Such routine delays could mechanically generate positive revisions even when the liabilities are reported according to a predictable schedule. This subsection therefore examines whether such delays can account for the results documented in the main text of the paper. We first measure the time between the contracting of unreported borrowing and its incorporation into the statistical record. We then test whether average revisions remain positive after excluding revisions made shortly after the borrowing.

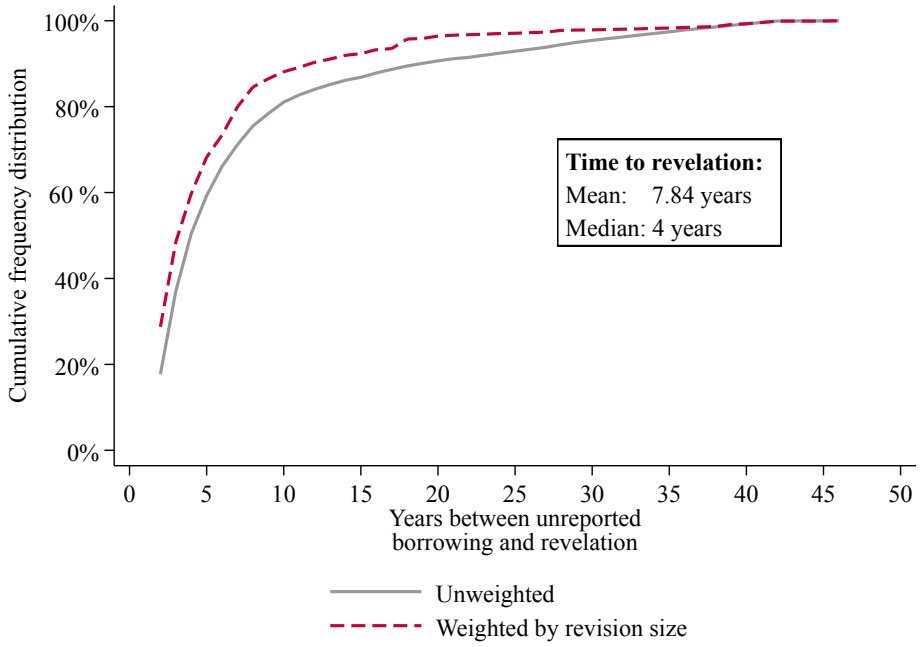
The timing of borrowing can be identified most precisely using commitment data, because commitments assign new debt obligations to the year in which they were contracted. We therefore conduct the timing analysis using commitments of external public and publicly guaranteed debt from the World Bank International Debt Statistics. For each upward revision, we calculate the number of years between the borrowing year and the vintage in which the previously unreported commitment is incorporated into the database. Analogous exercises using debt stocks and the full sample of reporting systems yield very similar conclusions.

Figure B.2 plots the cumulative distribution of the resulting revelation lags. The unweighted distribution gives equal weight to each upward revision, while the revision-weighted distribution assigns greater weight to larger revisions, measured as a percentage of GDP.

The median revelation occurs four years after the corresponding borrowing was contracted, while the average revelation lag is 7.84 years. The difference between the median and the mean reflects a pronounced right tail: approximately 10 percent of previously unreported commitments are incorporated into the database only more than 15 years after the borrowing year.

Approximately 20 percent of upward revisions occur at the first possible opportunity, which, given the IDS publication schedule, is two years after the borrowing year. These relatively prompt revisions could plausibly reflect routine reporting delays. Table B.3 therefore examines

Figure B.2: CFD of the time between unreported borrowing and revelation



Notes: This figure shows the cumulative distribution of the number of years between the contracting of unreported borrowing and its subsequent incorporation into the World Bank International Debt Statistics. The unweighted distribution gives equal weight to each upward revision. The revision-weighted distribution weights each observation by the size of the corresponding revision as a percentage of GDP.

whether the positive revision bias survives after excluding the vintages immediately following the initial publication of each debt statistic.

Table B.3: Underreporting of external public debt: accounting for reporting lags

	N	Mean	Median	Std. Dev.	p-value
Excl. first year	5,918	0.48	0.01	2.90	0.000
Excl. first two years	5,887	0.40	0.00	2.90	0.000

Notes: The table reports summary statistics and p-values for data revisions to debt flows as defined in equation (1) in percent of GDP, excluding the first and the first two vintages after initial publication of a debt statistic. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions. The reported p-values test the null hypothesis that the mean revision is zero, using Newey–West heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987).

Average revisions remain positive and statistically significant. Even after excluding the first two subsequent vintages, the average upward revision amounts to 0.40 percent of GDP and is highly statistically significant ($p < 0.001$). Together with the relatively long revelation lags shown in Figure B.2, these results indicate that routine reporting delays may account for some early revisions but cannot explain the systematic upward revision bias in the data.

B.4 Revisions to recently reported debt statistics

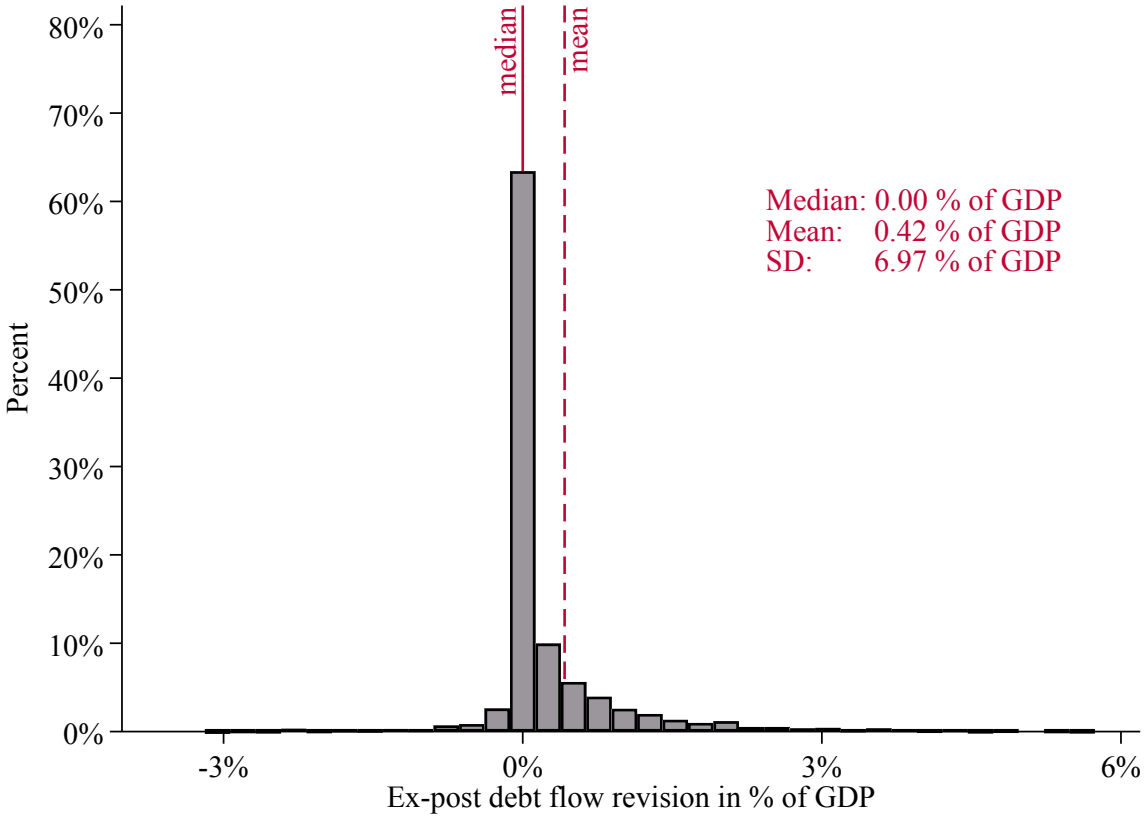
This subsection tests whether the systematic upward bias in debt data revisions is also present when we focus only on revisions that change the most recently reported debt statistics. Figure B.2 shows that it can take more than 30 years for initially unreported debt to be fully revealed. Arguably, revelations that occur after such a long time period are of little relevance to a country's creditors. We therefore derive summary statistics for only those revelations in each vintage that change the latest available debt data point. Table B.4 and Figure B.3 show that these revelations exhibit the same systematic upward bias as the full sample.

Table B.4: Summary statistics of revisions to the latest available data

	N	Mean	Median	Std. Dev.	p-value
Debt stocks	3,395	0.28	0.00	3.42	0.000
Debt flows	3,116	0.42	0.00	6.97	0.001

Notes: The table reports summary statistics and p-values for data revisions to debt stocks and flows as defined in equation (1) in percent of GDP, only for revisions to the values initially reported in the respective prior year. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions. The reported p-values test the null hypothesis that the mean revision is zero, using Newey–West heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987).

Figure B.3: The distribution of recent debt flow revisions



Notes: The figure shows the percentage distribution of data revisions to debt flows as defined in equation (1), in percent of GDP. The horizontal axis is truncated for readability but all observations are retained in the calculations. In contrast to the histogram shown in the main text, this figure focuses on revisions to the latest debt data point only. The solid line shows the median, and the dashed line visualizes the mean. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions.

B.5 Comparison with IMF reporting violations

Member countries of the IMF that misreport information to the Fund face sanctions under Article VIII of the IMF's Articles of Agreement, unless misreporting is solely due to a lack of capacity. If the IMF's Executive Board concludes that a member country has misreported information for other reasons than lack of capacity, it can establish a breach of obligation on the part of the member country and decide on the application of sanctions. All Board decisions with respect to a breach of obligations will be publicly announced.

By going through IMF reports and policy documents (see, e.g., IMF, 2006), we are able to identify 50 instances in which IMF member countries were sanctioned for intentionally misreporting data. 17 of these cases are closely related to the publication of statistics on debt and fiscal policy and affect countries and years that are covered by our new database. Table B.5 lists these cases, the dates on which they were discussed by the IMF board, and whether we observe an associated upward revision in our database. In all but four cases we are able to indeed observe revelations, ranging from USD 2 million to USD 1.5 billion.

Table B.5: IMF reporting violations and hidden debt revelations

Country	Date discussed	Upward revision?
Argentina	September 17, 2004	✓
Burkina Faso	February 2, 2005	
Chad	June 23, 2003	✓
Djibouti	December 20, 2002	
Dominica	April 8, 2004	
Dominica	July 3, 2005	✓
Ghana	June 28, 2001	✓
Hungary	February 21, 1990	✓
Nepal	January 18, 2006	✓
Pakistan	March 4, 2021	✓
Tajikistan	February 7, 1999	
Tajikistan	November 12, 2002	✓
Tajikistan	February 13, 2002	✓
Tajikistan	July 18, 2003	✓
Turkey	April 26, 2005	✓
Uganda	July 30, 2004	✓
Ukraine	December 13, 1995	✓

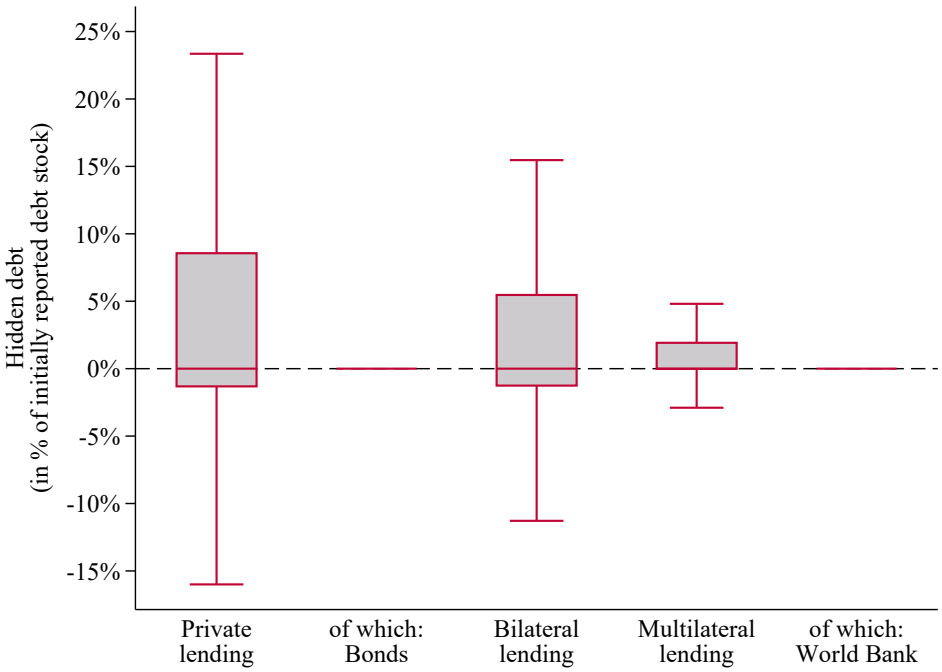
Notes: The table lists 17 instances in which IMF member countries were sanctioned for misreporting data, the dates on which these cases were discussed by the IMF board (IMF, 2021; IMF, 2006), and whether we observe an associated upward revision in our database.

B.6 Debt revisions by creditor group

The interpretation of upward revisions as previously unreported debt suggests that revision patterns should vary systematically across creditor groups. Liabilities owed to creditors whose claims are independently observable should be relatively difficult to omit from official statistics. This is particularly true for debt owed to multilateral institutions, which typically maintain detailed public records of their own lending, and for publicly traded bonds, whose issuance and outstanding amounts are widely reported. By contrast, bilateral loans and non-bond private claims are generally less transparent: they are not traded in secondary markets, information about individual contracts is often limited, and loan agreements may contain confidentiality clauses (Gelpern et al., 2023; Mosley and Rosendorff, 2023).

The World Bank IDS is the only reporting system in our database that provides sufficiently detailed creditor-level breakdowns to test this assertion. We therefore use the IDS subsample to compare revisions across creditor groups. To account for large differences in the size of outstanding claims and ease comparisons across creditor categories, we express hidden debt as a share of the debt initially reported for the corresponding creditor group rather than as a share of GDP. Figure B.4 uses whisker plots to present the resulting distributions.

Figure B.4: Distribution of hidden debt across creditor groups



Notes: The boxplot shows the distribution of hidden debt, as defined in equation (1), across creditor groups. Creditor groups are only available in the World Bank's IDS, and definitions follow those of the World Bank.

The results closely match our prior. Revisions are comparatively small for debt owed to the World Bank and for publicly traded bonds. They are substantially larger for bilateral claims and non-bond private lending, precisely the categories for which independent verification is more difficult and contractual information is not readily available. This systematic variation across creditor groups is difficult to reconcile with an undifferentiated process of routine reporting

noise and provides additional support for our identification of hidden debt through ex post debt data revisions. Beyond reinforcing our preferred interpretation, these differences also relate to a growing literature on the importance of investor composition in sovereign debt and other asset markets (Fang et al., 2023; Coppola, 2025; Agarwal et al., 2024).

C Case Archive

This appendix complements the statistical analysis in the main text by placing the debt data revisions in their broader historical and institutional context. Section C.1 traces hidden debt accumulation and revelation across the major international lending cycles of the past century and combines our revision data with the accounts of contemporary policymakers and observers. Section C.2 presents the complete country-level chronology of large hidden debt revelation episodes identified under our baseline definition. Together, the historical accounts and long-run chronology show that the revelation episodes identified in our data have recurred across widely different reporting regimes and correspond closely to documented concerns about incomplete debt reporting.

C.1 A history of hidden debt accumulation and revelation

From the interwar lending boom of the 1920s to the syndicated bank lending boom of the 1970s and the expansion in international lending to the Global South during the 2000s and 2010s, periods of rapid debt accumulation were repeatedly accompanied by concerns that official statistics understated the true scale of sovereign liabilities. When these booms ended in crisis, intensified scrutiny and debt reconciliation efforts often uncovered large previously unreported obligations, and eventually resulted in revised statistics. Throughout this period, the dominant international reporting systems of their time——the League of Nations' and the United Nations' Statistical Yearbooks, the IMF's Government Finance Statistics, and the World Bank's International Debt Statistics——served simultaneously as the principal tools for monitoring sovereign indebtedness and as recurring subjects of criticism over omissions and incomplete coverage.

C.1.1 The Inter-War Period and the Great Depression

The first sustained international effort to systematize public debt reporting emerged under the League of Nations following the International Financial Conference in Brussels in 1920. Acting on a recommendation of the Provisional Economic and Financial Committee, the League began compiling annual volumes on public finance based on standardized questionnaires circulated to member and non-member states. In launching this effort, the League stressed that "full information is essential to the creation and maintenance of confidence" and that "each country should undertake the publication of frequent and complete statements of the condition of its public finances," while the League would "continue to compile and issue periodical volumes based on returns from as many countries as possible" (League of Nations, 1922b).

At the same time, contemporary observers were well aware of the limitations of sovereign debt statistics. Prefaces to the League of Nations *Statistical Yearbooks* and *Public Finance* memoranda repeatedly cautioned that published figures were not fully comparable across countries and would "not always include *all* the fiscal debts of the States" (see, e.g., League of Nations, 1933). Reporting deficiencies typically centered on floating debt, including domestic arrears and other short-term obligations, as well as provincial, municipal, and guaranteed debt, whose

coverage varied substantially across countries. The rapid borrowing boom of the 1920s appears to have further strained monitoring and debt management capacity. Contemporary observers were therefore generally aware that official statistics provided only an incomplete picture of total indebtedness (see for example the classical accounts by Winkler (1933) or Lewis (1938)). Yet, the true extent of sovereign indebtedness seems to have been unknown even to the statistical compilers of the time, as shown in the excellent accounts of underreporting of sub-national public debt by Papadia (2015) and domestic public debt by Reinhart and Rogoff (2011).

In our revision data, these shortcomings are reflected by a series of large upward revisions, in particular during the early 1930s after the sovereign defaults of the Great Depression spread rapidly across the globe. We identify a total of 51 hidden debt revelation episodes (as defined in Section 3.2) in 32 different countries during the 1930s: Domestic and/or external public debt numbers were significantly upward revised in Latin American countries such as Argentina (1932), Brazil (1935), Chile (1933), and Ecuador (1936), but also in countries such as Japan (1934), Egypt (1935), and South Africa (1935). Figure C.1 illustrates the Brazil case by contrasting the 1932 and 1935 vintages of the League of Nations *Statistical Yearbooks* in Panel A and Panel B, respectively.

Figure C.1: Underreporting of Brazil's domestic debt in League of Nations statistics, 1932

Panel A: League of Nations *Statistical Yearbook* 1932

Tableau 110 *(suite)*. **Finances publiques. Dette publique et service de la dette** (en millions).
Table 110 *(continued)*. **Public Finance. Public Debt and Debt Service** (000,000's).

(Pour la note générale, voir fin du tableau. — For general note, see end of table.)

PAYS Unité monétaire	Date	Dette intérieure Domestic debt Consolidée Funded	Flottante Floating	Totale Total	Dette extérieure Foreign debt	Dette totale Total debt	Année financière Financial year	Service de la dette publique Debt service Intérêts Interest	Amortissement Amortisation	COUNTRY Unit of currency
Brésil ..... (Milreis)	31. XII. 1930	2,460.1	2,543.0	5,003.1	6,947.2	11,950.3	1931	*782.6*		Brazil. (Milreis)
	31. XII. 1931	2,510.7	2,771.0	5,281.7	.	.	1932	*802.7*		
	31. XII. 1932	2,456.6	3,004.0	5,460.6	.	.	1933	*693.8*		
	La dette int. flottante est formée par des billets du Trésor. — Floating domestic debt consists of Treasury notes.									

Panel B: League of Nations *Statistical Yearbook* 1935

Tableau 136 *(suite)*. **Finances publiques. Dette publique et service de la dette** (en millions).
Table 136 *(continued)*. **Public Finance. Public Debt and Debt Service** (000,000's).

Note. — Les chiffres en italique représentent des prévisions. L'astérisque * signifie situation probable de la dette ou chiffres provisoires du service de la dette.

Note. — Figures in italics represent estimates. An asterisk * indicates probable debt situation or provisional figures of debt service.

PAYS COUNTRY Unité monétaire Unit of currency	Date	Dette totale Total debt	Dette intérieure Domestic debt Consolidée Funded	Flottante Floating	Totale Total	Dette extérieure Foreign debt	Année financière Financial year	Service de la dette publique Debt service Intérêts Interest Intér. Domestic	Ext. Foreign	Remboursem. Redemption Intér. Domestic	Ext. Foreign
a	b	c	d	e	f	g	h	i	j	k	l
Brésil — Brazil (Milreis)	31. XII. 1932	15,909.3	2,932.8	4,282.4	7,215.2	7,694.1	1933	*173.3*	*374.4*	—	*146.3*
	31. XII. 1933	16,922.5	3,005.2	4,517.0	7,522.2	9,400.3	1934		428.4		
	31. XII. 1934	.	3,505.1	.	.	9,358.2	1935		425.6		
	31. XII. 1935	.	3,505.1	.	.	9,340.8	1936		*501.4*		
	La dette consolidée intérieure										

Notes: The figure shows Brazil's public debt statistics as reported in the *Statistical Yearbooks* of the League of Nations in vintages 1932 (Panel A) and in 1935 (Panel B). While the 1932 vintage reports a domestic public debt stock of roughly 5.5 billion mil-réis for year 1932, the 1935 vintage revised this value upward to 7.2 billion mil-réis.

While underreporting was particularly widespread and sizeable in periphery borrowers, our data also reveal prominent hidden debt episodes in advanced economies. Germany's interwar public

debt, for example, was strongly underreported in the League of Nations statistics as the regime increasingly shifted military expenditures off the official budget during the 1930s rearmament drive. Upward revisions for Germany peak at roughly 2 billion Reichsmarks in 1934, with the sectoral breakdown indicating that the newly added liabilities consisted predominantly of domestic debt. Historians have documented how "large parts of the deficit were channeled through an elaborate system of shadow budgets, using the services of public banks and setting up other money-laundering devices" (Ritschl, 2002). Most prominent among these arrangements was the issuance of state-guaranteed instruments—known as Mefo bills—to finance rearmament and explicitly designed to circumvent conventional budgetary accounts (Tooze, 2006). The revised debt statistics incorporating these liabilities were only published after World War II.

C.1.2 Bretton Woods and the post-World War II era

After World War II, responsibility for international public finance statistics shifted to the United Nations and the International Monetary Fund. United Nations bodies explicitly framed improvements in debt and fiscal reporting as an unfinished project. Upon the recommendation of its Statistical Commission, the UN Economic and Social Council adopted Resolution 486 D (XVI) in July 1953, calling for the work of the UN and IMF secretariats in preparing and publishing comparable public finance statistics "be accelerated in so far as possible." The resolution further recommended continuation of the volume *Public Finance Statistics 1938–1952*, dissemination of a draft *Manual on the Classification of Government Accounts*, and the preparation of a revised questionnaire "designed to obtain better [public finance] data." This language reflected a recurring theme in the post-war international financial architecture: sovereign debt statistics were treated as essential public goods, yet also recognized as incomplete, provisional, and in need of methodological refinement.

Although the 1950s and 1960s did not witness a sovereign default wave comparable in scale to the aftermath of the Great Depression, they nevertheless featured numerous idiosyncratic debt crises, several of which coincided with large upward revisions in reported public debt in the United Nations *Statistical Yearbooks*. A particularly notorious case was the uncertainty surrounding Turkey's indebtedness leading up to its 1956 default on external creditors. A 1949 World Bank memorandum warned that the information received from the Turkish authorities was insufficient "to justify complete confidence in the figures" (IBRD, 1949). Anne Krueger later noted that "the precise amount of arrears and total debt during the 1952–1958 period has never been known," and that creditor governments were forced to advertise domestically to identify outstanding claims on the country (Krueger, 1974). Figure C.2 illustrates the resulting revisions to Turkey's public debt in successive United Nations *Statistical Yearbooks*. The upward revision peaks at roughly 0.8 billion Turkish lira (about 2.4 percentage points of GDP or 33 percent of total domestic debt) in 1953.

The challenges creditors faced in reconstructing Turkey's total indebtedness were by no means unique. Our new data reveal that sovereign debt restructurings with the London and Paris Club at the time were frequently followed by large upward revisions in the United Nations debt statistics. These issues were particularly pronounced among newly independent states, where weak

Figure C.2: Underreporting of Turkey's domestic debt in United Nations statistics, 1953

Panel A: United Nations *Statistical Yearbook* 1954

165. Budget accounts and public debt (continued) — Comptes budgétaires et dette publique (suite)

Country and items	1939	1950	1951	1952	1953	1954	1955	Pays et postes
ASIA (continued)								ASIE (suite)
TURKEY (continued)								TURQUIE (suite)
Balance (+) or (−)	−44.2	−77.6	−33.9	−226.6	−97.1	E −157.6	E +.9	Solde (+) ou (−)
Public debt (end of calendar year):								Dette publique (fin de l'année civile):
Domestic: long-term	181.0	764.0	733.0	760.0	724.0	...	...	Intérieure: à long terme
: short-term	166.0	831.0	946.0	792.0	826.0	...	...	: à court terme
Total	347.0	1 595.0	1 679.0	1 552.0	1 550.0	...	...	Total
Foreign	187.0	775.0	750.0	822.0	754.0	...	...	Extérieure
Total	534.0	2 370.0	2 429.0	2 374.0	2 304.0	...	...	Total

Panel B: United Nations *Statistical Yearbook* 1956

PUBLIC FINANCE

171. Budget accounts and public debt (continued) — Comptes budgétaires et dette publique (suite)

Country and items	1939	1952	1953	1954	1955	1956	1957	Pays et postes
ASIA (continued)								ASIE (suite)
TURKEY (continued)	Years ending 28 February — Années finissant le 28 Février							TURQUIE (suite)
Balance (+) or (−)	−44.2	−226.6	−97.1	−361.6	−450.4	—	—	Solde (+) ou (−)
Public debt (end of calendar year):								Dette publique (fin de l'année civile):
Domestic: long-term	181.0	760.4	724.1	815.2	...	...	...	Intérieure: à long terme
: short-term	166.0	1 312.5	1 582.0	1 604.5	...	...	...	: à court terme
Total	347.0	2 072.9	2 306.1	2 419.7	...	...	...	Total
Foreign	187.0	822.6	754.2	852.1	...	...	...	Extérieure
Total	534.0	2 895.5	3 060.3	3 271.8	...	...	...	Total

Notes: The figure shows Turkey's public debt statistics as reported in the *Statistical Yearbooks* of the United Nations in 1954 (Panel A) and in 1956 (Panel B). While the vintage published in 1954 reports a domestic public debt stock of 1,550 million Turkish lira for year 1953, the subsequent vintage revised this value upward to 2,306 million Turkish lira. The ex post increase can be traced back to a near doubling of reported short-term debts.

administrative capacity often resulted in incomplete records of government liabilities. Ghana provides a striking example. During the country's 1966 default and subsequent restructurings with external creditors, observers noted that the government had no central record of supplier credits, although supplier credits accounted for an (estimated) 80 percent of the government's total public debt. The large uncertainty stemmed primarily from a lack of oversight and centralized control, as "loan agreements were sometimes signed by one Ministry, while another was still engaged in the negotiation of the same loans" (Hutchful, 1984).

C.1.3 The syndicated lending boom and the 1980s debt crisis

These early post-war episodes foreshadowed much deeper and more widespread hidden debt problems once patchy debt-recording systems in developing countries came under increasing strain during the syndicated lending boom of the 1970s and early 1980s.

When international lending expanded rapidly, a 1977 report prepared by staff of the U.S. Congress cautioned that "one cannot emphasize too strongly the highly tentative nature of the data concerning international debt and private bank lending" (United States Congress, 1977).

While the World Bank's Debtor Reporting System——later incorporated into what is now the *International Debt Statistics*——served as the central global repository for external public debt data, the report observed that figures reported by governments could be inaccurate because "that government may itself not know exactly how much it has borrowed," given decentralized borrowing through public utilities, nationalized industries, development corporations, and subnational entities.

Similar concerns emerged in technical assistance missions conducted by the United Nations to assist debtor countries facing mounting repayment difficulties. The official history of UNCTAD recounts the organization's first technical assistance mission in 1979 as follows: "The first difficulty faced by UNCTAD officials was the lack of information on external debt. How much did the country owe? To which creditors? In which currencies? When were the payments falling due? Who were the national debtors besides the central Government? The participation of an UNCTAD representative in the Paris Club meetings in the early 1980s confirmed that this lack of information applied generally to developing countries" (UNCTAD, 2014).

Creditor records were not necessarily more reliable. The Congressional staff report observed that "private banks have apparently neglected to analyze in any systematic fashion their country-by-country exposure." As a result, banks were assessing sovereign risk "on the basis of false or inadequate data," concluding that "the true magnitude of international debt … remains a mystery" (United States Congress, 1977).

Our new revision data again provide a systematic way to quantify the shortcomings of sovereign debt statistics during this period. When the syndicated lending boom gave way to a lending bust in the wake of the Federal Reserve's monetary policy reversal, widespread debt distress, IMF stabilization programs and eventually a wave of hidden debt revelations followed. At the height of the 1980s debt crisis, a staggering 73 countries experienced large upward revisions in their World Bank debt statistics. Hidden debt revelations were particularly common among the world's low-income countries—in particular in Sub-Saharan Africa— many of which had just accessed international private capital markets for the first time in their history. Figure C.3 illustrates Nigeria's large hidden debt revelation as seen from subsequent vintages of the World Bank's World Debt Tables. In Latin America, our data unveil particularly large revelations in Costa Rica (upward revision of external debt by 16%), Bolivia (22%), Ecuador (21%), and the Bahamas (38%), with somewhat smaller revelations in Brazil (1%), Chile (0.7%), and Mexico (0.7%).[33]

The resolution of the 1980s debt crises proved exceptionally protracted, contributing to what later became known as a lost decade for many developing countries. Not only did serial debt restructurings drag on for years, it also took considerable time for official debt statistics to converge toward the true level of indebtedness. In Zaire, for example, a 1978 World Bank study described the task of establishing an accurate external debt record as "a complex, tedious and lengthy undertaking which is continuing," explicitly acknowledging that "future work will reveal

[33]The upward revision of Chile's debt in the World Bank Debt Statistics may appear small in light of the classic account of Diaz-Alejandro (1985). We note, however, that the contingent liability realizations related to bank bailouts are an *additional* source of debt surprise that we do not intend to measure. See Section B.2 for details.

Figure C.3: Underreporting of Nigeria's external debt in World Bank statistics, 1983

Panel A: World Bank *World Debt Tables* 1983

NIGERIA
(US$ Millions)

	1972	1974	1976	1977	1978	1979	1980	1981
DEBT OUTS. DISB. (DOD)	680.5	1,219.7	838.4	892.7	2,347.5	3,211.7	4,001.1	4,651.8
Official Creditors	570.8	692.3	781.0	842.3	908.9	935.4	982.3	983.2
Multilateral	282.5	335.7	406.2	450.6	490.4	523.7	570.5	620.6
IBRD	257.4	296.8	365.3	409.5	447.1	478.2	516.6	562.2
IDA	24.4	35.6	36.5	38.5	38.3	37.9	37.5	37.1
Bilateral	288.3	356.7	374.8	391.7	418.5	411.7	411.7	362.6
Private Creditors	109.7	527.4	57.3	50.4	1,438.6	2,276.3	3,018.9	3,668.6
Suppliers	69.1	57.2	42.3	45.6	36.6	28.5	18.1	8.5
Financial Markets	40.6	34.4	15.1	4.8	1,402.0	2,247.8	3,000.8	3,660.2

Panel B: World Bank *World Debt Tables* 1985

NIGERIA°
(US$ Millions)

	1974	1976	1978	1979	1980	1981	1982	1983
DEBT OUTS. DISB. (DOD)	1,218.7	838.4	2,347.7	3,267.6	4,275.7	5,898.7	8,488.1	11,757.2
Official Creditors	692.3	781.0	908.9	936.4	981.9	992.7	1,152.5	1,819.3
Multilateral	335.7	406.2	490.4	523.7	570.5	619.9	739.3	881.6
IBRD	296.8	365.3	447.1	478.2	516.6	562.2	674.0	824.1
IDA	35.6	36.5	38.3	37.9	37.5	37.1	36.7	36.3
Bilateral	356.7	374.8	418.5	412.7	411.4	372.9	413.2	937.7
Private Creditors	527.4	57.3	1,438.7	2,331.2	3,293.8	4,905.9	7,335.6	9,937.8
Suppliers	57.2	42.3	36.7	28.5	24.4	75.0	141.1	183.3
Financial Markets	34.4	15.1	1,402.0	2,302.8	3,269.3	4,830.9	7,194.5	9,754.5

Notes: The figure shows Nigeria's external public and publicly-guaranteed debt statistics as reported in the *World Debt Tables* of the World Bank in 1983 (Panel A) and in 1985 (Panel B). While the vintage published in 1983 reports an external public debt stock of USD 4,852 million for the year 1981, the 1985 vintage revised this value upward to USD 5,899 million. The ex post increase can be traced back to the identification of previously unreported debts to financial markets (i.e. syndicated bank loans), while the debt to official creditors changes only marginally.

discrepancies in the data on individual loans" (World Bank, 1978). Serial debt restructurings were therefore frequently accompanied by serial hidden debt revelations throughout the 1980s and 1990s, consistent with the elevated incidence shares reported in Figure 8 in the main text. By the late 1990s and early 2000s, initiatives such as the Highly Indebted Poor Country (HIPC) initiative aimed not only to reduce debt overhangs, but also to strengthen the reliability of debt statistics by improving debt management capacity.

C.1.4 The Global Financial Crisis and Eurozone Debt Crisis

While sovereign debt distress had temporarily receded in low-income countries following the HIPC initiative, it reemerged with force in advanced economies during the Global Financial Crisis and the subsequent Eurozone Debt Crisis. And once again, shortcomings in sovereign debt statistics and fiscal reporting were at the center of the crisis.

After Greece's hidden debt revelation fundamentally altered perceptions of sovereign risk in the Eurozone (see Section 2.2 in the main text), debt data revisions in other European countries revealed broader weaknesses in debt reporting beyond Greece itself. A particularly noteworthy case was Portugal. In 2011, when Portugal turned to the IMF and Eurozone partners for financial assistance, Banco de Portugal and the Portuguese statistical authorities disclosed more

than EUR 1.1 billion in previously unreported liabilities in the autonomous region of Madeira (European Commission, 2011). At the same time, Eurostat and national statistical authorities reclassified state-owned enterprises and other quasi-public entities into the general government sector. A Banco de Portugal statistical release noted that the inclusion of three public transport corporations alone added debt equivalent to 5.3 percent of GDP to Portugal's general government debt statistics (Banco de Portugal, 2011). In our database, Portugal's total public debt stock is upward revised by EUR 13.3 billion in the 2012 vintage of the IMF's Government Finance Statistics, corresponding to 8 percent of Portugal's GDP.

C.1.5 The Covid Pandemic

While Europe was grappling with the fallout from the debt crisis, a new lending boom was underway in the Global South. As during the lending booms of the 1920s and 1970s, the rapid expansion of external borrowing was once again accompanied by rising levels of hidden debt, in particular in low-income countries.

In a strong parallel to the 1970s syndicated lending boom, underreporting built up during a decade with low interest rates, ample global liquidity, high commodity prices, and large lending by new creditors such as Chinese state-owned banks. As of 2019, around 50 percent of China's overseas lending to emerging and developing countries—the largest official creditor at the time—had not been recorded in the World Bank's International Debt Statistics (Horn et al., 2021). And a World Bank report observed that 40 percent of low-income countries had not published any sovereign debt data in the past two years and concluded that "analyzing public debt in low-income developing countries is like solving a puzzle with many missing pieces" (World Bank, 2021).

When commodity prices collapsed and the Covid-19 pandemic triggered a sharp tightening in global financial conditions, debt distress spread rapidly across the Global South. As in previous waves of sovereign distress, IMF programs and increased investor scrutiny brought large hidden liabilities to light and debt data revisions contributed to record-high debt levels. Our vintage-by-vintage data show that a total of 28 countries experienced a large hidden debt revelation episode in the World Bank debt statistics during this period, with upward revisions averaging 4 percent of GDP, or 10 percent of initially reported debt. As we documented in earlier work, the World Bank's 2022 vintage of the *International Debt Statistics* alone added US$199 billion of previously undisclosed borrowing, setting a new record in the more than 50-year history of the database (Horn et al., 2022).

Figure C.4 illustrates the case of Zambia, where successive vintages of the World Bank debt statistics added substantial previously unreported liabilities to Chinese and other external creditors during the pandemic period. During the 2010s, Zambia had rapidly expanded its external borrowing, taking on debt from a wide range of creditors through the central government, state-owned enterprises, and special purpose vehicles. As the debt portfolio became more complex, investors began doubting the accuracy of official debt figures, especially from 2018 onward. COVID-19 then intensified these pressures, and Zambia entered default in October 2020 after

missing a Eurobond coupon payment. The restructuring process was slowed by uncertainty over the true size and composition of Zambia's liabilities, with creditors resisting relief until more complete debt data were available. As presented in Figure C.4, later revisions confirmed that Zambia's debt had been materially understated: the World Bank's reported 2021 stock of external public and publicly guaranteed debt rose from USD 12.5 billion in the initial 2022 vintage to USD 15.2 billion in the 2024 vintage, implying USD 2.7 billion in previously hidden debt, equal to 12.1% of GDP.

Figure C.4: Underreporting of Zambia's external debt in World Bank statistics, 2021

Panel A: World Bank *IDS* 2022

ZAMBIA

(US$ million, unless otherwise indicated)

	2010	2017	2018	2019	2020	2021
Summary external debt data, by debtor type						
Total external debt stocks	**4,253**	**22,955**	**23,526**	**27,254**	**26,690**	**24,046**
Use of IMF credit and SDR allocations	1,117	794	715	667	678	1,969
of which: SDR allocations	722	668	652	649	676	1,969
Long-term external debt	1,986	21,260	22,189	25,752	25,335	20,811
Public and publicly guaranteed sector	1,192	8,786	9,888	11,017	12,260	12,498
Public sector	1,192	8,786	9,888	11,017	12,260	12,498
of which: General government	1,141	8,765	9,871	11,003	12,250	12,491
Private sector guaranteed by public sector	..	0	0	0	..	..
Private sector not guaranteed	794	12,474	12,301	14,736	13,074	8,313
Short-term external debt	1,150	901	623	835	676	1,266

Panel B: World Bank *IDS* 2024

Summary External Debt Data	2010	2019	2020	2021	2022	2023
Total external debt stocks	**4,325**	**29,445**	**29,642**	**26,941**	**28,339**	**29,579**
Long-term external debt stocks	**2,058**	**27,939**	**28,233**	**23,593**	**23,677**	**23,701**
Public and publicly guaranteed debt from:	*1,264*	*13,208*	*15,167*	*15,293*	*15,755*	*15,868*
Official creditors	1,207	6,485	7,874	8,088	8,778	8,931
Multilateral	877	2,204	3,043	3,140	3,861	4,075
of which: World Bank	430	1,108	1,296	1,377	2,047	2,221
Bilateral	331	4,281	4,831	4,948	4,917	4,856
Private creditors	56	6,723	7,293	7,205	6,976	6,938
Bondholders	..	3,000	3,000	3,000	3,000	3,000
Commercial banks and others	56	3,723	4,293	4,205	3,976	3,938
Private nonguaranteed debt from:	*794*	*14,731*	*13,066*	*8,301*	*7,922*	*7,832*
Bondholders	..	..	..	..	..	..
Commercial banks and others	794	14,731	13,066	8,301	7,922	7,832

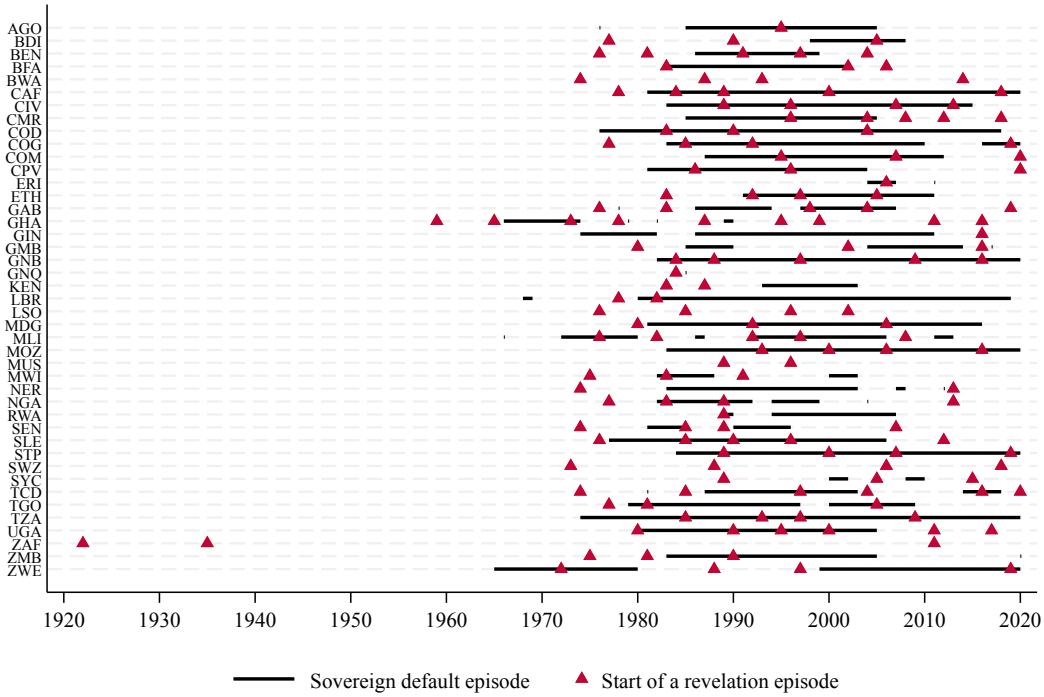
Notes: The figure shows Zambia's external public debt statistics as reported in the World Bank's *International Debt Statistics* in 2022 (Panel A) and in 2024 (Panel B). The reported stock of Zambia's external public and publicly guaranteed debt for 2021 amounted to USD 12.5 billion when it was initially published in the World Bank's *International Debt Report* 2022. In the 2024 vintage, the same figure is given as USD 15.2 billion, indicating an upward revision of USD 2.7 billion.

The episodes assembled in this appendix follow a recurring pattern. Across the major international lending booms we study, contemporary observers repeatedly warned about hidden debt and the unreliability of reported debt statistics. These warnings were strikingly similar across eras. The League of Nations publications of the 1920s and World Bank debt tables from the 1950s, the Congressional staff assessments of the 1970s, and the World Bank and IMF debt transparency reports of the 2020s all pointed to the same underlying problem: reported debt figures provided an incomplete picture of sovereign liabilities. Yet, such warnings often had only a limited effect as long as credit remained ample and sovereign risk was perceived to be low. Hidden liabilities typically came to light only after the lending boom had turned to bust, when countries entered crisis, sought official support, or began debt restructuring negotiations. Each crisis then led to improvements in reporting standards, debt management systems, and moni-

toring infrastructure, which often restored confidence in the reliability of debt statistics—until the next crisis exposed new gaps.

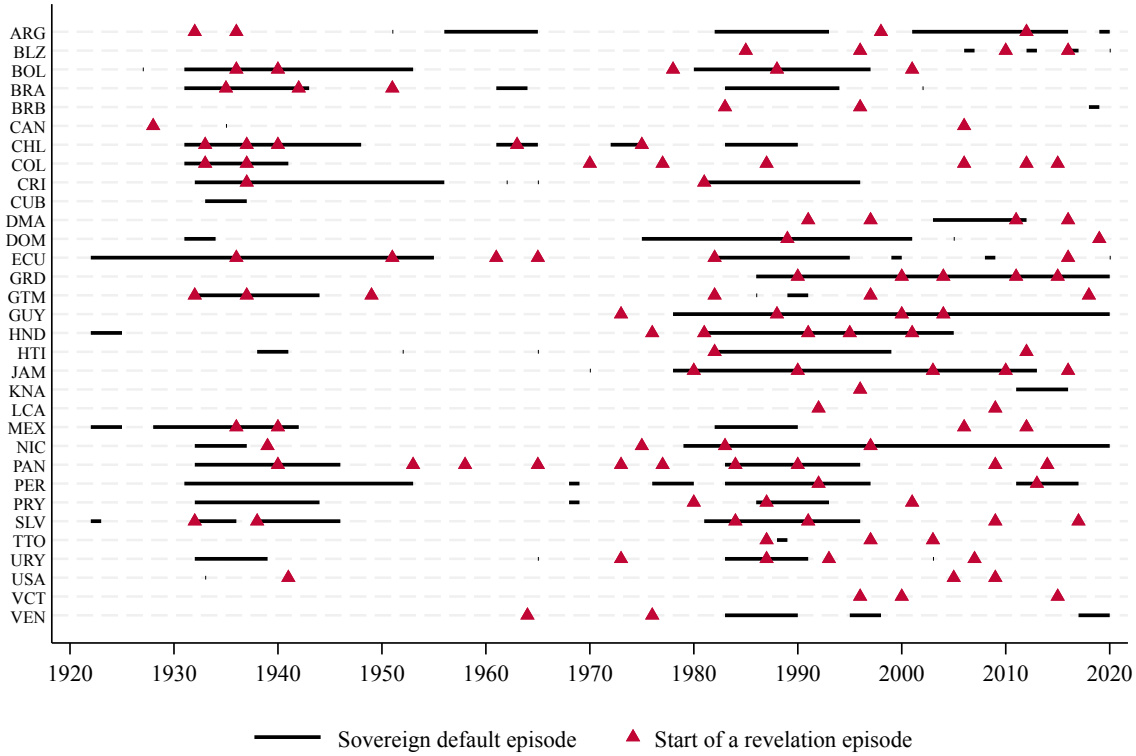
C.2 Hidden debt revelation episodes by country, 1922-2020

Figure C.5: Sovereign defaults and revelation episodes: Africa



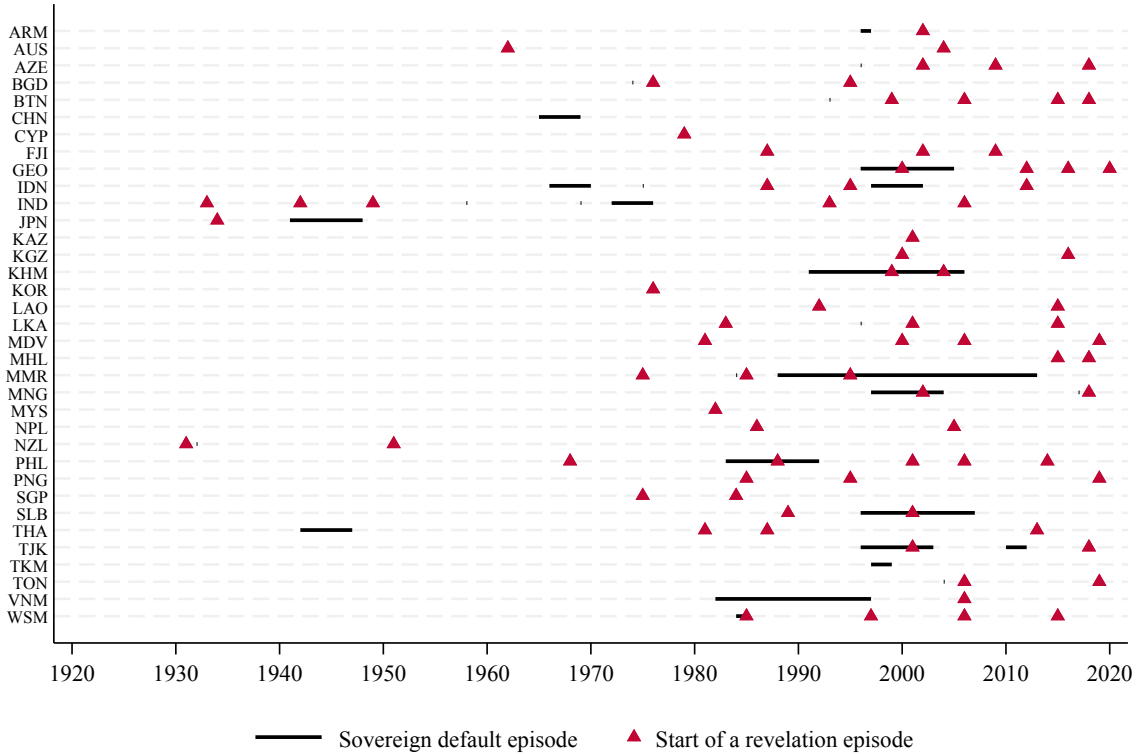
Notes: The figure shows sovereign defaults and large revelation episodes by country. Black bars indicate sovereign default episodes, defined as country-years in which a country is either in an external sovereign default, a domestic sovereign default, or has significant and persistent arrears to official creditors as defined in Reinhart and Trebesch (2016). Triangles mark the start of large revelation episodes, defined as in Section 5.1. The absence of triangles during a default may also reflect missing revelation data.

Figure C.6: Sovereign defaults and revelation episodes: Americas



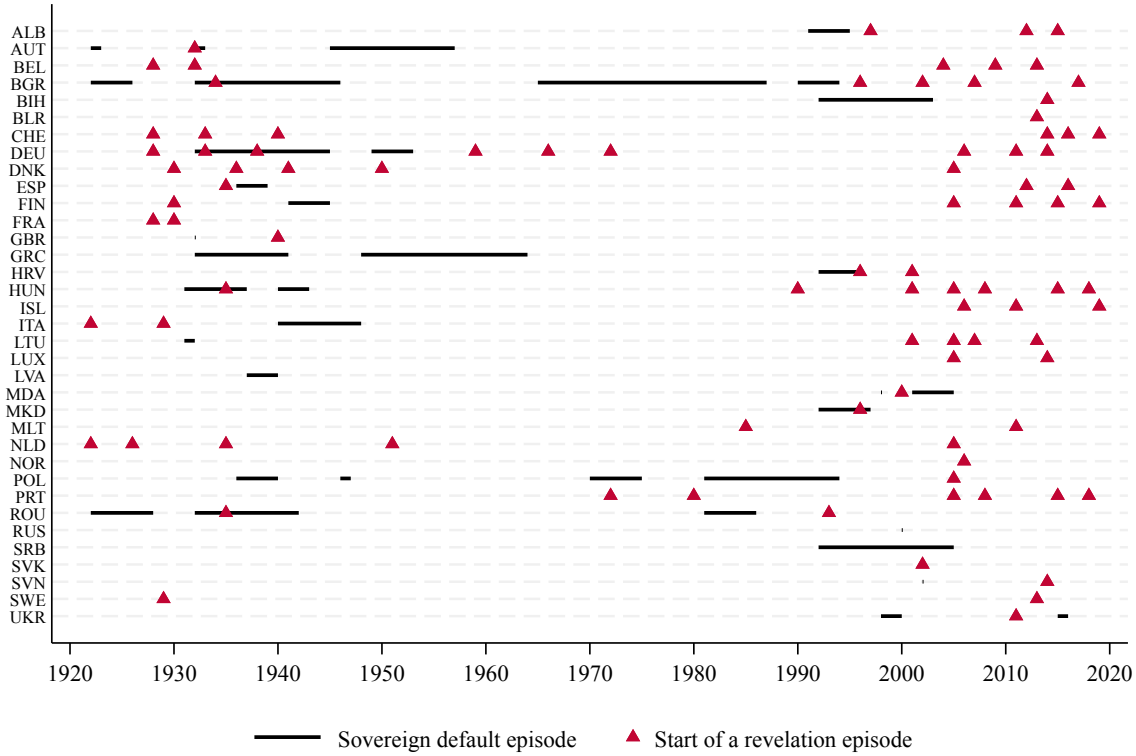
Notes: The figure shows sovereign defaults and large revelation episodes by country. Black bars indicate sovereign default episodes, defined as country-years in which a country is either in an external sovereign default, a domestic sovereign default, or has significant and persistent arrears to official creditors as defined in Reinhart and Trebesch (2016). Triangles mark the start of large revelation episodes, defined as in Section 5.1. The absence of triangles during a default may also reflect missing revelation data.

Figure C.7: Sovereign defaults and revelation episodes: Asia



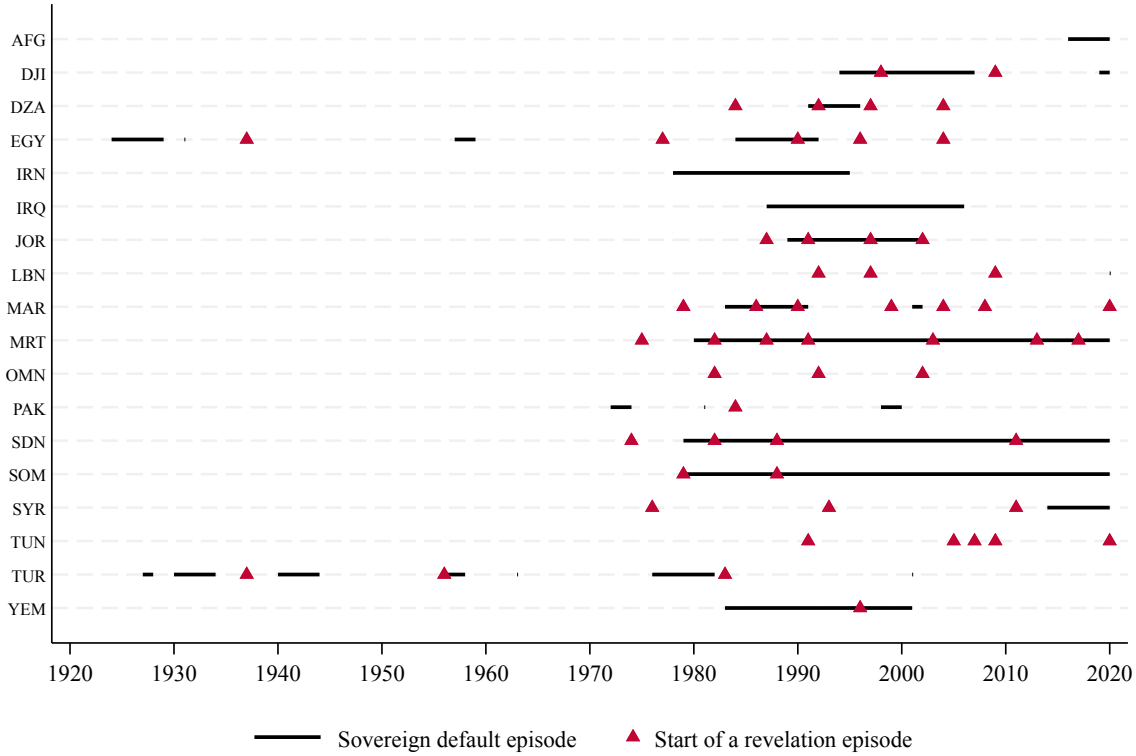
Notes: The figure shows sovereign defaults and large revelation episodes by country. Black bars indicate sovereign default episodes, defined as country-years in which a country is either in an external sovereign default, a domestic sovereign default, or has significant and persistent arrears to official creditors as defined in Reinhart and Trebesch (2016). Triangles mark the start of large revelation episodes, defined as in Section 5.1. The absence of triangles during a default may also reflect missing revelation data.

Figure C.8: Sovereign defaults and revelation episodes: Europe



Notes: The figure shows sovereign defaults and large revelation episodes by country. Black bars indicate sovereign default episodes, defined as country-years in which a country is either in an external sovereign default, a domestic sovereign default, or has significant and persistent arrears to official creditors as defined in Reinhart and Trebesch (2016). Triangles mark the start of large revelation episodes, defined as in Section 5.1. The absence of triangles during a default may also reflect missing revelation data.

Figure C.9: Sovereign defaults and revelation episodes: MENA



Notes: The figure shows sovereign defaults and large revelation episodes by country. Black bars indicate sovereign default episodes, defined as country-years in which a country is either in an external sovereign default, a domestic sovereign default, or has significant and persistent arrears to official creditors as defined in Reinhart and Trebesch (2016). Triangles mark the start of large revelation episodes, defined as in Section 5.1. The absence of triangles during a default may also reflect missing revelation data.

D Additional results and figures

This appendix presents additional descriptive statistics, empirical exercises, and robustness checks.

D.1 Separating reporting noise from systematic underreporting

Section 4.1 documents that debt-stock revisions are systematically right-skewed and that the mean revision is significantly positive, which is inconsistent with a well-behaved symmetric revision process. This pattern does not arise from a single mechanism. Some revisions reflect routine reporting noise, including accidental errors, administrative updates, and other corrections that can move reported debt in either direction. Others reflect systematic underreporting: a persistent upward bias arising from chronic gaps in debt recording and consolidation or, in some cases, the deliberate concealment of liabilities. Together, these two mechanisms determine the revision process observed in the data.

This subsection formalizes this distinction using a two-component Bayesian mixture model. The model decomposes observed external debt-stock revisions into two latent components, a symmetric reporting-noise component and a one-sided systematic-underreporting component, and assigns each observation a posterior probability of belonging to the latter. The exercise serves three purposes. First, it quantifies the relative frequency and economic magnitude of the two components. Second, it provides a data-driven benchmark for distinguishing large hidden-debt revelations from routine revisions. Third, it allows us to examine whether the relationships between hidden debt, institutional quality, and sovereign default documented in the main text remain visible when underreporting is measured using posterior probabilities rather than raw revision magnitudes or a top-decile episode threshold.

More specifically, let y denote a debt-stock revision, measured as in equation (1) and expressed in percentage points of GDP. Because previously omitted liabilities can only generate upward revisions when they enter the statistical record, we model underreporting using an exponential distribution with support on $y > 0$ and mean μ.

$$f_{\text{under}}(y \mid \mu) = \begin{cases} \dfrac{1}{\mu} \exp\left(-\dfrac{y}{\mu}\right), & y > 0, \\ 0, & y \leq 0. \end{cases} \tag{D.1}$$

By contrast, routine reporting and methodological revisions have no presumed direction and cluster sharply around zero. We approximate this component using a symmetric Laplace distribution with scale parameter b, which captures the pronounced peak around zero in the empirical revision distribution more closely than a Gaussian specification.

$$f_{\text{noise}}(y \mid b) \;=\; \frac{1}{2b} \exp\left(-\frac{|y|}{b}\right). \tag{D.2}$$

The density of observed revisions is then given by the mixture

$$f(y \mid \pi, \mu, b) \;=\; \pi f_{\text{under}}(y \mid \mu) + (1-\pi) f_{\text{noise}}(y \mid b), \tag{D.3}$$

where π is the mixture weight of the systematic-underreporting component.

The two components are distinguished by the asymmetry of the revision distribution. The negative side of the distribution identifies the scale of routine reporting noise, while the excess mass of positive revisions identifies the one-sided underreporting component. In the data, there are 1.78 upward debt-stock revisions for every downward revision, and this imbalance becomes increasingly pronounced at larger revision magnitudes. A purely symmetric noise process cannot generate this pattern.

For each positive revision, the posterior probability that revision y originates from the systematic-underreporting component is given as

$$\widehat{p}_{\text{under}}(y) = \frac{\widehat{\pi} f_{\text{under}}(y)}{\widehat{\pi} f_{\text{under}}(y) + (1-\widehat{\pi}) f_{\text{noise}}(y)}, \tag{D.4}$$

where $f_{\text{under}}(y)$ and $f_{\text{noise}}(y)$ denote the fitted exponential and Laplace densities defined above. For nonpositive revisions, we set $\widehat{p}_{\text{under}}(y) = 0$, because the systematic-underreporting component has support only on positive values.

The posterior probability compares how likely a revision of magnitude y is under the two fitted components, taking into account their estimated mixture weights. Small positive revisions may plausibly arise from either routine reporting noise or systematic underreporting. As the revision becomes larger, however, it becomes increasingly unlikely to have been generated by the symmetric noise component.

Figure D.1 visualizes the resulting decomposition.[34] Panel A compares the empirical distribution of debt-stock revisions with the fitted reporting-noise component. Panel B plots $\widehat{p}_{\text{under}}(y)$ over the magnitude of positive debt-stock revisions. The posterior probability is close to zero for small revisions, rises sharply with revision size, and crosses 0.5 at approximately 2.8 percent of GDP.

The estimated mixture weight is $\hat{\pi} = 0.12$, implying that approximately 12 percent of debt-stock revisions are assigned to the systematic-underreporting component in expectation. These cases are relatively infrequent but substantially larger than routine revisions, with an estimated median of 4.8 percent of GDP. As a result, systematic underreporting accounts for nearly 80 percent of the total value of upward revisions (in percent of GDP terms), despite accounting for only a small share of individual revision observations.

Robustness to probabilistic classification of underreporting. Section 4.2 regresses continuous revision size directly, while Section 5 classifies large hidden debt revelations using a top-decile threshold on raw revision size. The following uses the Bayesian mixture model instead: each debt data revision is assigned a continuous posterior probability of reflecting systematic

[34] We estimate the Bayesian latent mixture model using Markov Chain Monte Carlo (MCMC). After discarding 5,000 burn-in iterations and retaining every fifth subsequent draw, the posterior effective sample sizes range from 6,827 to 8,341.

underreporting, $\hat{p}^{\text{under}}$. We use this alternative classification to re-examine the institutional and default associations documented in the main text. Table D.1 reports OLS estimates using $\hat{p}^{\text{under}}$ as the outcome throughout—first regressed on Polity5, then on the default indicator—across five fixed-effect structures.

The classification reproduces the institutional and default patterns documented in Sections 4.2 and 5. The mean posterior underreporting probability falls monotonically from 0.177 in the weakest Polity5 quartile to 0.072 in the strongest, and the negative relationship with institutional quality is stable across four of five fixed-effect specifications in Table D.1. It attenuates only in the fully saturated specification, consistent with limited within-country year-to-year variation in Polity5 once common time trends are removed, but the point estimate remains negative and within two standard errors of the other columns. For sovereign default, the positive association between revelation size and default is robust across all five specifications, including in the fully saturated model with country, source, and year fixed effects (0.066, $p = 0.001$), consistent with the evidence documented in Section 5. Country-years in default are nearly three times more likely to cross the $p = 0.5$ underreporting threshold (22.0 percent vs. 7.7 percent).

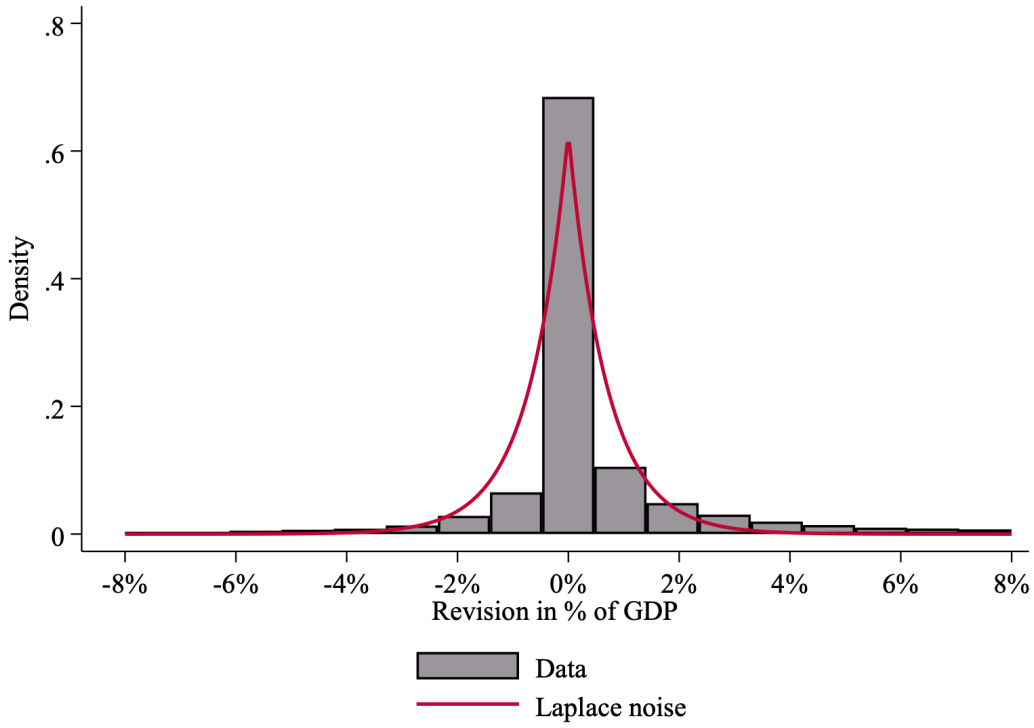
Table D.1: Robustness of institutional and default associations to fixed effects

	Fixed effects				
	None	Source	Country	Year	All three
Polity5	-0.0062***	-0.0047***	-0.0049***	-0.0039***	-0.0024
	(0.0013)	(0.0012)	(0.0019)	(0.0012)	(0.0019)
Default	0.1419***	0.1404***	0.1029***	0.1312***	0.0660***
	(0.0192)	(0.0190)	(0.0201)	(0.0194)	(0.0188)
N (Polity5)	8,854	8,854	8,854	8,853	8,853
N (Default)	2,644	2,644	2,638	2,639	2,633

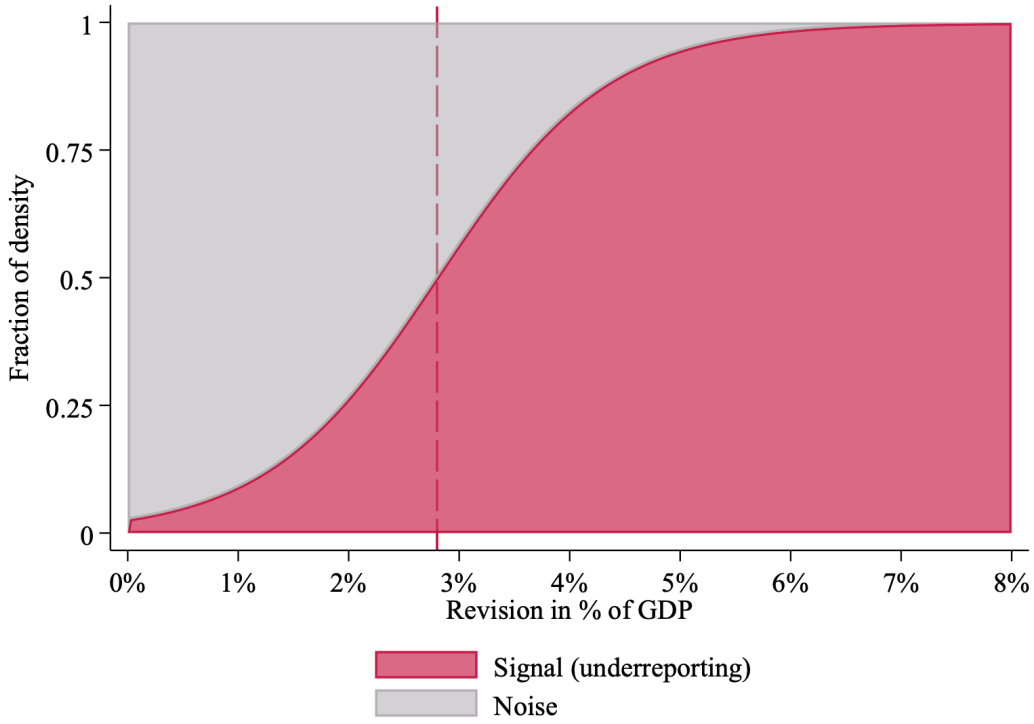
Notes: OLS coefficients with standard errors in parentheses, clustered at the country level. Both regressions use $\hat{p}^{\text{under}}$, the posterior probability of underreporting, as the outcome: the Polity5 row is estimated over hidden debt (as measured in equation (1)), while the default row is estimated over hidden debt revelations (as measured in equation (3)). The fully saturated specification absorbs country, source, and year fixed effects simultaneously. Asterisks ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Figure D.1: Bayesian mixture decomposition of debt-stock revisions

Panel A: Debt data revisions vs. fitted Laplace noise



Panel B: Systematic underreporting versus reporting noise



Notes: Panel A shows the histogram of revisions in $[-8\%, 8\%]$ of GDP, overlaid with the fitted Laplace noise distribution. Panel B shows the fraction of fitted density attributable to systematic underreporting (red) and noise (gray) as a function of revision magnitude; the dashed line marks the $\hat{p}^{\text{under}} = 0.5$ cross-over at $\approx 2.8\%$ of GDP.

D.2 Hidden debt and institutional strength

Section 4.2 documents a negative relationship between institutional strength and the bias and precision of debt reporting. This subsection presents the regression estimates underlying the graphs in the main text and examines whether the relationship is robust to alternative specifications with richer sets of fixed effects.

Table D.2 reports regressions of external underreporting (as defined in equation (1)), expressed in percent of GDP and winsorized at the 1st and 99th percentiles, on the Polity5 score, where higher values indicate more democratic political institutions. Column (1) presents the baseline OLS estimate, while column (2) allows for clustered standard errors. The subsequent columns progressively add source, country, vintage, and debt-series fixed effects. The estimated coefficient on the Polity score is negative and statistically significant across all specifications except column (5), where the inclusion of vintage fixed effects renders the estimate (marginally) insignificant. Depending on the specification, a one-point increase in the Polity score is associated with a reduction in the average upward revision of between 0.01 and 0.06 percentage points of GDP.

Table D.2: Hidden debt revisions and institutional strength (Polity5)

	Dep. var.: Hidden debt % GDP					
	(1)	(2)	(3)	(4)	(5)	(6)
Polity5	-0.05***	-0.05***	-0.04***	-0.06**	-0.03	-0.01**
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.00)
Observations	8,854	8,854	8,854	8,854	8,853	242,570
R-squared	0.011	0.011	0.017	0.163	0.182	0.075
Clustered SE		✓	✓	✓	✓	✓
Source FE			✓	✓	✓	✓
Country FE				✓	✓	✓
Vintage FE					✓	✓
Series FE						✓

Notes: The dependent variable is the revision to the external public debt stock, as defined in equation (1). Revisions are expressed as a percentage of GDP and winsorized at the 1st and 99th percentiles. The main explanatory variable is the Polity5 score, where higher values indicate more democratic political institutions. Column (1) reports the baseline OLS specification. Column (2) retains the same specification but clusters standard errors at the country level. Columns (3)–(5) progressively add source, country, and vintage fixed effects. Column (6) uses the full panel of underlying debt series and additionally includes series fixed effects at the most granular level available in the database. Standard errors are reported in parentheses. Asterisks ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Most importantly, the coefficient remains negative when standard errors are clustered, when source fixed effects absorb systematic differences across reporting systems, when country fixed effects remove time-invariant heterogeneity across debtors, and when vintage fixed effects absorb shocks or reporting practices common to all observations published in a given vintage. Finally, column (6) uses the full panel of underlying debt series, which substantially expands the sample and adds series fixed effects at the finest level of disaggregation available in our database. Identification therefore comes from variation within debt series over time. The Polity coefficient remains negative and statistically significant. Taken together, the table shows that institutional

strength covaries negatively with reporting bias, even when controlling for source, country, vintage, and debt series fixed effects.

D.3 Cyclicality of hidden debt accumulation and revelation

Section 4.3 documents a pronounced boom-bust pattern in hidden debt: previously unreported borrowing tends to accumulate during economic expansions, whereas hidden liabilities tend to be incorporated into the statistical record during downturns. This subsection describes the regression specifications underlying Figure 7 and examines their robustness to alternative debt-flow measures, samples, and fixed-effect specifications.

Measurement and sample. The analysis focuses on revisions to debt *flows* because flow data allow us to assign previously unreported borrowing to the year in which the corresponding liability was contracted. Our baseline sample combines commitments of external public and publicly guaranteed debt from the World Bank IDS (series code DT.COM.DPPG.CD) with external borrowing commitments reported in the League of Nations data. Both measures capture the value of new debt obligations contracted in a given year.

Further, we distinguish between the *borrowing year* and the *revelation year*. The borrowing year t is the year in which the (initially) unreported liability was incurred. The corresponding dependent variable is the hidden-debt measure defined in equation (1), and the unit of observation is a country–year–source observation. The revelation year on the other hand is the year associated with vintage v, in which previously unreported borrowing is incorporated into the reporting system. The corresponding dependent variable is the flow-revelation measure defined in equation (2), and the unit of observation is a country–vintage–source observation. As throughout the paper, revisions are constructed only by comparing observations across vintages of the same reporting system.

To facilitate comparisons across debt series and countries, we standardize the hidden debt series and winsorize the resulting measures at the 1st and 99th percentiles. Our measure of the business cycle is based on real GDP growth from Müller et al. (2025). Annual growth rates are first winsorized at the 1st and 99th percentiles and then detrended using a Hodrick–Prescott filter with smoothing parameter $\lambda = 100$. The resulting cyclical component, denoted $g_{i,t}^{cycle}$, is measured in decimal units in the regressions, so that 0.01 corresponds approximately to one percentage point.

Regression specifications. Panel A of Figure 7 is based on the following specification

$$HiddenDebt_{i,t,s,flow} = \beta_A g_{i,t}^{cycle} + \alpha_i + \lambda_t + \delta_s + \varepsilon_{i,t,s},$$

where $HiddenDebt_{i,t,s,flow}$ denotes underreporting—as defined in equation (1)—in country i, year t, and for source s. Country fixed effects α_i absorb persistent differences in reporting quality and borrowing behavior across countries; year fixed effects λ_t absorb common global shocks; and source fixed effects δ_s account for systematic differences across reporting systems. A positive

value of β_A indicates that borrowing undertaken during economic expansions is subject to larger subsequent upward revisions.

For Panel B, the corresponding fixed-effects regression is

$$HiddenDebtRevelation^{v}_{i,s,flow} = \beta_B g^{cycle}_{i,v} + \alpha_i + \lambda_v + \delta_s + \varepsilon_{i,v,s},$$

where $HiddenDebtRevelation^{v}_{i,s,flow}$ denotes the previously unreported borrowing revealed in vintage v and source s—in line with the definition in equation (2). Cyclical GDP growth is measured in the corresponding revelation year. A negative value of β_B indicates that hidden-debt revelations are larger during economic downturns. In both specifications we cluster standard errors at the country level.

Table D.3 reports the results from the baseline regressions in column (1) and tests their robustness across alternative flow measures, data samples, and fixed-effects specifications in columns (2) to (4). Specifically, column (2) uses the same sample but omits year or vintage fixed effects. Column (3) restricts the sample to revisions in IDS disbursements of external public and publicly guaranteed debt (series code DT.DIS.DPPG.CD). Column (4) instead uses revisions to IDS net flows, (series code DT.NFL.DPPG.CD).

Table D.3: Robustness: cyclicality of hidden debt accumulation and revelations

	(1) Preferred	(2) No year FE	(3) DIS	(4) NFL
Panel A: Hidden debt accumulation				
Cyclical GDP growth	0.727***	0.572***	0.379**	0.509***
	(0.209)	(0.208)	(0.189)	(0.180)
Year FE	✓		✓	✓
Country FE	✓	✓	✓	✓
Source FE	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓
Observations	6,778	6,782	6,387	6,377
R^2	0.080	0.003	0.030	0.022
Panel B: Hidden debt revelations				
Cyclical GDP growth	-0.724**	-1.129***	-0.890**	-0.523
	(0.310)	(0.332)	(0.403)	(0.378)
Year FE	✓		✓	✓
Country FE	✓	✓	✓	✓
Source FE	✓	✓	✓	✓
Clustered SE	✓	✓	✓	✓
Observations	4,275	4,275	3,802	3,698
R^2	0.055	0.004	0.022	0.019

Notes: Panel A reports regressions for hidden-debt accumulation, while Panel B reports regressions for hidden-debt revelations. Outcomes are standardized and winsorized at the 1st and 99th percentiles. The regressor is cyclical real GDP growth from Müller et al. (2025), constructed using an HP filter with $\lambda = 100$ after winsorizing at the 1st and 99th percentile. Column (1) presents the original regression results underlying Figure 7, while column (2) uses the same sample but omits year fixed effects. Column (3) uses IDS disbursements only, and column (4) uses IDS net flows only. All columns include country and source fixed effects. Standard errors are clustered at the country level and are reported in parentheses. Asterisks ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The results confirm the distinction between the timing of hidden-debt accumulation and the timing of its revelation highlighted in Figure 7. Panel A shows that $HiddenDebt_{i,t,s,flow}$ is

positively associated with cyclical GDP growth across all specifications. The coefficient is largest in the preferred baseline and remains positive and statistically significant when year fixed effects are omitted, when disbursements are used instead of commitments, and when using net financial flows.

Panel B shows the opposite pattern for $HiddenDebtRevelation^{v}_{i,s,flow}$. In the preferred baseline, cyclical growth is negatively associated with hidden-debt revelations. The negative association is also present when year fixed effects are omitted and when using disbursement instead of commitment data. The coefficient remains negative in the net-financial-flow specification, although it is smaller and no longer statistically significant. Taken together, the results support a clear boom–bust pattern: hidden liabilities tend to be incurred during relatively strong economic conditions and incorporated into the statistical record during weaker ones.

D.4 Hidden debt and sovereign default

Section 5.2 documents a strong overlap between the occurrence of sovereign defaults and hidden debt revelation episodes. In the main text, we defined a large hidden debt revelation episode as a two-year period beginning with an upward revision, expressed in percent of GDP, that falls within the top decile of the revelation distribution for the corresponding debt aggregate. To address overlaps across reporting systems and to balance the sample over time, the main text Figure 8 shows revelation episodes from the League of Nations for the inter-war period, from the United Nations for years 1948-1972, and from the World Bank debt statistics thereafter. This subsection examines the robustness of the results to alternative definitions of large revelation episodes and to the simultaneous inclusion of data from all four reporting systems.

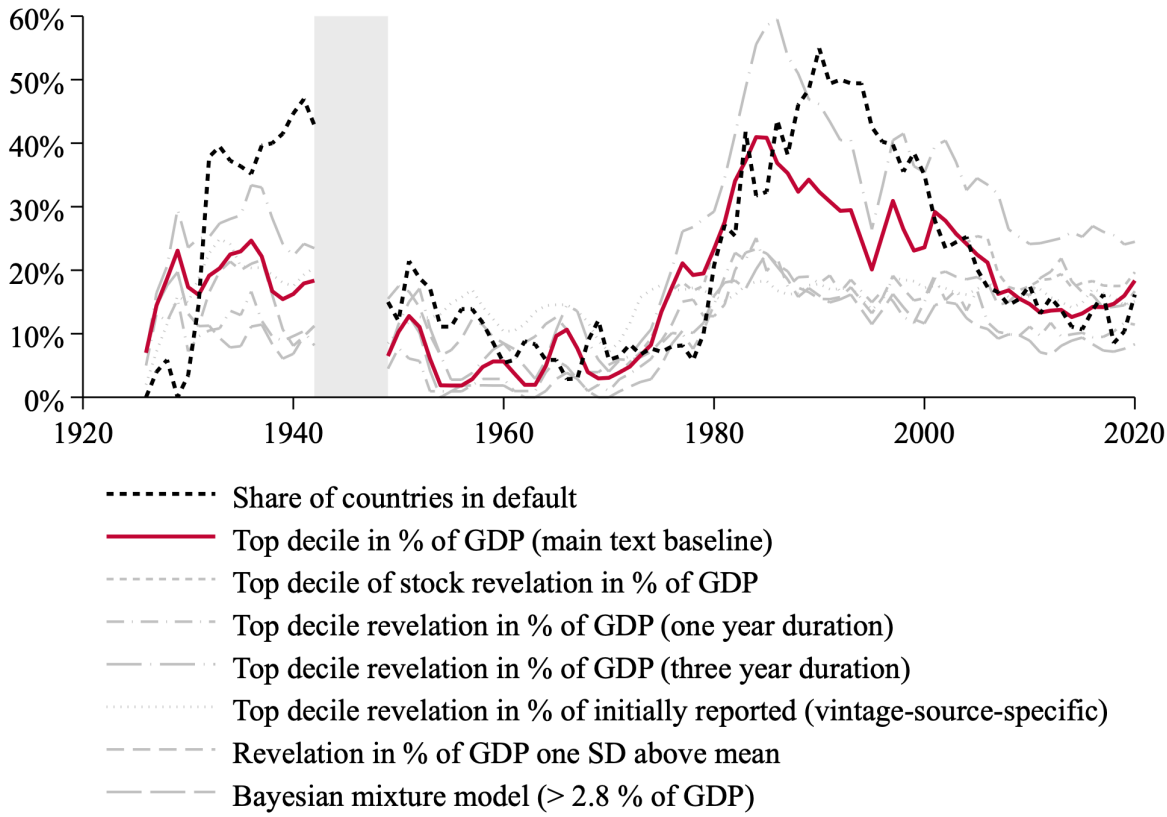
Specifically, we consider the following alternative episode definitions. Each retains the benchmark two-year episode duration, unless otherwise noted, and derives results for all four reporting systems:[35]

- **Top decile revelation, one-year duration:** Hidden debt revelations fall in the top decile of the revelation distribution (as in Section 5.1) but are assumed to last for only one year.
- **Top decile revelation, three-year duration:** Hidden debt revelations fall in the top decile of the revelation distribution (as in Section 5.1) but are assumed to last three years.
- **Top decile of revelation in % of initially reported:** A large revelation is an observation in the top decile of revelations measured relative to initially reported debt rather than debtor country GDP. To derive the top decile of revelations, this definitions uses country and source-specific thresholds.
- **Revelation one standard deviation above country mean:** Instead of applying a common top decile threshold, this definition defines a large revelation episode in relation to the mean and dispersion of the debtor country's hidden debt process. Specifically, an episode begins when a revelation observation exceeds the country and source-specific mean by at least one standard deviation.
- **Bayesian mixture model: above 2.8% of GDP:** A large revelation is an observation above 2.8% of GDP and therefore more likely to be a systematic underreporting case rather than noise, as classified by the Bayesian mixture model described in Section D.1.

Figure D.2 plots the share of countries experiencing a large revelation episode under each definition. For comparability with Figure 8, all series are presented as three-year moving averages. The alternative definitions produce similar historical patterns: revelation episodes rise during the sovereign-debt crises of the 1930s and 1980s and continue to move closely with the share of countries in default throughout the full sample.

[35] If there are revelation observations from two distinct reporting systems for a given country and year, we set the revelation episode dummy to one if at least one of the sources satisfies the revelation episode threshold.

Figure D.2: Hidden debt revelation and sovereign default episodes: Alternative definitions



Notes: The figure shows the share of countries in a large hidden debt revelation episode under alternative episode definitions. The default shares depicted by the black dashed line as well as the benchmark definition depicted by the thick red line are a reproduction of Figure 8. The alternative definitions (grey lines) use shorter (one year) or longer (three year) episodes, define revelations in percent of initially reported debt, or refer to country and/or source-specific cutoffs. We also show episode classification based on the Bayesian mixture model presented in Section D.1. All revelation series are shown as three-year moving averages.

Table D.4 quantifies the comovement. For each definition, we report the number of identified episodes, the coefficient on sovereign default from the linear probability model corresponding to column (4) of Table 4 in the main text, and the correlation between the annual shares of countries in revelation episodes and sovereign default. The first row reproduces the baseline results: sovereign default is associated with a 8-percentage-point increase in the probability of a large revelation episode, and the two annual shares have a correlation of 0.65. Across the alternative definitions, the estimated default coefficient ranges from 0.05 to 0.12 and remains statistically significant in every specification. The corresponding correlations range from 0.37 to 0.67 and are all statistically significant at the 1 percent level. The close association between large hidden-debt revelations and sovereign default is therefore robust to the choice of sample, episode duration, normalization, and the revelation size threshold, or any combination thereof.

Table D.4: Large revelation episodes: Robustness to alternative definitions

Revelation episode definition	No. episodes	$\hat{\beta}_{default}$	ρ with default share
Top dec. of stock revelation (% of GDP)	531	0.08***	0.65***
Episode duration: 1 year (top dec. of stock revelation, % of GDP)	569	0.06***	0.54***
Episode duration: 3 years (top dec. of stock revelation, % of GDP)	448	0.12***	0.67***
Top dec. of revelation (% of initially reported, vintage-source-specific)	440	0.05**	0.53***
Revelation in % of GDP (one SD above mean)	423	0.06***	0.37***
Bayesian mixture model (above 2.8 % of GDP)	278	0.05***	0.51***

Notes: The table reports alternative definitions of large revelation episodes alongside the number of episodes identified with each definition, results from estimating the linear probability model presented in Table 4 column (4), and the Pearson correlation coefficient between the annual share of countries in default and the annual share of countries in large revelation episodes. Unlike Figures 8 and D.2, revelation shares underlying calculations and regressions are raw annual shares rather than the three-year moving averages depicted in the figures. The $\hat{\beta}_{default}$ coefficients are obtained from regressing a binary indicator for large revelation episodes on sovereign default and IMF/LoN program participation, controlling for the type of debt, real GDP growth and institutional strength, as well as absorbing year, country, and source fixed effects, with standard errors clustered at the country level. Asterisks ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

D.5 Hidden debt revelations and political cycles

In Sections 4.3 and 5, we show that hidden debt revelations are more likely to occur during bad times, in particular during episodes of high outside scrutiny. An alternative hypothesis is that governments strategically reveal hidden debts for political gain, for example after coming to power or after elections. This hypothesis is motivated by a large political economy literature that studies institutional and political drivers of government reporting practices (see, e.g., Martinez, 2022). Against this backdrop, this section presents additional regression results that test whether domestic political factors can explain revelations of hidden debt. We do not find any systematic evidence that governments strategically reveal previously unreported debt for political gains or that hidden debt revelation episodes vary systematically across the political cycle.

More specifically, we consider the following variables as potential political drivers of hidden debt revelations:

- **Elections:** We use data from the Database of Political Institutions to measure the incidence of both legislative and presidential elections (Cruz et al., 2021). More specifically, this source identifies 647 parliamentary and 387 presidential elections that overlap with our revision data. As in the literature on political business cycles, one might conjecture that hidden debt revelations are less likely before an election but more likely after an election (Nordhaus, 1975). Hence, elections enter with a lag.

- **Changes in political leaderships:** We use data from the Archigos dataset of political leaders to measure the incidence of changes in the political leadership of a country (Goemans et al., 2009). Specifically, we use a dummy variable to indicate all years in which a new leader enters office and a dummy variable to indicate all years in which a leader entered office in an irregular manner, e.g., through a coup or through direct imposition by another state. Incoming leaders might have particularly high incentives to reveal unreported debts at the beginning of their tenure. Of the political leadership changes recorded in Goemans et al. (2009), 433 regular and 61 irregular changes fall within the coverage of our dataset.

We begin our analysis by including these measures in the fixed effects linear probability model presented in Section 5. Since data on political drivers is not readily available over the full 100-year sample, we limit the estimation to large revelation episodes of hidden domestic and external debt between 1975 and 2020. Table D.5 shows that none of the included political economy variables enters the regression with a statistically significant coefficient. A possible explanation for these null results might be that political events impact hidden debt revelation episodes with a significant time lag, i.e., a change in political leadership could affect debt reporting practices only after a number of years. To test for dynamic effects, we run panel event study regressions as in Schmidheiny and Siegloch (2023) or Clarke and Tapia Schythe (2020). More specifically, we estimate the following model:

$$HDR_{it} = \alpha + \sum_{j=\underline{j}}^{\hat{j}} \beta_j x_{it}^j + \sigma_i + \theta_t + \epsilon_{it}$$

where HDR_{it} are revelation episodes of previously hidden debt as defined in Section 5.1 above, σ_i and θ_t are country and vintage fixed effects, and ϵ_{it} is an unobserved error term. s indexes each qualifying political event and $Events_s$ denotes its calendar year. The leads and lags of x_{it}^j capture the years before and after a political event of interest, normalized relative to the event year ($\beta_0 \equiv 0$), and are defined as follow:

$$x_{it}^j = \begin{cases} \mathbb{1}[t \leq Events_s + j] & \text{if } j = \underline{j} \\ \mathbb{1}[t = Events_s + j] & \text{if } \underline{j} < j < \hat{j} \\ \mathbb{1}[t \geq Events_s + j] & \text{if } j = \hat{j} \end{cases}$$

Figures D.3 and D.4 show the results of the panel event study regressions and confirm the results from the static regression model. Hidden debt revelation episodes show no statistically significant co-movement with the political cycle.

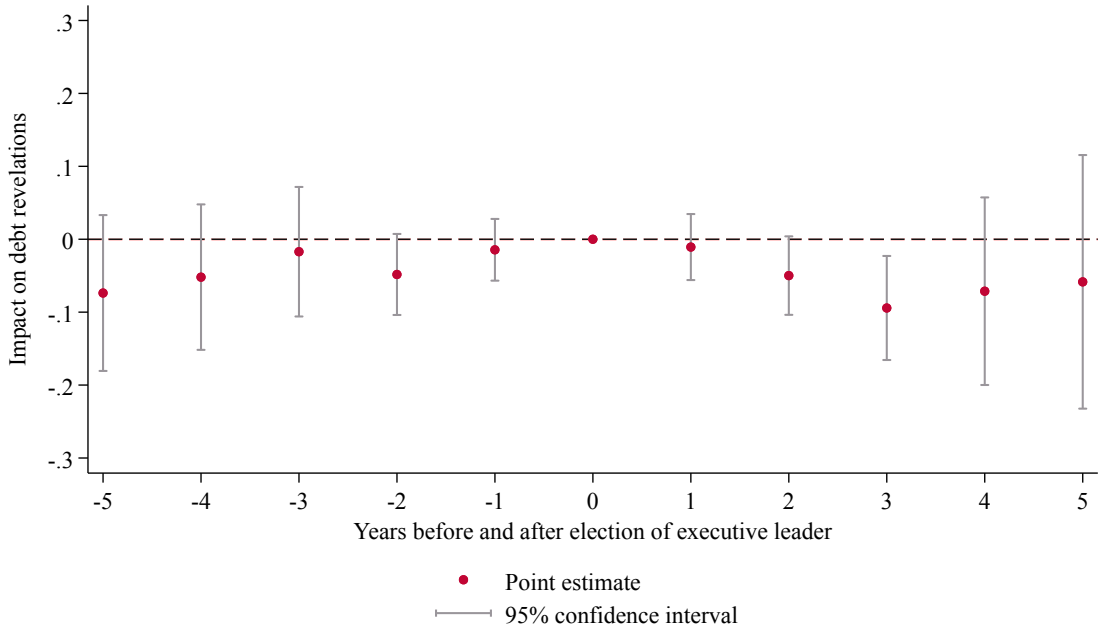
Table D.5: Political drivers of hidden debt revelation episodes

	Dep. var.: Large revelation episodes, 1975-2020				
	(1)	(2)	(3)	(4)	(5)
Executive election	0.01				0.01
	(0.02)				(0.02)
Legislative election		0.01			0.01
		(0.01)			(0.01)
Regular change in leadership			-0.02		-0.01
			(0.02)		(0.02)
Irregular change in leadership				0.02	0.05
				(0.06)	(0.06)
IMF program					0.04**
					(0.02)
Sovereign default					0.09**
					(0.03)
Observations	4,423	4,422	4,824	4,824	3,779
R-squared	0.174	0.174	0.177	0.177	0.187
Country FE	✓	✓	✓	✓	✓
Vintage FE	✓	✓	✓	✓	✓
Source FE	✓	✓	✓	✓	✓

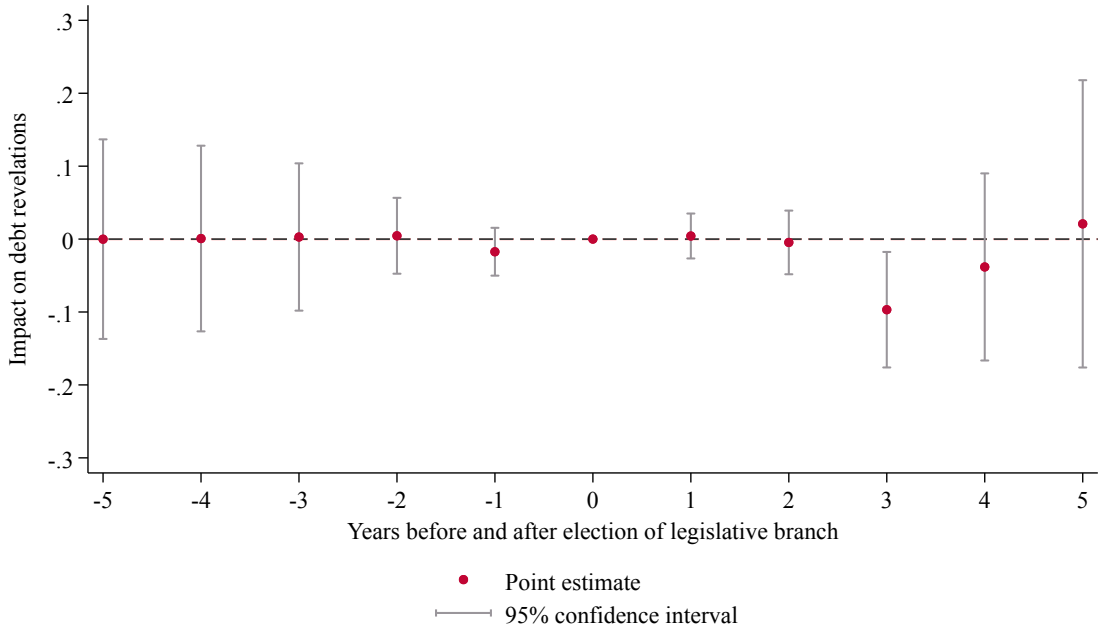
Notes: This table shows regression results from a linear probability model with fixed effects of hidden debt revelation episodes on various political economy variables (see text for details and sources). The dependent variable is a binary variable equal to one during a large hidden debt revelation episode (as defined in Section 5.1). Elections enter with a lag. All regressions include country, vintage and source fixed effects, control for the type of debt, and use robust standard errors clustered at the country level. Column (5) additionally controls for the standardized cyclical component of real GDP growth and for institutional strength.

Figure D.3: Hidden debt revelation episodes and the political cycle: event study panel regressions

Panel A: Election of executive leader



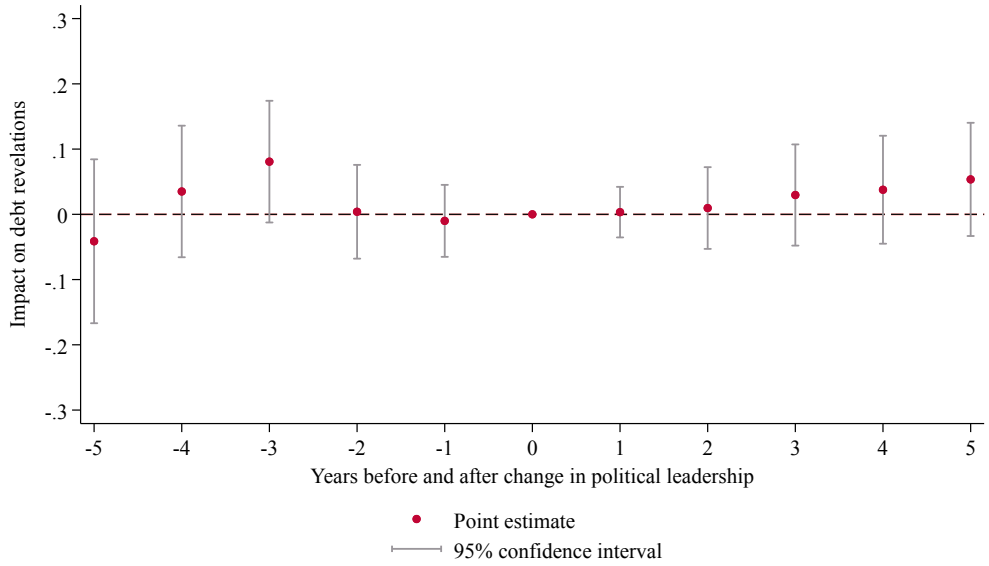
Panel B: Election of legislative branch



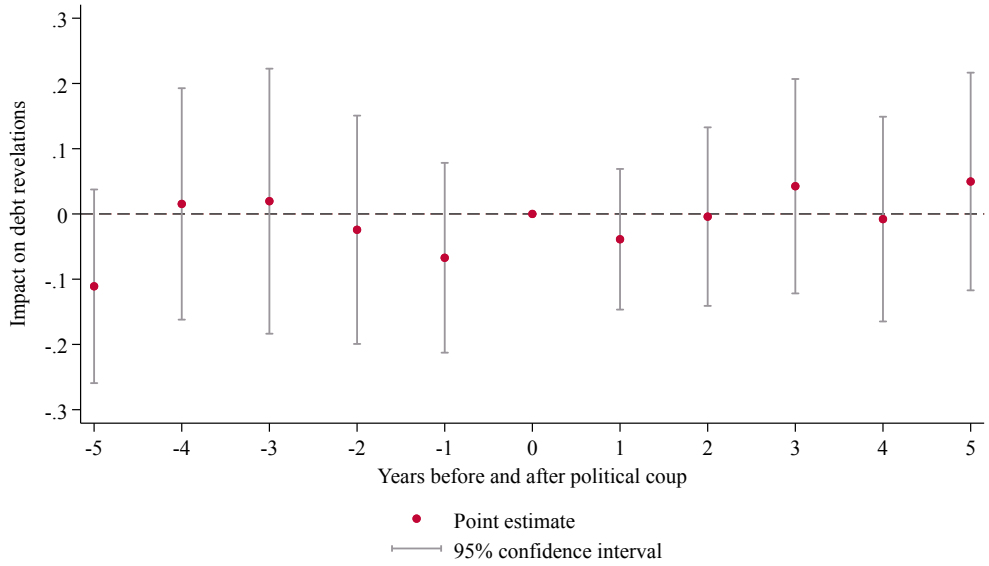
Notes: This figure shows point estimates and 95 percent confidence intervals obtained from regressing hidden debt revelation episodes as defined in Section 5.1 on a set of lags and leads for elections of the executive (Panel A) and legislative branch of government (Panel B).

Figure D.4: Hidden debt revelation episodes and changes in political leadership: event study panel regressions

Panel A: Change in political leadership



Panel B: Irregular change in political leadership



Notes: This figure shows point estimates and 95 percent confidence intervals obtained from regressing hidden debt revelation episodes as defined in Section 5.1 on a set of lags and leads for regular (Panel A) and irregular changes in political leadership (Panel B).

D.6 Hidden debt and default spells

Section 5 documents that debt revelations cluster around sovereign defaults. A natural follow-up question is whether they are also associated with the *severity* of default, as measured by creditor losses ("haircuts") and the duration of the default spell.

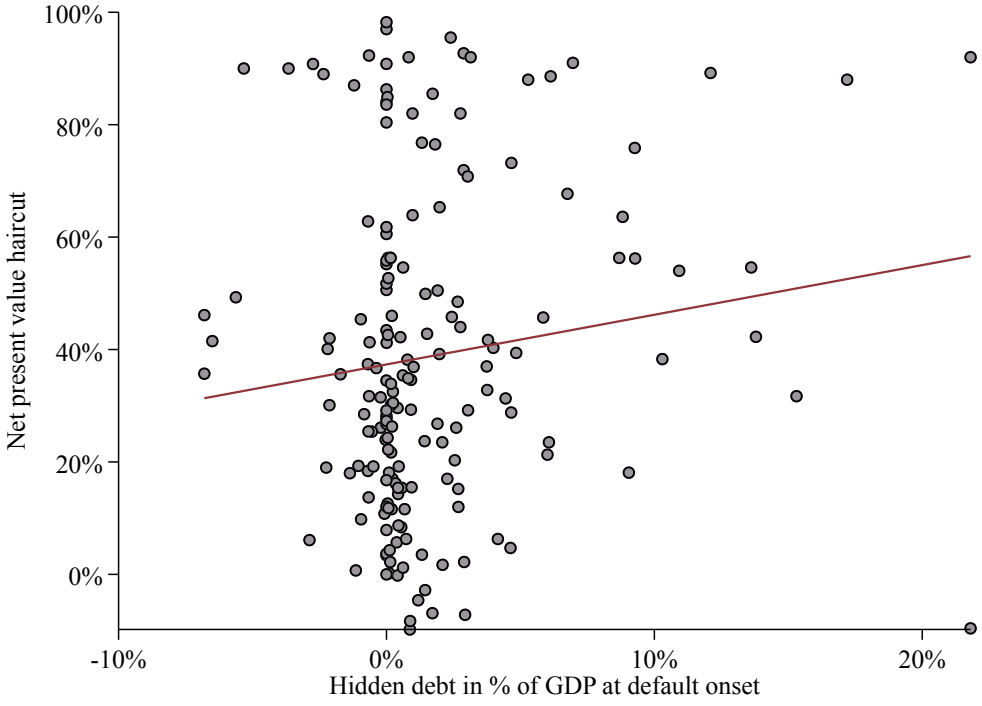
The unit of observation is the default episode: haircuts are realized once, at resolution, so the analysis is a cross section of episodes rather than a country–year panel. Hidden debt is measured as the upward revision to the reported external public debt stock at the onset of default, expressed as a percentage of GDP and winsorized at the 1^{st} and 99^{th} percentiles. Figure D.5 plots this measure against the creditor haircut in Panel A and the duration of the default spell in Panel B. Both outcome measures are taken from Graf von Luckner et al. (2024), which extend the haircut and restructuring database of Cruces and Trebesch (2013) to our full one-hundred year sample.

Panel A provides suggestive evidence that larger hidden-debt burdens are associated with greater creditor losses. A one-percentage-point increase in hidden debt relative to GDP is associated with an increase in the net-present-value haircut of approximately 0.9 percentage points. The relationship is economically meaningful and statistically significant at the 10 percent level (p=0.09). At the same time, the dispersion of observations is substantial, particularly among episodes with large hidden debt, underscoring the considerable heterogeneity in restructuring outcomes.

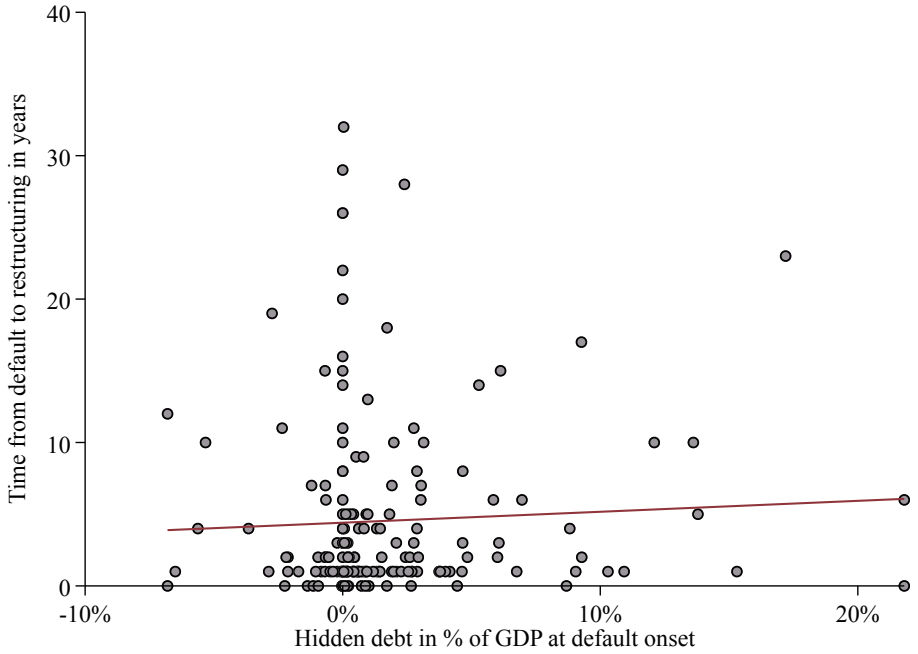
Panel B shows that default spells also tend to be longer when hidden debt is larger, although this relationship is estimated much less precisely. The point estimate implies that a one-percentage-point increase in hidden debt relative to GDP is associated with an increase in restructuring duration of approximately 0.08 years, or about one month, but the coefficient is not statistically significant. Taken together, the two panels provide suggestive evidence that defaults involving larger hidden liabilities are associated with greater creditor losses and a potentially more protracted default resolution process. This pattern is consistent with the view that previously unreported claims dilute creditor recoveries and complicate debt reconciliation and creditor coordination, although we caution that heterogeneity in outcomes is large and cross-sectional evidence does not establish causality.

Figure D.5: Hidden debt and default spells, 1931-2021

Panel A: Hidden debt and haircuts



Panel B: Hidden debt and default duration



Notes: The figure relates hidden debt at the onset of sovereign default to restructuring outcomes across 178 default episodes over the past century. In both panels, the horizontal axis shows hidden debt at the onset of default, measured as the upward revision to the reported external public debt stock relative to the preceding vintage, expressed as a percentage of GDP and winsorized at the 1st and 99th percentiles. In Panel A, the vertical axis reports the net-present-value haircut, expressed as a percentage. Negative haircuts indicate restructurings in which creditors gained in net present value terms. In Panel B, the vertical axis reports the duration of the default spell in years, measured from the onset of default to the year of the restructuring agreement. Solid lines are obtained from bivariate OLS regressions. The estimated slopes are 0.88 in Panel A ($p = 0.09$) and 0.08 in Panel B ($p = 0.50$).

D.7 Debt stock revisions by type of debt

This subsection complements the summary statistics in Table 2. Here, we move beyond sample moments and present the full distributions of debt-stock revisions across different debt categories. Because coverage differs across debt aggregates, sources, countries, and periods, differences in the unconditional means across debt types should not necessarily be interpreted as differences in their underlying susceptibility to underreporting. Across all categories, however, the distributions share the central pattern documented in the main text: a large mass of observations around zero, combined with pronounced right tails and positive mean revisions.

Figure D.6 compares revisions to total public and total private external debt stocks.[36] Median revisions are zero for both categories, while mean revisions are positive at 1.16 percent of GDP for public debt and 1.2 percent of GDP for private debt. Thus, the upward bias in reported debt is not confined to public-sector liabilities; private debt statistics also exhibit substantial positive revisions.

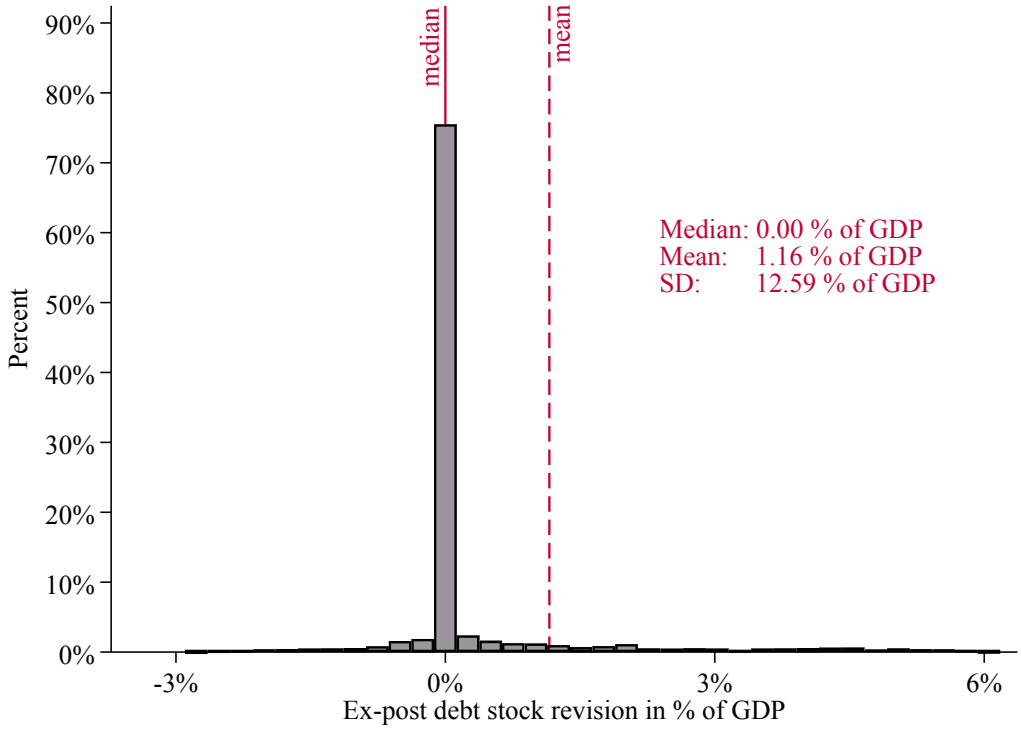
Figure D.7 separates public debt into its domestic and external components. Both distributions are right-skewed and have positive means, amounting to 0.48 percent of GDP for domestic debt and 0.86 percent of GDP for external debt. As discussed in detail in Appendix Section D.10, a clean comparison of external and domestic debt underreporting based on an identical underlying sample provides no robust evidence of a systematic difference between the two revision distributions.

Finally, Figure D.8 reports revisions to total external debt and private non-guaranteed external debt in the World Bank IDS. Both distributions display positive means and pronounced right tails. This pattern also supports the validation exercise in Appendix Section B.2: upward revisions to public external debt cannot primarily reflect the reclassification of liabilities that were already recorded as private debt, since both total external debt and private non-guaranteed debt are themselves systematically revised upward.

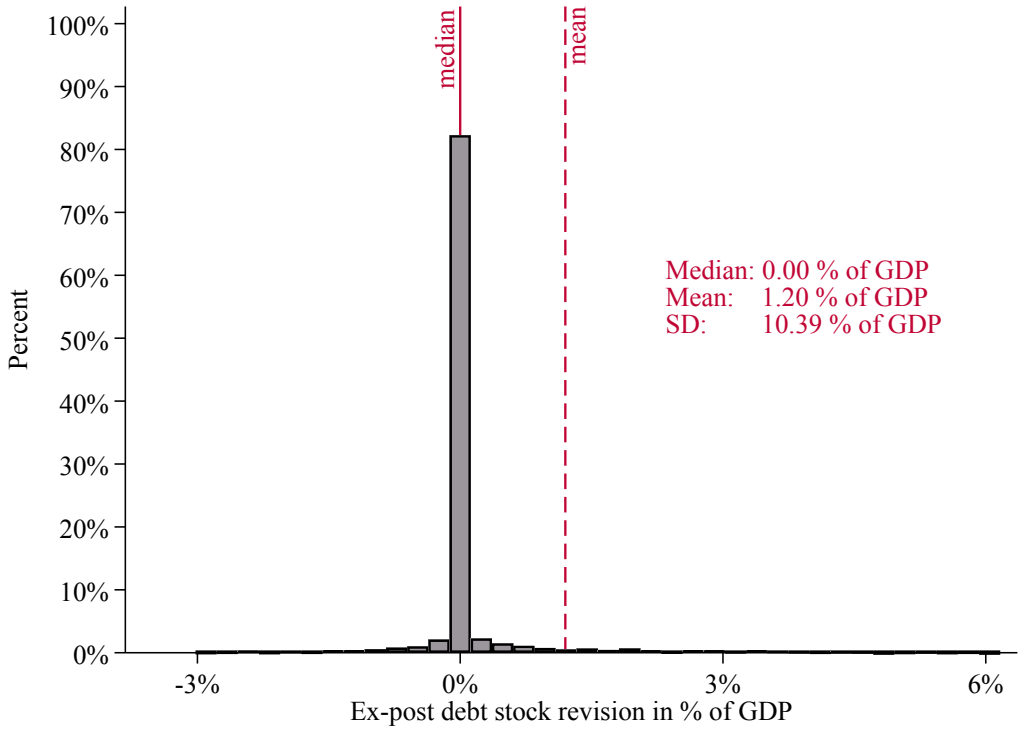
[36] Public and private refer to the debtor entity, i.e., we are comparing the debts of public and private (non-guaranteed) entities to all external creditors.

Figure D.6: Distribution of debt stock revisions - public vs. private

Panel A: Total public debt in percent of GDP



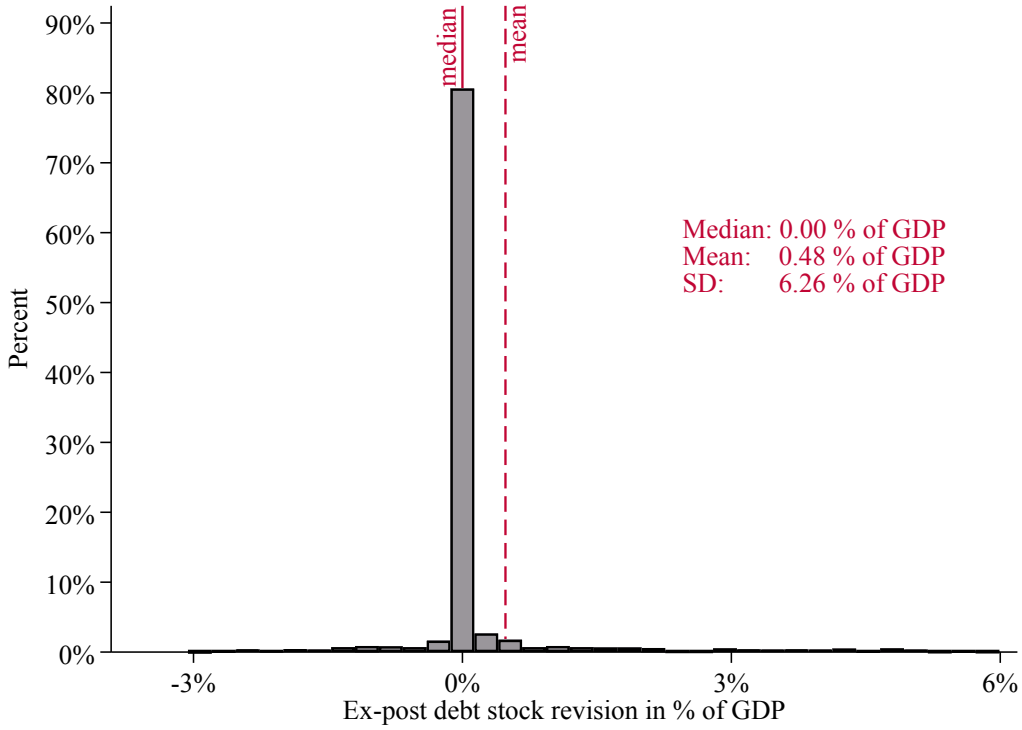
Panel B: Private non-guaranteed debt stocks in percent of GDP



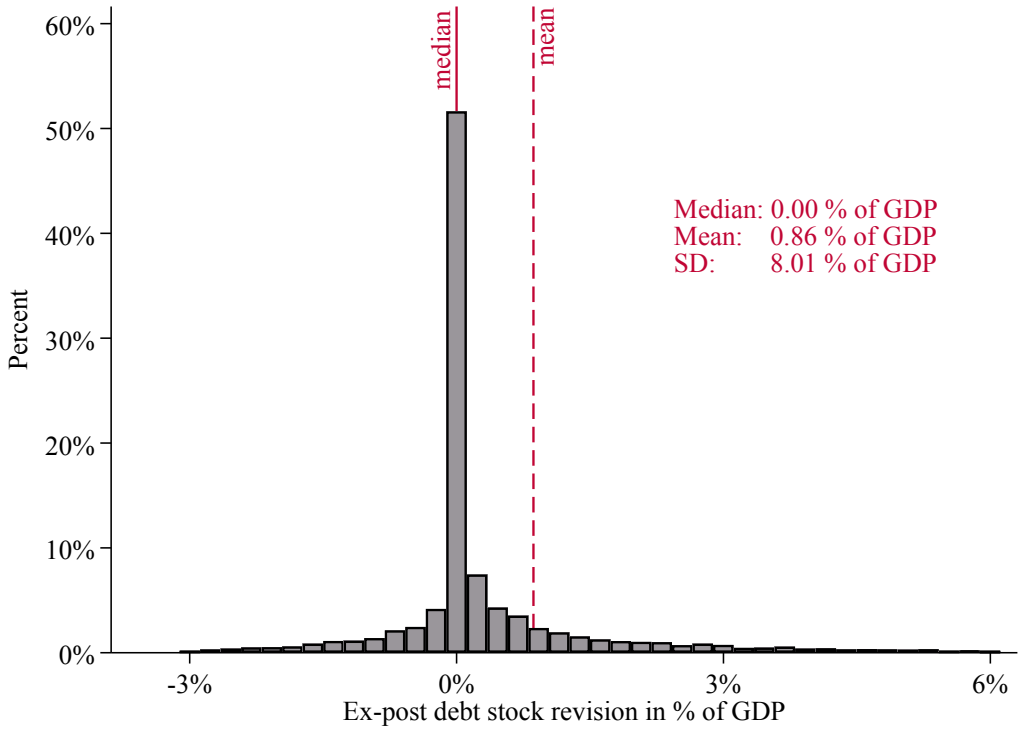
Notes: The figure shows the percentage distribution of data revisions to total public debt stocks and total private debt stocks, defined as in equation (1), in percent of GDP. The horizontal axes are truncated for readability but all observations are retained in the calculations. The solid lines show the median, dashed lines show the mean. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions.

Figure D.7: Distribution of debt stock revisions - domestic vs. external

Panel A: Public domestic debt stocks in percent of GDP



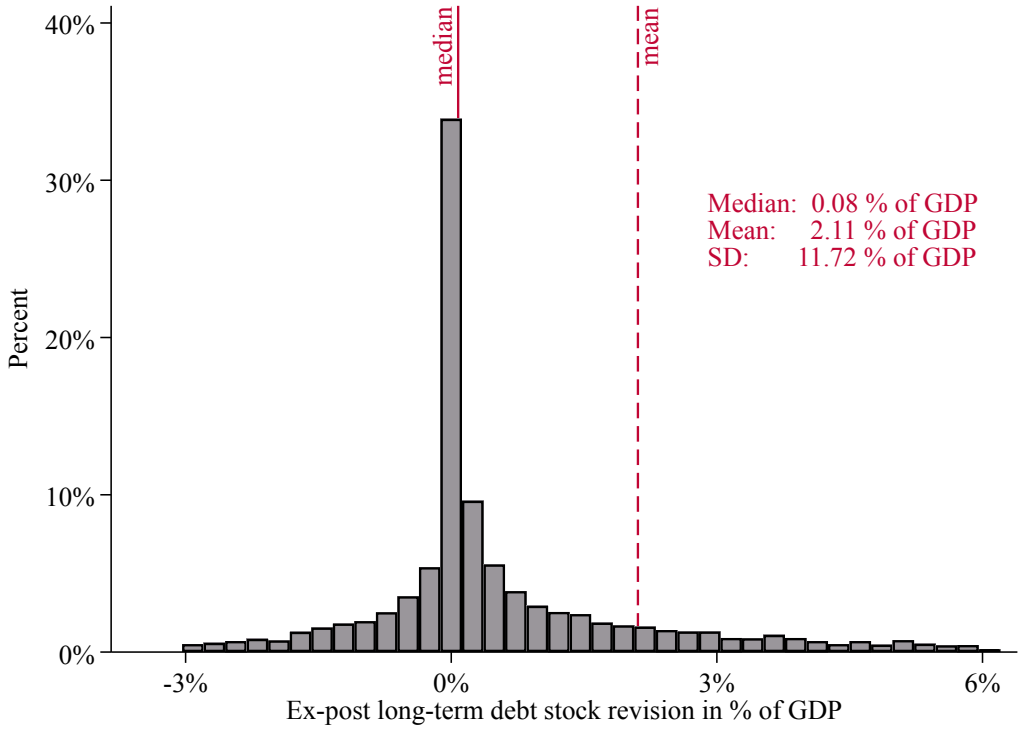
Panel B: Public external debt stocks in percent of GDP



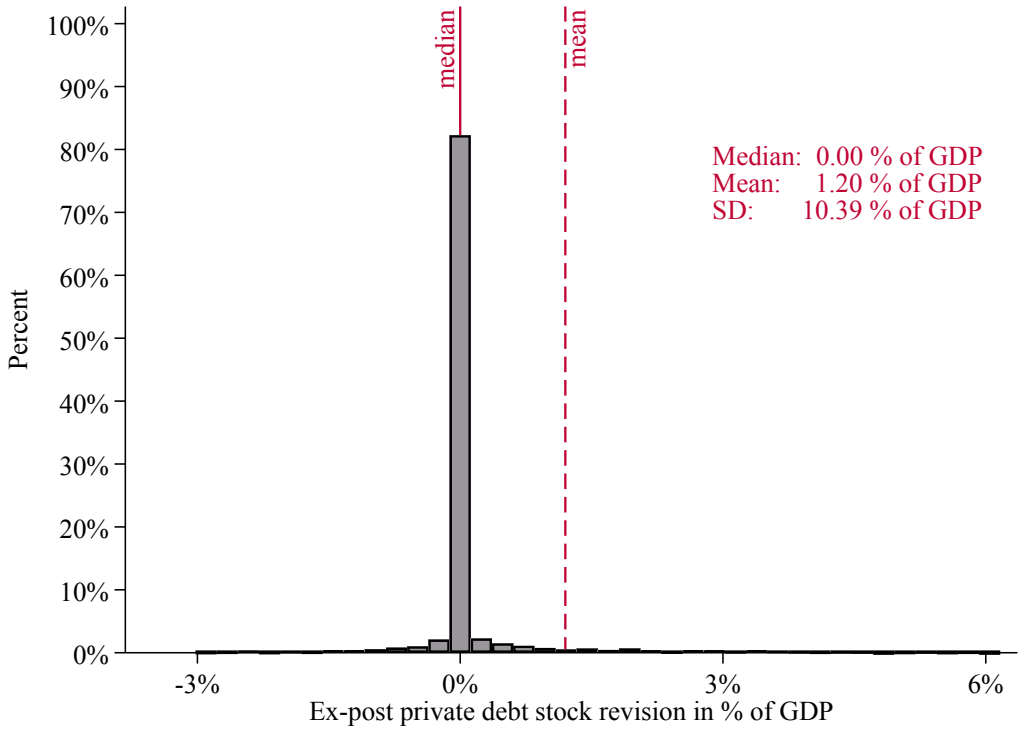
Notes: The figure shows the percentage distribution of data revisions to total public domestic debt stocks and to total public external debt stocks defined analogously to equation (1), in percent of GDP. The horizontal axes are truncated for readability but all observations are retained in the calculations. The solid lines show the median, dashed lines show the mean. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions.

Figure D.8: The distribution of total and private non-guaranteed debt stock revisions

Panel A: Total external debt stocks in percent of GDP



Panel B: Private non-guaranteed debt stocks in percent of GDP



Notes: The figure shows the percentage distribution of data revisions to the total external debt stocks and to the private non-guaranteed debt stocks, defined analogously to equation (1), in percent of GDP. The horizontal axes are truncated for readability but all observations are retained in the calculations. The solid lines show the median, dashed lines show the mean. GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are therefore not subject to revisions.

As an additional robustness exercise, we restrict the sample to revisions between -5 and +5 percent of GDP. This allows us to assess whether the baseline results are driven by a small number of extreme observations in the right tail or whether they also hold within a symmetric range around zero. Table D.6 shows that they do: across all debt categories, mean revisions remain positive and the revision distributions exhibit statistically significant right skewness. Thus, even after excluding large revisions, we reject symmetry in favor of positive skewness.

Table D.6: Summary statistics of debt data revisions - excluding large revisions

	N	Mean	Median	Std. Dev.	Skew	Hidden debt in % of total debt
Public external debt	8,846	0.20***	0.00	1.21	0.48***	1.77
Total public debt	3,604	0.19***	0.00	1.05	1.45***	0.90
Public domestic debt	2,405	0.11***	0.00	0.93	1.60***	1.30
Private debt	5,745	0.08***	0.00	0.75	1.60***	9.08

Notes: The table reports summary statistics for debt data revisions, as well as the share of hidden debt in percent of total debt, restricted to revisions between -5 and +5 percent of GDP, across different types of debt. Mean, median, standard deviation and skew are expressed as percentages of GDP. Asterisks in the Mean column indicate significance from tests of the null hypothesis that the mean revision is zero, using Newey–West heteroskedasticity- and autocorrelation-consistent standard errors (Newey and West, 1987). Asterisks in the Skew column indicate significance from a one-sided large-sample skewness z-test of the hypothesis of zero skewness against the alternative of right skewness. Asterisks ***, **, and * indicate significance at the 1%, 5%, and 10% level respectively.

D.8 Revision distributions for alternative flow measures

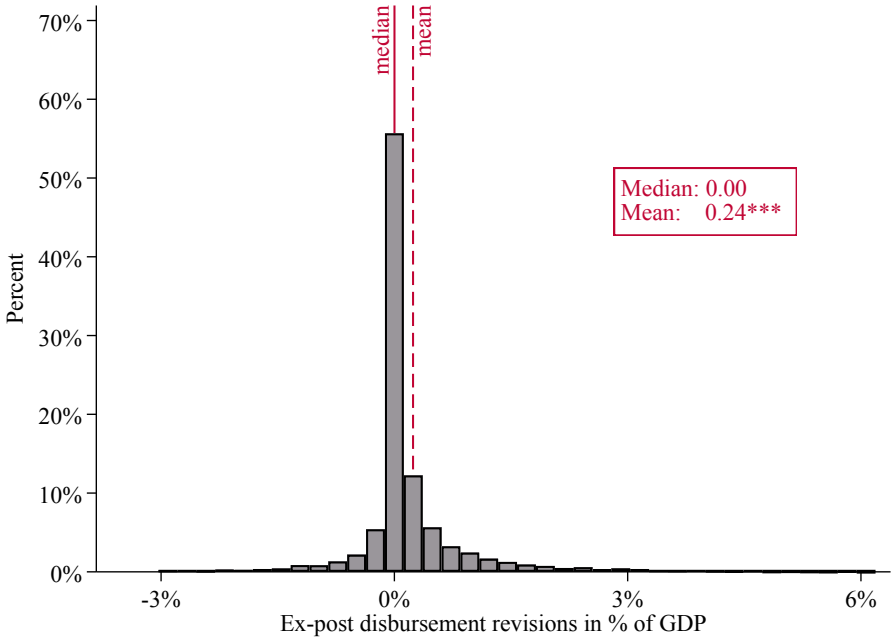
As laid out in Appendix Section A.2, our preferred measure for debt flows is commitments, which capture the total value of loan contracts signed in a given year. However, debt flows can also be measured in alternative ways. Compared to commitments, disbursements record the amounts actually drawn while net flows subtract principal repayments from disbursements and are closest to the contemporaneous net financing received by the borrower. These concepts need not coincide in a given year: committed amounts may be disbursed only gradually, and net flows also reflect repayment schedules.

In our core flow analysis, presented in Panel B of Figure 5 in the main text, we focus on revisions to commitments, on which we rely on for two reasons. First, they capture the act of borrowing and are therefore particularly well suited for studying co-movement with other cyclical variables, such as GDP growth, even though they may precede disbursement and do not immediately enter the outstanding debt stock. Second, they are the most consistently available measure of new borrowing across the World Bank IDS and selected historical League of Nations publications.

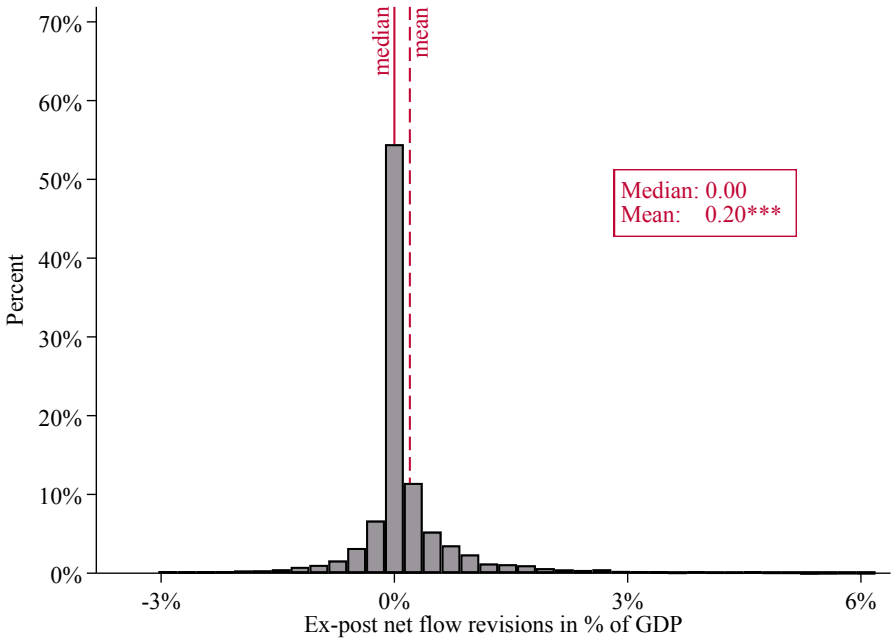
To show that our results on debt flows are robust to the choice of the flow measure, Figure D.9 repeats the distributional analysis using two alternatives from the World Bank IDS. Panel A reports revisions to disbursements of external public and publicly guaranteed debt (series code DT.DIS.DPPG.CD), while Panel B reports revisions to net flows (series code DT.NFL.DPPG.CD). Both measures display the same qualitative pattern as commitments: their medians are zero, but their distributions have pronounced right tails and significantly positive means. Average upward revisions amount to 0.24 percent of GDP for disbursements and 0.20 percent of GDP for net flows. The systematic upward bias in reported debt flows is therefore not specific to commitments and remains visible when flows are measured by the amounts actually disbursed or by the net financing received by the borrower.

Figure D.9: Distributions of alternative flow measures

Panel A: Disbursements



Panel B: Net flows



Notes: The figure shows the percentage distribution of ex post debt flow revisions for two alternative flow measures from the World Bank's IDS in percent of GDP. The horizontal axes are truncated for readability but all observations are retained in the calculations. Panel A reports revisions to disbursements (series code DT.DIS.DPPG.CD), defined as the amounts drawn by borrowers during a given year. Panel B reports revisions to net flows (series code DT.NFL.DPPG.CD), defined as disbursements minus principal repayments. GDP data are taken from a single vintage of World Bank (2025) and are therefore not subject to revisions. Solid vertical lines indicate the median, and dashed vertical lines indicate the mean. Asterisks ***, **, and * indicate whether the mean revision differs statistically significantly from zero at the 1%, 5%, and 10% levels, respectively.

D.9 Revision distributions by market access

This subsection examines whether debt-stock revision patterns differ between countries with and without access to international capital markets. Because no consistent measure of market access is available over the full century covered by our data, we construct a source-specific indicator using the most informative debt breakdown available in each reporting system. The resulting classification should be interpreted as a broad proxy for market access status rather than as a precise chronology of market entry and exit.

We classify country-year observations as having market access as follows:

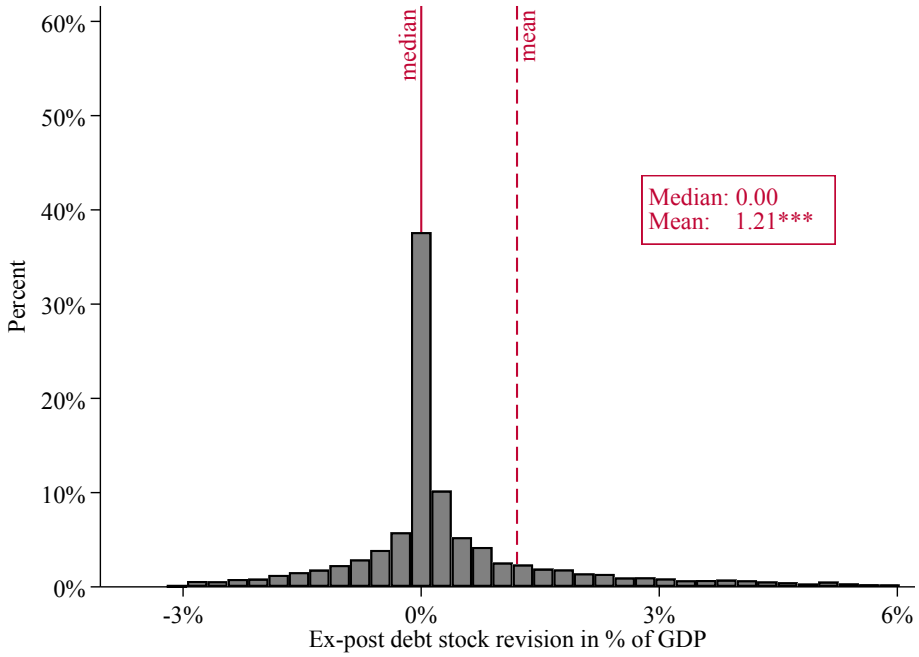
- For the League of Nations data, we classify countries reporting a positive stock of foreign debt as having market access and countries with no reported foreign debt as lacking market access. This classification reflects the institutional structure of international capital flows during the interwar period, when cross-border official lending was comparatively limited and foreign sovereign borrowing consisted predominantly of market-based finance (see, for example, Horn et al. (2026)).
- We exclude observations from the United Nations data from this exercise because these statistics do not provide a sufficiently informative breakdown for distinguishing market-based from non-market-based borrowing. Furthermore, given the widespread imposition of capital controls during the Bretton Woods period, external market borrowing was low to non-existent for reasons unrelated to the specific issuer.
- For the World Bank *International Debt Statistics*, the creditor-type decomposition of external debt permits a more direct classification. We classify countries reporting a positive stock of external bond debt (series code DT.DOD.PBND.CD) as having market access and countries with no reported external bond debt as lacking market access.
- For the IMF *Government Finance Statistics*, we apply the classification derived from the World Bank *International Debt Statistics* to countries covered by both reporting systems. For countries classified as high-income economies by the World Bank (World Bank, 2025) and not included in the IDS, we assume market access.
- Across the full sample, countries are coded as having no market access during external sovereign defaults, using data from Farah-Yacoub et al. (2024).

Figure D.10 presents the distributions of debt-stock revisions for the resulting non-market-access and market-access samples. Both distributions exhibit the principal features documented for the full sample: their medians are close to zero, their means are significantly positive, and they display pronounced right tails. The mean revision is 1.21 percent of GDP among non-market-access countries and 0.74 percent of GDP among market-access countries.

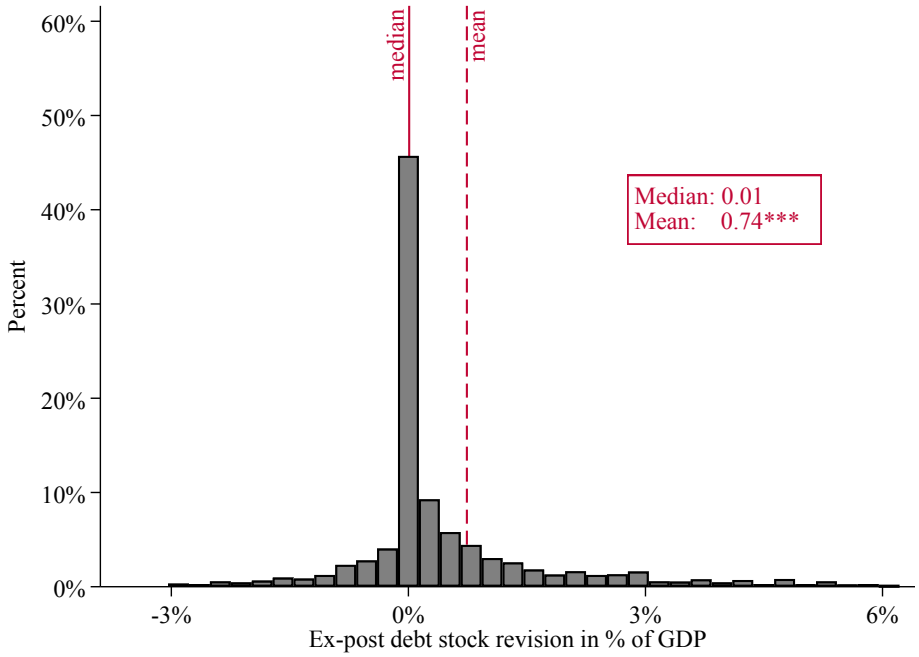
These results show that systematic upward revisions are not confined to countries excluded from international capital markets. They are also present among market-access countries, although the average revision is significantly larger in the non-market-access sample.

Figure D.10: Distribution of debt stock revisions by market access

Panel A: Non-market access countries



Panel B: Market access countries



Notes: The figure shows the distributions of ex post debt-stock revisions, expressed as a percentage of GDP, for countries classified as lacking market access in Panel A and countries classified as having market access in Panel B. The horizontal axes are truncated for readability but all observations are retained in the calculations. Market-access status is constructed separately for each reporting system (see text for details). GDP data are taken from a single vintage of World Bank (2025) and Müller et al. (2025) and are not subject to revisions.

D.10 External versus domestic debt revisions

Table 2 in the main text shows that average revisions to external public debt are larger than those to domestic public debt when both are expressed as a percentage of GDP. These unconditional means, however, cannot be interpreted as a direct comparison of the two debt categories. The underlying samples differ substantially across countries, periods, and reporting systems: external debt has much broader coverage and includes the World Bank IDS, whereas domestic debt is observed only in the League of Nations, United Nations, and IMF GFS data. Moreover, scaling revisions by GDP combines differences in reporting behavior with differences in the size of the underlying debt stocks. A larger GDP-scaled revision may therefore reflect a larger initial debt stock rather than a greater propensity for that debt category to be underreported. This subsection therefore provides a clean comparison that only uses observations for which domestic and external public debt are reported simultaneously and scales each revision by its own initially reported stock.

More specifically, we restrict the sample to country–year observations for which both domestic and external public debt stocks are available from the same reporting system and in the same pair of vintages. For each debt component $j \in \{\text{domestic}, \text{external}\}$, we calculate the proportional revision

$$HD_{i,t}^{j,prop} = \frac{Debt_{i,t}^{j,V} - Debt_{i,t}^{j,v_0}}{Debt_{i,t}^{j,v_0}}, \tag{D.5}$$

as well as the corresponding log revision,

$$HD_{i,t}^{j,log} = \ln(Debt_{i,t}^{j,V}) - \ln(Debt_{i,t}^{j,v_0}), \tag{D.6}$$

where v_0 denotes the initial vintage and V the most recent vintage, as defined in equation (1). The resulting matched sample contains 8,212 observations from the IMF GFS, League of Nations, and United Nations reporting systems.

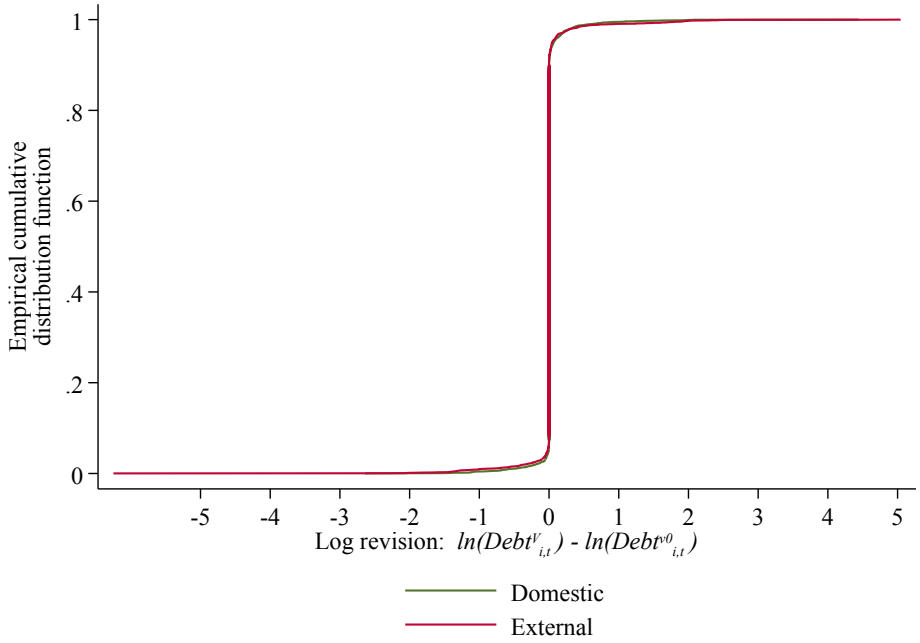
Figure D.11 compares the cumulative distribution functions of domestic and external log revisions.[37] In Panel A, which includes all matched observations, the two distributions are almost indistinguishable. A two-sided Kolmogorov–Smirnov test fails to reject equality of the pooled distributions ($D = 0.011$, $p = 0.97$). The same conclusion holds when the test is conducted separately within each reporting system, with p-values of 0.10 for the IMF GFS, 0.95 for the League of Nations, and 0.61 for the United Nations. The close overlap partly reflects the large mass of exact-zero revisions in both debt categories.

Panel B excludes exact-zero revisions and therefore compares the distributions conditional on a debt figure being revised. In this sample, external debt revisions are somewhat larger, particularly in the right tail. A one-sided Kolmogorov–Smirnov test rejects equality of the two

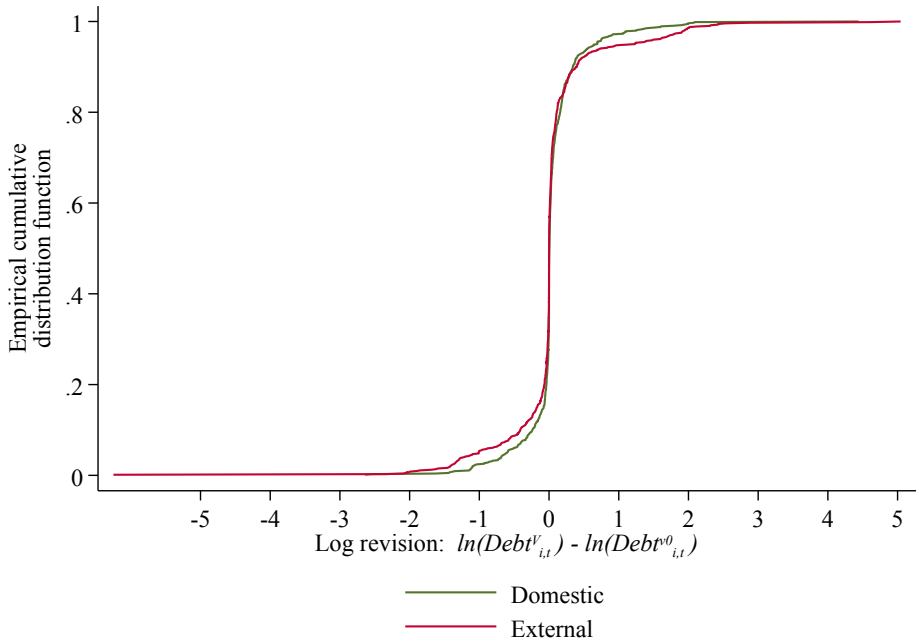
[37] We plot log revisions rather than proportional changes because the log scale is symmetric in relative increases and decreases and keeps extreme upward revisions from dominating the horizontal scale; the Kolmogorov–Smirnov test is invariant to this monotone transformation, so the test results are identical under either scale.

Figure D.11: Empirical cumulative distribution functions of log revisions, domestic and external debt

Panel A: All observations



Panel B: Conditional on non-zero revision



Notes: The figure plots the empirical cumulative distribution functions of log revisions $HD^{j,log}_{i,t} = \ln Debt^{V}_{i,t} - \ln Debt^{v_0}_{i,t}$ for the domestic (green) and external (red) components of public debt, pooled across all sources reporting both public debt components. The sample is restricted to country-year observations where domestic and public debt are reported in the same source and vintage pair. Panel A uses all 8,212 matched observations; Panel B conditions on $|\ln Debt^{V}_{i,t} - \ln Debt^{v_0}_{i,t}| > 0$, leaving 1,518 non-zero revisions.

distributions against the alternative that external revisions are larger over at least part of the distribution ($D = 0.069$, $p = 0.027$), while the corresponding two-sided test is only marginally significant ($p = 0.054$). Moreover, the difference is not statistically robust when the reporting systems are examined separately.

Taken together, the results provide little evidence of a systematic difference between the revision distributions of domestic and external public debt. Conditional on a revision occurring, there is some suggestive evidence that external debt revisions may be larger, but the difference is modest and sensitive to the sample and test used. The lower mean revision for domestic debt reported in Table 2 should therefore not be interpreted as evidence that domestic public debt is inherently less susceptible to underreporting.

D.11 Debt intolerance and debt-carrying capacity in the data

In Section 6.3, we calibrate our quantitative sovereign debt and default model to the hidden debt processes of two economies: one estimated from low- and lower-middle-income countries with relatively weak institutions and high hidden debt, and one estimated from high-income countries with relatively strong institutions and low hidden debt. We show that differences in the hidden-debt process alone generate a roughly 4-percentage-point difference in the reported debt-to-GDP ratio at default and a difference in sovereign spreads of roughly 70 basis points. This appendix subsection describes how we define the two groups, derive the moments used in the calibrations, and how we construct empirical benchmarks against which we assess the magnitude of the model results.

To construct the two model economies, we divide the countries in our database into two groups based on their income classification from the World Bank (2025). The first group consists of low-income and lower-middle-income countries, while the second group consists of high-income countries. We omit upper-middle-income countries to sharpen the contrast between the two groups. These income groups also differ substantially in institutional quality: the average Polity5 score is 1.2 among low- and lower-middle-income countries, indicating relatively weak institutions, and 6.6 among high-income countries, indicating relatively strong institutions.

For each group, we then calculate the mean and standard deviation of debt data revisions as a share of GDP (see Table D.7). These moments discipline the hidden-debt accumulation process in the corresponding model economy. Low- and lower-middle-income countries exhibit both larger average data revisions (μ_ε in our model) and substantially greater dispersion (σ_ε in our model) than high-income countries. This pattern is consistent with the evidence in Section 4.2 that reported debt is more downward biased and less precise in weaker institutional environments.

To put model results into perspective, we also construct an empirical proxy for each group's debt-carrying capacity. Debt-carrying capacity is not directly observable, and the resulting measure should therefore be regarded as a rough descriptive proxy rather than a structural estimate of a country's debt limit. Following the debt-intolerance literature, we proxy a country's debt-carrying capacity by the public debt-to-GDP ratio at which the country enters sovereign default

(e.g. Reinhart et al., 2003). Specifically, we identify all default episodes in the two country groups using data from Farah-Yacoub et al. (2024) and Reinhart and Rogoff (2009), and record the reported public debt-to-GDP ratio in the first year of each default episode. We then calculate the mean across default episodes within each group. This measure has a direct counterpart in the model, where debt-carrying capacity is summarized by the distribution of reported debt-to-GDP ratios at the moment of default (see Figure E.4).

Table D.7 reports the resulting moments. Low- and lower-middle-income countries enter default with average public debt of 69.1 percent of GDP, compared with 88.6 percent among high-income countries. The resulting gap of approximately 20 percentage points provides a descriptive empirical benchmark for the difference in debt-carrying capacity between the two groups. Using data on sovereign spreads from World Bank (2022), we further find that countries in the low- and lower-middle-income group face average spreads of 481 basis points, compared with 231 basis points among high-income countries—a spread premium of approximately 250 basis points.[38]

Table D.7: Comparison of benchmark model economies

Moment	Low- & lower-middle income countries	High income countries
Average Polity5 score	1.178	6.613
Mean underreporting in percent of GDP	1.172	0.158
SD of underreporting in percent of GDP	4.506	1.500
Mean debt-to-GDP in year of default	69.1	88.6
Mean spread in basis points	481	231

Notes: The table reports descriptive moments for low- and lower-middle-income economies and high-income economies. Debt-carrying capacity is proxied by the total public debt-to-GDP ratio in the first year of sovereign default, derived as the mean across all default episodes within each income group. Mean underreporting and its standard deviation refer to revisions to external public debt and are derived as defined in equation (1). Polity5 scores measure political institutions, with higher values indicating more democratic institutions. Sovereign spread data are from World Bank (2022) and exclude observations during domestic or external sovereign defaults.

In addition to the baseline comparison of weak- and strong-institution economies, we also consider a model economy representing the most opaque countries in our sample with the largest mean underreporting. To do so, we rank countries by their country-specific mean revisions as a share of GDP, and divide the resulting distribution into deciles. For top-decile countries, we take the unweighted average across the mean and standard deviation of underreporting in percent of GDP. [39] Among the top-decile underreporters, mean underreporting of public external debt is 5.6 percent of GDP, with an average standard deviation of 12.6 percent.

[38] We exclude all observations during domestic or external sovereign defaults when calculating the spread difference.

[39] Our top-decile underreporters are Cambodia, Cameroon, Rep. of Congo, Ethiopia, Ghana, Guinea-Bissau, Laos, Madagascar, Mongolia, Myanmar, Sierra Leone, and Tanzania.

E Quantitative Model

This appendix presents the full recursive formulation of the quantitative model summarized in Section 6 of the main text: the complete environment, the government's and lenders' problems, the equilibrium definition, and calibration details (Sections E.1–E.6). It also reports two additional exercises: robustness of the debt-intolerance results to an exogenous third-party hidden-debt revelation channel (Appendix E.7), and an extension in which the sovereign can strategically conceal the third-party revelation at a cost (Appendix E.8).

To quantify the effects of hidden debt and its revelation on default risk, borrowing costs, and debt-carrying capacity, the model builds on the standard Eaton–Gersovitz environment (following Eaton and Gersovitz, 1981, Arellano, 2008, and Aguiar and Gopinath, 2006) with long-duration debt and positive recovery values (as in Hatchondo et al., 2016 and Hatchondo et al., 2021). We extend this model by adding three key ingredients: (i) hidden debt accumulation, (ii) costly monitoring by risk-averse international lenders, and (iii) an endogenous recovery rate through which hidden debt dilutes the recovery value of market debt during default.

To keep the framework tractable while preserving the empirical mechanisms highlighted in the data, our baseline model treats hidden debt as an exogenous process rather than a strategic choice by the sovereign.[40] As discussed in Section 6, the model economy is best understood as one in which the government has limited control over the borrowing decisions of the broader public sector. Therefore, the model primarily reflects the case of countries with weak institutions and large uncertainty about the true level of indebtedness, consistent with the empirical patterns discussed in Section 4.2 in the main text.

The quantitative model focuses on *external* market debt, following the canonical sovereign default literature. This abstracts from important issues that arise when domestic and external public debt coexist, including differences in seniority, currency denomination, and the role of inflation (Du and Schreger, 2022). The empirical evidence above nevertheless shows that hidden debt is not confined to external borrowing. We therefore interpret the model as isolating the information and pricing mechanisms associated with hidden liabilities that can arise across different forms of public debt.

E.1 Environment

Preferences and income process. The representative domestic household has preferences

$$E_t \sum_{j=t}^{\infty} \beta^{j-t} u(c_j),$$

[40] We study a richer set-up in Section E.8, in which the government can strategically suppress information about hidden debt. For other models with strategic hidden borrowing, see Alfaro and Kanczuk (2022), Gamboa (2023), and Guler et al. (2025).

where $\beta \in (0,1)$ is the subjective discount factor and $u(\cdot)$ is a strictly increasing and concave flow utility function. The government cannot commit to future default or borrowing decisions.[41]

The economy's endowment of the single tradable good is denoted by $y \in Y \subset \mathbb{R}_{++}$. This endowment follows a Markov process.

Market debt. The sovereign issues long-duration bonds, denoted b. A bond issued at t promises coupons $\kappa(1-\delta)^{j-1}$ at $t+j$, for all $j \geq 1$. The advantage of this payment structure is that it enables us to condense all future payment obligations derived from past debt issuances into a one-dimensional state variable: the face value of outstanding debt, b.[42]

Hidden debt. We assume that, in addition to market debt, the country also faces an exogenous process for hidden debt. Provided that there has not been a revelation in the previous period (more details on the revelation below), the country starts period t with a level of hidden debt, h, which has the same coupon structure as the market debt. Absent a default in period t, the country needs to service the initial hidden debt (i.e., it pays the coupons due), and it receives an innovation $\varepsilon \sim \mathcal{N}(\mu_\varepsilon, \sigma_\varepsilon^2)$. We assume ε is i.i.d. across periods and independent of any other shocks, and that its distribution is common knowledge. The hidden debt evolves according to

$$h' = (1-\delta)h + \varepsilon. \tag{E.1}$$

Information, monitoring, and taste shocks. The government observes $(b, h, y, \varepsilon, \tau)$, where τ is the time since the last revelation. Lenders observe (b, y, τ) and then observe realized market borrowing b', but do not observe (h, ε) unless they monitor.

A key friction in the model is therefore that reported debt b does not fully reveal the sovereign's true liabilities. This captures an institutional environment in which governments compile and report debt statistics, but self-reporting alone cannot credibly establish the absence of hidden liabilities. Lenders face uncertainty about the true debt stock until information is verified through external monitoring or other information-producing mechanisms. Hidden debt is therefore not simply information that the government can reveal credibly at will.

Monitoring is costly: lenders pay a fee f to trigger a revelation of hidden debt. In line with the patterns observed in the data, a default also triggers a revelation. In a revelation, the hidden-debt stock and the current hidden-debt innovation are incorporated into current market issuance and hidden debt is reset to $h' = 0$.

To smooth discrete policy rules, we introduce i.i.d. Type-I extreme value shocks in three decisions: sovereign default, sovereign borrowing choice, and lender monitoring choice. These

[41] Thus, one may interpret this environment as a game in which the government making decisions in period t is a player who takes as given the (default and borrowing) strategies of other players (governments) who will decide after t.

[42] Arellano and Ramanarayanan (2012) and Hatchondo et al. (2016) allow the government to issue both short-term and long-term debt, and they study optimal maturity and the effects of debt dilution, respectively. Roch and Roldán (2023) and Sosa-Padilla and Sturzenegger (2023) allow the government to issue debt with payments contingent on the level of income.

shocks are privately observed by the deciding agent, but their distributions are common knowledge. Consequently, lenders forecast sovereign behavior using conditional choice probabilities, and the government forecasts lender monitoring using the monitoring choice probabilities.

Defaults and recovery rates. When the government defaults, it does so on all (reported and hidden) current and future debt obligations. This is consistent with the observed behavior of defaulting governments, and it is a standard assumption in the literature.[43] As mentioned above, and following the empirical evidence on hidden debt revelations discussed in the main text, we assume that a default triggers a hidden debt revelation.

A default event also triggers temporary exclusion from financial markets. During exclusion, income is $y - \phi(y)$. Re-entry occurs with probability $\theta \in [0, 1]$. Upon re-entry, defaulted debt is exchanged for new bonds b_D:

$$b_D(b, h, y) = \min \left\{ \alpha(y),\, b + \tilde{h} \right\} , \tag{E.2}$$

where $\tilde{h} = \max\{0, h\}$ and $\alpha(y)$ is a non-decreasing function of the income level realized upon reentry. These new bonds b_D are divided among holders of the previously issued market and hidden debt as follows. Holders of hidden debt (which was revealed at the default event) obtain $\psi\tilde{h}$, with $\psi \in [0, 1]$.[44] Holders of the previously issued market debt obtain the remainder, $b_D - \psi\tilde{h}$. This implies the following recovery rate for market debt:

$$\omega^b(b, h, y) = \frac{b_D(b, h, y) - \psi\tilde{h}}{b} . \tag{E.3}$$

Equation (E.3) shows—in line with the data (see Appendix Section D.6)—how hidden debt can dilute the recovery rate for market lenders, providing an incentive for investors to monitor the country's accounts.[45]

Timing. For a sovereign that begins the period in good standing:

0. Government knows (b, h, τ); lenders know (b, τ).
1. y and ε realize; all observe y, only government observes ε.
2. Taste shocks (for default, borrowing, and monitoring) realize privately.
3. Lenders post contingent monitoring and price schedules $(m, q_{\text{M}}, q_{\text{NM}})$.

[43] Sovereign debt contracts often contain an acceleration clause and a cross-default clause. The first clause allows creditors to call the full value of the debt that they hold in case the government defaults on a single payment. The cross-default clause states that a default on any government obligation constitutes a default on all the other contracts containing such a clause. As a result of these two clauses, after a default event, all future debt obligations become current.

[44] Inspired by the patterns observed in the data (see Appendix Section D.6), we assume that debt that was hidden at the time of default is excluded from the regular restructuring process. This hidden debt has an effective recovery rate of ψ.

[45] In the numerical solution of the model we guarantee that $\omega^b(\cdot) \in [0, 1]$.

4. Government chooses its default policy. If defaulting, h gets revealed; if repaying, it chooses b'.

5. Conditional on the observed borrowing choice b', monitoring is realized. If monitoring occurs, hidden debt is revealed, gets added to the stock of market debt, and h is reset to zero for the next period, and the monitored price schedule applies; otherwise, lenders update beliefs using (E.9), and the no-monitoring price schedule applies.

6. Settlement: consumption and coupon payments (if any) are realized.

For a sovereign in exclusion, a re-entry shock is realized first: with probability $1-\theta$ the sovereign remains excluded; with probability θ it re-enters with debt level given by (E.2), hidden debt resets, and then the same sequence of events follows within the same period.

E.2 Beliefs about hidden debt

Hidden debt is not observed by lenders unless there is a revelation. Lenders, therefore, enter each period with a belief about the current stock of hidden debt. The public state relevant for this belief is not only the time elapsed since the last revelation, τ, but also the observable market debt and income state, (b, y). We denote the prior used by lenders at the beginning of the period by

$$\pi_0(h \mid b, y, \tau)\,. \tag{E.4}$$

This object is the model counterpart of investors' assessment of the sovereign's hidden liabilities immediately before the government makes its default decision. If the government defaults, hidden debt is revealed and no posterior inference is required. If the government repays, lenders update this prior using the information contained in repayment and in the subsequent borrowing choice.

The role of τ is straightforward. Hidden debt is reset to zero after a revelation. If no further revelation occurs, hidden debt evolves according to its law of motion, given by equation (E.1). Starting from $h = 0$, a longer spell without a revelation raises both the expected stock of hidden debt and the uncertainty around it. Given the normality assumption for the hidden debt innovations, the τ-only benchmark moments are

$$E[h \mid \tau] = \mu_\varepsilon \frac{1-(1-\delta)^{\tau-1}}{\delta}, \qquad \mathrm{Var}(h \mid \tau) = \sigma_\varepsilon^2 \frac{1-(1-\delta)^{2(\tau-1)}}{1-(1-\delta)^2}\,. \tag{E.5}$$

These moments make clear why the time since the last revelation is an important state variable: absent a revelation, hidden liabilities drift upward and become more dispersed in the lenders' information set.

We assume that lenders use a richer prior than the τ-only moments in equations (E.5). Let $\mu_G^*(b, h, y, \tau)$ denote the stationary distribution over good-standing states generated by the equilibrium policies. The state-dependent prior is

$$\pi_0(h_i \mid b, y, \tau) = \frac{\mu_G^*(b, h_i, y, \tau)}{\sum_j \mu_G^*(b, h_j, y, \tau)}. \tag{E.6}$$

This conditioning matters because the observable states (b, y, τ) are themselves selected by past borrowing, repayment, default, and monitoring decisions. Two countries with the same time since the last revelation need not therefore have the same hidden-debt distribution when their observable debt or income differs.

Bayesian updating conditional on repayment. After the sovereign chooses to repay and issues market debt b', lenders update their beliefs about both current hidden debt and the current hidden-debt innovation. Let

$$\Pi_b(b' \mid b, h, y, \varepsilon, \tau)$$

denote the probability that a repaying sovereign chooses b' in state $(b, h, y, \varepsilon, \tau)$, and let

$$\Pi_d(b, h, y, \varepsilon, \tau)$$

denote the probability that the sovereign defaults in that state.[46] For compactness, write $s_{ik} = (b, h_i, y, \varepsilon_k, \tau)$. Because lenders observe both repayment and the market-debt choice, the relevant likelihood is the joint probability

$$\mathcal{L}_{ik}(b', b, y, \tau) = [1 - \Pi_d(s_{ik})]\, \Pi_b(b' \mid s_{ik}). \tag{E.7}$$

The beginning-of-period prior over (h_i, ε_k) is $\pi_0(h_i \mid b, y, \tau) \Pr(\varepsilon_k)$ because the current innovation ε_k is i.i.d. and independent of inherited hidden debt. Define the unnormalized joint posterior weight

$$\mathcal{Z}_{ik}(b', b, y, \tau) = \mathcal{L}_{ik}(b', b, y, \tau)\pi_0(h_i \mid b, y, \tau) \Pr(\varepsilon_k)\,. \tag{E.8}$$

Bayes' rule then gives the normalized joint posterior

$$\zeta_{ik}(b', b, y, \tau) \equiv \Pr(h_i, \varepsilon_k \mid b', b, y, \tau, \text{repay}) = \frac{\mathcal{Z}_{ik}(b', b, y, \tau)}{\sum_{j,\ell} \mathcal{Z}_{j\ell}(b', b, y, \tau)}\,. \tag{E.9}$$

The posterior over current hidden debt is the corresponding marginal,

$$\Pr(h_i \mid b', b, y, \tau, \text{repay}) = \sum_k \zeta_{ik}(b', b, y, \tau). \tag{E.10}$$

[46] As explained above, we assume the government receives taste shocks for its default and borrowing choices. These shocks give rise to $\Pi_b(\cdot)$ and $\Pi_d(\cdot)$.

Equations (E.7)–(E.9) describe lenders' posterior after observing repayment and the borrowing choice b'. This posterior is used on the no-monitoring branch to construct the predictive distribution μ_{NM} below. On the monitoring branch, hidden debt is revealed, and no inferred distribution is required.

Predictive beliefs under no-monitoring. On the no-monitoring branch, lenders use the posterior distribution over (h_i, ε_k) to forecast next period's hidden debt. Each possible pair implies

$$h'_{ik} = (1-\delta)h_i + \varepsilon_k \tag{E.11}$$

and receives posterior probability $\zeta_{ik}(b', b, y, \tau)$. Thus, for any function g of next period's hidden debt,

$$\mathbb{E}_{\text{NM}}\left[g(h') \mid b, b', y, \tau\right] = \sum_{i,k} \zeta_{ik}(b', b, y, \tau) g\left((1-\delta)h_i + \varepsilon_k\right). \tag{E.12}$$

We denote the distribution underlying this expectation by $\mu_{\text{NM}}(h' \mid b, b', y, \tau)$.[47] Because the current innovation affects both default and borrowing, observing repayment and b' updates lenders' beliefs about ε as well as h. The predictive distribution μ_{NM} therefore uses their joint posterior; only next period's innovation ε' is drawn independently from the unconditional innovation distribution in the lenders' continuation problem (in the next subsection).

E.3 Foreign lenders

Our modeling of foreign lenders is inspired by Gu and Stangebye (2023). We assume that foreign lenders are risk-averse and that they arrive in overlapping generations, each with wealth W. Each generation enters with a common prior over hidden debt implied by the public state and the hidden-debt process.[48] They can save at the exogenous risk-free gross return $1 + r$ or purchase the sovereign's long-duration bonds. Each lender holds the sovereign bond for one period and values its coupon and resale or recovery value next period.

When a sovereign in good standing repays and chooses market debt b', the lender cohort makes a common monitoring choice: $m = 1$ denotes monitoring and $m = 0$ denotes no monitoring. Monitoring costs f and reveals hidden debt; no monitoring leaves lenders with the predictive belief $\mu_{\text{NM}}(h' \mid b, b', y, \tau)$ derived in Section E.2. Bond holdings and prices are then determined competitively conditional on the monitoring outcome.[49]

[47] In the numerical implementation, if $(1-\delta)h_i + \varepsilon_k$ lies between two nodes of the hidden-debt grid, the probability mass ζ_{ik} is divided linearly between those neighboring nodes.

[48] The overlapping-generations structure captures imperfect information transmission across investor cohorts, consistent with the recurring "this time is different" narratives emphasized by Reinhart and Rogoff (2009) and with the repeated comovement of crises and hidden-debt revelations documented in Section 5 and Appendix C.

[49] This assumption keeps the information-acquisition problem tractable: lenders coordinate on whether to incur the monitoring cost but compete in the bond market, so the price schedules satisfy the Euler equations below. A similar assumption appears in Hatchondo et al. (2014), who study "voluntary debt exchanges." Without such coordination, individual creditors could have incentives to free ride on monitoring by other creditors. We abstract from this creditor-level collective-action problem; for discussions of collective action in sovereign debt markets, see Wright (2011) and the references therein.

There are three benchmark bond prices. The monitored price $q_{\mathrm{M}}(b', y)$ applies when lenders reveal hidden debt. The no-monitoring price $q_{\mathrm{NM}}(b, b', y, \tau)$ applies when they do not. The price $q_D(b, h, y)$ applies to market claims already in default. The first two prices concern newly issued long-duration bonds; they differ because monitoring changes both lenders' information and their available wealth.

Payoffs on bonds issued in good standing. Let $\mathcal{B}$ denote the grid of sovereign borrowing choices and let $\tau' = \tau + 1$. Conditional on repayment next period, let $b'' \in \mathcal{B}$ be the sovereign's realized borrowing choice and $m' \in \{0, 1\}$ the realized monitoring choice. The corresponding continuation price is

$$\bar{q}(b', b'', y', \tau', m') = m' q_{\mathrm{M}}(b'', y') + (1 - m') q_{\mathrm{NM}}(b', b'', y', \tau'). \tag{E.13}$$

For the next-period state $s' = (b', h', y', \varepsilon', \tau')$ and realized default choice $d' \in \{0, 1\}$, the realized gross payoff per unit of the bond is

$$\mathcal{R}'(s', d', b'', m') = d' q_D(b', h', y', \tau') + (1 - d') \left[\kappa + (1 - \delta)\bar{q}(b', b'', y', \tau', m')\right]. \tag{E.14}$$

Thus, default delivers the market value of the defaulted claim, whereas repayment delivers the coupon plus the market value of the remaining long-duration claim.

The same payoff distribution enters both lender expected utility and the Euler equations. We begin with the monitoring case. For any function Φ of the realized gross payoff, and writing $s'_{\mathrm{M}} = (b', 0, y', \varepsilon', 1)$, the corresponding expectation is

$$\begin{aligned} E^{\ell}_{\mathrm{M}}\left[\Phi(\mathcal{R}')\right] = \sum_{y'} \Pr(y' \mid y) \sum_{\varepsilon'} \Pr(\varepsilon') \Bigg\{ & \Pi_d(s'_{\mathrm{M}}) \Phi\big(q_D(b', 0, y', 1)\big) \\ & + \left[1 - \Pi_d(s'_{\mathrm{M}})\right] \sum_{b'' \in \mathcal{B}} \Pi_b(b'' \mid s'_{\mathrm{M}}) \Bigg[\Pi_m(b', b'', y', 1) \Phi\big(\kappa + (1 - \delta) q_{\mathrm{M}}(b'', y')\big) \\ & + \left[1 - \Pi_m(b', b'', y', 1)\right] \Phi\big(\kappa + (1 - \delta) q_{\mathrm{NM}}(b', b'', y', 1)\big) \Bigg] \Bigg\}. \end{aligned} \tag{E.15}$$

Monitoring reveals hidden debt, so the next-period hidden-debt state and revelation clock are $h' = 0$ and $\tau' = 1$.

Under no monitoring, lenders instead integrate over the predictive distribution $\mu_{\mathrm{NM}}(h' \mid b, b', y, \tau)$ (derived above), and the time since the last revelation advances to τ'. Writing $s' = (b', h', y', \varepsilon', \tau')$, the corresponding expectation is

$$\begin{aligned} E^{\ell}_{\mathrm{NM}}\big[\Phi(\mathcal{R}')\big] = &\sum_{h'} \mu_{\mathrm{NM}}(h' \mid b, b', y, \tau) \sum_{y'} \Pr(y' \mid y) \sum_{\varepsilon'} \Pr(\varepsilon') \\ &\times \Bigg\{ \Pi_d(s') \Phi\big(q_D(b', h', y', \tau')\big) + \big[1 - \Pi_d(s')\big] \sum_{b'' \in \mathcal{B}} \Pi_b(b'' \mid s') \\ &\times \Bigg[\Pi_m(b', b'', y', \tau') \Phi\big(\kappa + (1-\delta) q_{\mathrm{M}}(b'', y')\big) \\ &+ \big[1 - \Pi_m(b', b'', y', \tau')\big] \Phi\big(\kappa + (1-\delta) q_{\mathrm{NM}}(b', b'', y', \tau')\big) \Bigg] \Bigg\}. \end{aligned} \tag{E.16}$$

Thus, lender utility and marginal utility are evaluated over the full distribution of realized payoffs, including future default, borrowing, and monitoring choices.

Lender values, monitoring, and prices. For a bond with current price q, lender holding B', available wealth w, and realized payoff per unit p, define next-period lender consumption as

$$c_\ell(p; q, B', w) = (w - qB')(1 + r) + B'p. \tag{E.17}$$

The lender value under monitoring is

$$V^{\ell}_{\mathrm{M}}(b', y) = \max_{B'} E^{\ell}_{\mathrm{M}} \left[u_\ell\big(C'_{\ell,\mathrm{M}}(\mathcal{R}'; B')\big) \right], \tag{E.18}$$

$$\text{with } C'_{\ell,\mathrm{M}}(\mathcal{R}'; B') = c_\ell(\mathcal{R}'; q_{\mathrm{M}}(b', y), B', W - f). \tag{E.19}$$

Under no monitoring, the corresponding objects are

$$V^{\ell}_{\mathrm{NM}}(b, b', y, \tau) = \max_{B'} E^{\ell}_{\mathrm{NM}} \left[u_\ell\big(C'_{\ell,\mathrm{NM}}(\mathcal{R}'; B')\big) \right], \tag{E.20}$$

$$\text{with } C'_{\ell,\mathrm{NM}}(\mathcal{R}'; B') = c_\ell(\mathcal{R}'; q_{\mathrm{NM}}(b, b', y, \tau), B', W). \tag{E.21}$$

With Type-I extreme value monitoring shocks of scale χ_m, the probability of monitoring is

$$\Pi_m(b, b', y, \tau) = \frac{\exp\big(V^{\ell}_{\mathrm{M}}(b', y)/\chi_m\big)}{\exp\big(V^{\ell}_{\mathrm{M}}(b', y)/\chi_m\big) + \exp\big(V^{\ell}_{\mathrm{NM}}(b, b', y, \tau)/\chi_m\big)}. \tag{E.22}$$

Let $B^*_{\mathrm{M}}(b', y)$ and $B^*_{\mathrm{NM}}(b, b', y, \tau)$ denote the optimal bond holdings in the two information branches. The corresponding Euler equations give the respective bond prices. Namely, under monitoring,

$$q_{\mathrm{M}}(b', y) = \frac{E^{\ell}_{\mathrm{M}}\Big[u'_\ell\Big(C'_{\ell,\mathrm{M}}(\mathcal{R}'; B^*_{\mathrm{M}})\Big)\,\mathcal{R}'\Big]}{(1+r) E^{\ell}_{\mathrm{M}}\Big[u'_\ell\Big(C'_{\ell,\mathrm{M}}(\mathcal{R}'; B^*_{\mathrm{M}})\Big)\Big]}, \tag{E.23}$$

and under no-monitoring,

$$q_{\mathrm{NM}}(b,b',y,\tau)=\frac{E^{\ell}_{\mathrm{NM}}\Big[u'_{\ell}\Big(C'_{\ell,\mathrm{NM}}(\mathcal{R}';B^{*}_{\mathrm{NM}})\Big)\,\mathcal{R}'\Big]}{(1+r)E^{\ell}_{\mathrm{NM}}\Big[u'_{\ell}\Big(C'_{\ell,\mathrm{NM}}(\mathcal{R}';B^{*}_{\mathrm{NM}})\Big)\Big]}\,. \tag{E.24}$$

Bonds in default. Finally, consider a lender holding a market claim on a sovereign in exclusion. With probability $1-\theta$, the sovereign remains excluded. With probability θ, it reenters with restructured market debt $b_D=b_D(b,h,y')$ and hidden debt reset to zero. The holders of the old market claim receive the fraction $\omega^b(b,h,y')$ of each unit of the restructured claim, as defined in equation (E.3).

For any function Φ of the realized gross payoff, and writing $b'_D=b_D(b,h,y')$, $\omega'_D=\omega^b(b,h,y')$ and $s'_D=(b'_D,0,y',\varepsilon',1)$, the corresponding expectation is

$$\begin{aligned}E^{\ell}_{\mathrm{D}}\big[\Phi(\mathcal{R}'_D)\big]=\sum_{y'}\Pr(y'\mid y)\Bigg\{&(1-\theta)\Phi\Big(q_D(b,\tilde{h},y')\Big)+\theta\sum_{\varepsilon'}\Pr(\varepsilon')\Bigg[\Pi_d(s'_D)\Phi\big(\omega'_D q_D(b'_D,0,y')\big)\\&+\big[1-\Pi_d(s'_D)\big]\sum_{b''\in\mathcal{B}}\Pi_b(b''\mid s'_D)\Bigg[\Pi_m(b'_D,b'',y',1)\Phi\big(\omega'_D\left[\kappa+(1-\delta)q_{\mathrm{M}}(b'',y')\right]\big)\\&+\big[1-\Pi_m(b'_D,b'',y',1)\big]\,\Phi\big(\omega'_D\left[\kappa+(1-\delta)q_{\mathrm{NM}}(b'_D,b'',y',1)\right]\big)\Bigg]\Bigg]\Bigg\}.\end{aligned} \tag{E.25}$$

If the country remains excluded, the claim is carried forward at its defaulted market value. If it reenters, its payoff is the recovery share times the payoff on the restructured claim, including the possibility of an immediate new default.

The lender's value in default is

$$V^{\ell}_{D}(b,h,y,\tau)=\max_{B'}E^{\ell}_{\mathrm{D}}\left[u_{\ell}\big(c_{\ell}(\mathcal{R}'_D;q_D(b,h,y),B',W)\big)\right]. \tag{E.26}$$

Let $B^{*}_{D}(b,h,y,\tau)$ denote the associated optimal holding. The price of a market claim in default satisfies

$$q_D(b,h,y)=\frac{E^{\ell}_{\mathrm{D}}[u'_{\ell}(c_{\ell}(\mathcal{R}'_D;q_D(b,h,y),B^{*}_{D},W))\,\mathcal{R}'_D]}{(1+r)E^{\ell}_{\mathrm{D}}\big[u'_{\ell}\big(c_{\ell}(\mathcal{R}'_D;q_D(b,h,y),B^{*}_{D},W)\big)\big]}. \tag{E.27}$$

Because default reveals hidden debt, it reduces uncertainty by making the inherited hidden-debt stock known during exclusion; the stock then resets upon reentry.[50] Lenders nevertheless integrate over next-period income and hidden-debt innovations, reentry, and the post-reentry sovereign and lender choices.

[50] This assumption is consistent with the evidence in our new dataset, in which revelations are high in default episodes. Recent work by Gutkowski (2024) similarly highlights how resolving a default through restructuring reduces uncertainty by eliminating belief heterogeneity.

E.4 The government's problem

A government that starts the period in good standing solves a two-step problem. It first compares default and repayment, and conditional on repayment it chooses next period's debt level taking into account that lenders may monitor. Its state vector is $s = (b, h, y, \varepsilon, \tau)$.

Default decision. Let $V_1(b, h, y)$ denote the value of default and $V_0(s)$ the value of repayment. With Type-I extreme value default shocks (of scale χ_d), default is probabilistic, and the default probability is

$$\Pi_d(s) \equiv P(d = 1 \mid s) = \frac{\exp\left(V_1(b, h, y)/\chi_d\right)}{\exp\left(V_1(b, h, y)/\chi_d\right) + \exp\left(V_0(s)/\chi_d\right)}. \tag{E.28}$$

The associated ex-ante value, before the default taste shock is realized, is the corresponding log-sum:

$$V(s) = \chi_d \log\left[\exp\left(V_1(b, h, y)/\chi_d\right) + \exp\left(V_0(s)/\chi_d\right)\right]. \tag{E.29}$$

The default value itself is

$$V_1(b, h, y) = u(c_D) + \beta E_{y', \varepsilon'|y}\left[(1-\theta)V_1(b, \tilde{h}, y') + \theta V(b_D, 0, y', \varepsilon', 1)\right] \tag{E.30}$$

with

$$c_D = y - \phi(y) + (\tilde{h} - h), \quad \text{and} \quad \tilde{h} = \max\{h, 0\}.$$

The continuation term captures temporary financial autarky: with probability $1-\theta$ the sovereign remains excluded next period, and with probability θ it re-enters and continues with restructured debt b_D, and without carrying any legacy hidden debt.

Repayment and borrowing decision. Conditional on repayment, the government evaluates each candidate level of borrowing, b'. For each candidate b', we define the *deterministic* repayment components as:

$$v_{\mathrm{M}}(b'; s) = u(c_{\mathrm{M}}) + \beta E_{y', \varepsilon'|y}\left[V(b', 0, y', \varepsilon', 1)\right], \tag{E.31}$$

$$v_{\mathrm{NM}}(b'; s) = u(c_{\mathrm{NM}}) + \beta E_{y', \varepsilon'|y}\left[V\left(b', (1-\delta)h + \varepsilon, y', \varepsilon', \tau + 1\right)\right]. \tag{E.32}$$

The budget constraints under monitoring and no monitoring are:

$$c_{\mathrm{M}} = y - \kappa(b + h) + q_{\mathrm{M}}(b', y)\,\iota_{\mathrm{M}} + q_h\varepsilon, \qquad \iota_{\mathrm{M}} = b' - [(1-\delta)b + (1-\delta)h + \varepsilon], \tag{E.33}$$

$$c_{\mathrm{NM}} = y - \kappa(b + h) + q_{\mathrm{NM}}(b, b', y, \tau)\,\iota_{\mathrm{NM}} + q_h\varepsilon, \qquad \iota_{\mathrm{NM}} = b' - (1-\delta)b. \tag{E.34}$$

We assume that hidden debt is priced at its ex post actuarially fair value, q_h.[51] The difference between the market debt issuance levels, ι_{M} and ι_{NM}, reflects whether new issuance is measured relative to total carried obligations (market plus revealed hidden debt, as in the monitoring case) or only the observable market debt stock (as in the no-monitoring case).

The choice-specific repayment value is then the monitoring-probability-weighted average:

$$v(b';s) = \Pi_m(b,b',y,\tau)\, v_{\mathrm{M}}(b';s) + \big(1-\Pi_m(b,b',y,\tau)\big)\, v_{\mathrm{NM}}(b';s)\,, \tag{E.35}$$

where $\Pi_m(b,b',y,\tau)$ is given by (E.22).

Borrowing shocks are Type-I extreme value with scale χ_b, yielding a smooth borrowing policy kernel and the repayment value:

$$\Pi_b(b' \mid s) = \frac{\exp(v(b';s)/\chi_b)}{\sum_{\tilde{b}} \exp(v(\tilde{b};s)/\chi_b)}, \qquad V_0(s) = \chi_b \log \sum_{\tilde{b}} \exp(v(\tilde{b};s)/\chi_b). \tag{E.36}$$

As χ_b decreases, the policy becomes closer to a deterministic maximization over b'.

E.5 Equilibrium definition

A recursive Markov perfect equilibrium consists of:

1. government value functions $\{V, V_0, V_1\}$ and sovereign choice probabilities $\{\Pi_d(s), \Pi_b(b' \mid s)\}$;
2. lender value functions $\{V^\ell_{\mathrm{M}}, V^\ell_{\mathrm{NM}}, V^\ell_D\}$, optimal bond holdings $\{B^*_{\mathrm{M}}, B^*_{\mathrm{NM}}, B^*_D\}$, and the monitoring probability $\Pi_m(b,b',y,\tau)$;
3. bond-price schedules $\{q_{\mathrm{M}}, q_{\mathrm{NM}}, q_D\}$;
4. the stationary distribution over good-standing states, $\mu^*_G(b,h,y,\tau)$;
5. the beginning-of-period prior $\pi_0(h \mid b,y,\tau)$, the joint posterior $\zeta_{ik}(b',b,y,\tau)$ over current (h_i,ε_k), and the no-monitoring predictive distribution $\mu_{\mathrm{NM}}(h' \mid b,b',y,\tau)$.

These objects satisfy the following conditions:

1. Given prices and the monitoring probability, the government's value functions and choice probabilities satisfy (E.28)–(E.36).
2. Given sovereign policies and beliefs, lender values, monitoring, and bond prices satisfy (E.18)–(E.24), (E.26)–(E.27), and (E.22).

[51] The price of hidden debt is determined at the end of the period, after all decisions have been made. Under monitoring, $q_h = q_{\mathrm{M}}$. Without monitoring, $q_h = q_{\mathrm{NM}}$ when the end-of-period hidden debt position satisfies $h' > 0$. When $h' < 0$, so that $-h'$ represents net *hidden* assets for the country, we use the risk-free price, $q_h = 1/(1+r)$.

3. The distribution μ_G^* is the good-standing component of the invariant distribution generated by the equilibrium default, borrowing, and monitoring policies, the reentry process, and the exogenous laws of motion for income and hidden debt.

4. The beginning-of-period prior is obtained by conditioning this stationary distribution on the observable state (b, y, τ), as in (E.6).

5. After observing repayment and b', the joint posterior over current (h, ε) satisfies Bayes' rule in (E.9). On the no-monitoring branch, the predictive distribution of next period's hidden debt is the distribution induced by this same joint posterior and the hidden-debt law of motion, as in (E.12).

6. Bond markets clear: aggregate lender holdings equal the outstanding stock of market debt in each state.

E.6 Quantitative Analysis

This section presents the quantitative results of the model. We first discuss the calibration strategy and the model's fit to the novel database introduced in Section 3. We then examine the model's implications for default incentives, debt-carrying capacity, and borrowing terms. Finally, we study to what extent hidden debt can account for the *debt intolerance* phenomenon.

E.6.1 Calibration

Functional forms and stochastic processes. The utility function of the representative agent in a small open economy displays a constant coefficient of relative risk aversion, i.e.,

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma}, \text{ with } \gamma \neq 1\,.$$

We assume that lenders have a utility function of the same form, with a coefficient of relative risk aversion given by γ_ℓ.

The endowment process for the borrowing country follows:

$$\log(y_t) = (1-\rho)\mu + \rho \log(y_{t-1}) + \nu_t,$$

where $|\rho| < 1$ and $\nu_t \sim N\left(0, \sigma_\nu^2\right)$. As in Chatterjee and Eyigungor (2012), we assume a quadratic loss function for income during a default episode $\phi(y) = \max\{y\left[\lambda_0 + \lambda_1[y - \mathbb{E}(y)]\right], 0\}$. The function controlling the cap on restructured debt upon reentry is parametrized as $\alpha(y) = \overline{\alpha}$.

Parameter values. Table E.1 presents the benchmark values assigned to all parameters in the model. A period in the model refers to a year. The coefficient of relative risk aversion for the borrowing country and the risk-free interest rate take standard values.

The parameters that govern the endowment process are estimated from our dataset. These values, $\rho = 0.6$ and $\sigma_\nu = 3\%$, are close to those typically found in studies of emerging and low-

income countries.[52] We assume an average duration of sovereign default events of three years ($\theta = 0.33$), following Dias and Richmond (2007). We set $\delta = 0.31$; with this value, sovereign debt has an average risk-free duration of 5 years in the simulations, which is close to the average duration found in the previous literature.[53] The coupon is normalized to $\kappa = (r + \delta)/(1 + r)$, which ensures that a default-free bond (with the same coupon structure as our sovereign bonds) trades at a price of $1/(1 + r)$.

Table E.1: Benchmark parameter values.

Parameter		Value	Source / target
Borrower's risk aversion	γ	2.0	Standard value
Risk-free rate	r	0.04	Standard value
Income autocorrelation	ρ	0.6	Our dataset
SD of income innovations	σ_ν	0.03	Our dataset
Prob. of re-entry	θ	0.33	Dias and Richmond (2007)
Debt maturity parameter	δ	0.31	5-year avg. duration
Coupon	κ	$(r + \delta)/(1 + r)$	Normalization
Lender's risk aversion	γ_ℓ	2.0	Aguiar et al. (2016)
Lender's wealth	W	2.5	Aguiar et al. (2016)
Recovery on hidden debt	ψ	1.0	Normalization
Mean of ϵ	μ_ϵ	1.17%	Our dataset
SD of ϵ	σ_ϵ	4.51%	Our dataset
Default taste-shock scale	χ_d	0.002	See text
Monitoring taste-shock scale	χ_m	0.0001	See text
Discount factor	β	0.8450	Debt & spread targets
Default cost (level)	λ_0	0.150	Avg. market debt = 45.3%
Default cost (slope)	λ_1	3.495	Avg. spread = 4.8%
Monitoring fee	f	0.125%	Freq. of revelations = 8.4%
Recovery rate parameter	α	0.3000	Mean recovery rate = 49%
Debt-choice shock scale	χ_b	0.0295	SD(Δ debt ratio) = 12.8%

Notes: Mean and standard deviation of ε and the monitoring fee are expressed in percent of GDP.

The second part of Table E.1 details our parametrization of the lender's side of the model and the properties of hidden debt. We follow Aguiar et al. (2016) in setting the risk aversion coefficient of lenders to the same value as that for the borrower ($\gamma_\ell = \gamma = 2$). The lender's wealth W is set to 2.5 (i.e., 250% of the mean income in the borrowing country), which is in line with the parameter value used in Aguiar et al. (2016). The effective recovery rate on hidden debt ψ is normalized to one, and the mean and variance of innovations to hidden debt are set using the values found in our dataset. We obtain μ_ε of 1.17% and σ_ε of 4.51% using our revisions series for low- and lower-middle income countries (see Appendix Section D.11 for details on the derivation).

The third panel of Table E.1 shows the values for the scale parameters of the default and monitoring taste shocks. Following recent advances in the literature using extreme value shocks

[52] Note that the income autocorrelation is somewhat lower than the values estimated for countries with continuous market access (e.g., Mexico).

[53] We use the Macaulay definition of duration, which, with the coupon structure in this paper, is given by $D = (1 + r)/(\delta + r)$, where r denotes the risk-free rate. Cruces et al. (2002), using a sample of 27 emerging economies, find an average duration of 4.77 years, with a standard deviation of 1.52 years. In a panel of 11 emerging economies, Bai et al. (2017) report an average debt duration of 6.7 years.

in sovereign debt models (see Mihalache, 2025 and Dvorkin et al., 2021), we set the values that are small enough to maintain the economic content of the sovereign's default and the lenders' monitoring decisions, but sufficiently large to ensure that computation of the value and price functions occurs in a timely manner.

The last part of Table E.1 has the remaining parameters. We calibrate the sovereign's discount factor (β), the default cost parameters (λ_0 and λ_1), the monitoring fee (f), recovery rate parameter ($\overline{\alpha}$), and the scale parameter for the debt-choice preference shocks (χ_b) to target five moments from our new data: (i) an average debt-to-GDP ratio of 45.3%, (ii) a mean spread of 4.8%, (iii) a frequency of revelations of 8.4%, (iv) a recovery rate of 49% using data from Graf von Luckner et al. (2024), and (v) a standard deviation of changes in the debt ratio of 12.8%.[54]

Model fit. The moments reported in Table E.2 are chosen to illustrate the ability of the model to replicate distinctive business cycle properties of economies with sovereign risk as well as the hidden debt revelation patterns that we observe in the data.

Table E.2: Model fit

Moment	Data	Model
Targeted moments		
Mean debt-to-GDP	45.3	46.0
Mean spread	4.8	4.9
Mean recovery rate	49	48
Freq. of revelations	8.4	8.5
SD(Δ debt-to-GDP)	12.8	13.2
Non-targeted moments		
a) Business cycle statistics		
SD(c)/SD(y)	0.8	3.1
corr(c, y)	0.84	0.32
corr(spread, y)	-0.23	-0.12
b) Hidden debt revelation patterns		
Mean revelation/y	0.53	0.46
corr(revelation/y, y)	-0.04	-0.04
corr(revelation/y, b/y)	0.20	0.01

Notes: Moments are computed using log-detrended series. Trends are computed using the Hodrick-Prescott filter with a smoothing parameter of 100.

Table E.2 shows that our model approximates well the moments used as targets and reproduces the qualitative signs of several non-targeted moments in the data. In both the model and data, consumption is procyclical and sovereign spreads are countercyclical, although consumption is substantially more volatile relative to income and less strongly correlated with income in the

[54] As discussed in Hatchondo and Martinez (2017), λ_0 is the key parameter for matching the average debt level and λ_1 is the key parameter for matching the average spread level. A low enough value of β is needed to match the average spread level, and, following Hatchondo et al. (2021), we select the maximum value of β that allows us to do so. We derive the frequency of revelations as the unweighted mean share of the number of revelation episodes by country (defined as in Section 5.1).

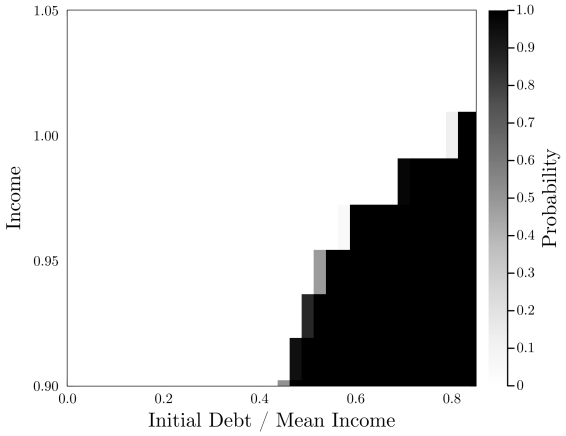
model.[55] The model also produces revelations that are similar in mean size to those observed in our novel dataset and matches their negative correlation with income. Finally, the model reproduces the positive correlation between revelations and the debt-to-income ratio observed in the data, although this correlation is quantitatively weaker in the model.

E.6.2 Default incentives and borrowing opportunities

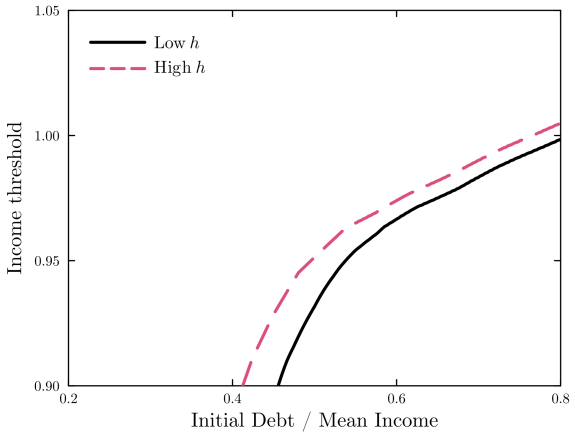
Default incentives. Panel A of Figure E.1 shows the default probability as a function of beginning-of-the-period debt and income levels. Since the model includes taste shocks for the

Figure E.1: Default incentives

Panel A: Default probability



Panel B: The effect of hidden debt



Notes: Panel A shows the ex-ante default probability, as computed in (E.28). Panel B shows the income threshold below which the default probability exceeds 50%. Panel A assumes that initial $h = 0$. Panel B uses $h = 0$ as the low value, and $h = 0.10$ as the high value, which is approximately $\mu_\varepsilon + 2\sigma_\varepsilon$. Both panels assume that ϵ is at its mean, and $\tau = 5$ (the median value in the simulations).

default decision, this panel shows the ex-ante probability that the government defaults, as expressed in equation (E.28). As is usual in this class of models, higher initial debt and lower income increase the default probability, other things equal.

Panel B uses an "income default threshold" to illustrate the effect of hidden debt on default incentives in our model. We define the income default threshold $\tilde{y}$ as the value of income below which the ex-ante default probability exceeds 50%, for given values of the other state variables.[56] Higher initial debt comes with higher default thresholds: there is a larger portion of the income space for which the default probability is larger than 50%. We plot these income thresholds for two values of initial hidden debt. Higher hidden debt increases default incentives: $\tilde{y}$ shifts upwards when we increase the initial level of hidden debt.

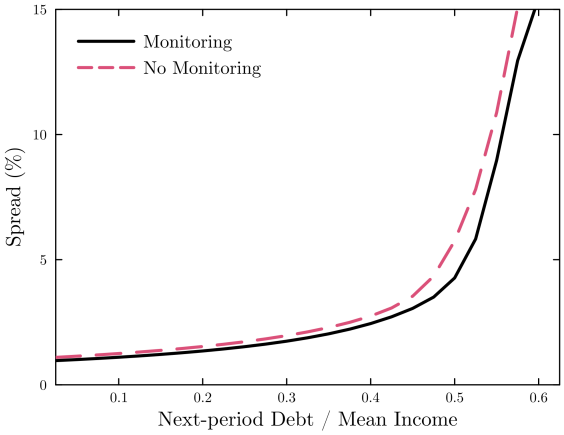
[55] In the data we consider, the volatility of consumption is slightly lower than the volatility of income, whereas emerging-market economies often display greater consumption volatility relative to income. The model captures this latter qualitative feature.

[56] Since we use 50% as the reference value, it follows from equation (E.28) that $\tilde{y}$ is the income level that satisfies $V_1(b, h, \tilde{y}) = V_0(b, h, \tilde{y}, \varepsilon, \tau)$.

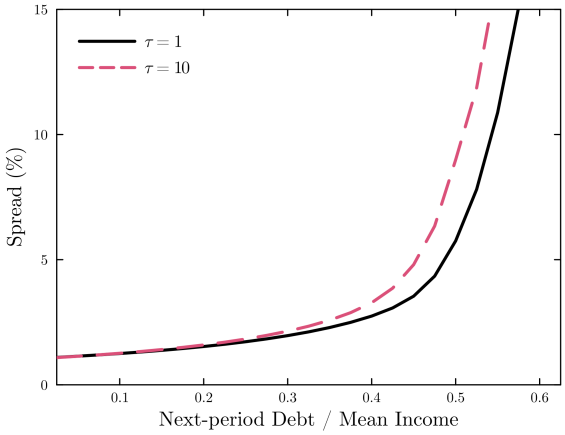
Borrowing opportunities. Figure E.2 shows the spread-debt menus from which the government can choose, with the panels conditioning on the monitoring policy of lenders (panel A) and the time since the last revelation (panel B). As is usual in this class of models, higher borrowing comes at the cost of higher spreads. When the chosen borrowing is sufficiently high, the spread increase acts, in effect, as an endogenous borrowing limit.

Figure E.2: Spread-debt menus, monitoring and the effect of uncertainty

Panel A: The effect of monitoring



Panel B: The effect of τ



Notes: The figure shows combinations of next-period debt and spreads from which the country can choose in the current period. Panel A differentiates between monitoring and no-monitoring cases. Panel B differentiates between two values of τ when the country is facing a non-monitoring episode. Panel A assumes that $\tau = 1$. Both panels assume that y is 5% below its mean and that initial market debt is at 45% (the median in the simulations).

The spreads in Panel A of Figure E.2 are shown for the case in which the government has market access in period t. Therefore, a debt revelation can occur in this situation only through monitoring. As our theory implies, monitoring makes *all* debt public knowledge, reducing uncertainty. This effect should, other things being equal, lower the sovereign's borrowing cost. At the same time, monitoring is costly, and lenders will endogenously charge higher interest rates to compensate for this cost. In equilibrium, we see that the first effect dominates: monitoring expands the sovereign's borrowing set.

Panel B of Figure E.2 focuses on the no-monitoring case. Holding current observable debt and income fixed, a higher τ records a longer spell since hidden debt was last revealed and reset. Lenders combine this history with the observable state (b, y) and, after observing repayment and each candidate borrowing choice b', update their beliefs about next period's hidden debt. In the states shown, a longer spell places greater probability on high hidden-debt realizations. This increases both expected default risk and the potential dilution of market-debt recovery, shifting the spread-debt menu toward worse borrowing terms.

E.6.3 Hidden Debt and Debt Intolerance

A long-standing puzzle in international finance is that emerging and developing countries repeatedly enter sovereign default at debt-to-GDP ratios that would be considered easily sustainable

in advanced economies. Reinhart et al. (2003) labeled this regularity *debt intolerance*: the same level of external public debt is associated with sharply higher default risk, higher borrowing costs, and a higher probability of credit events in emerging economies than in their advanced-economy counterparts.

Existing explanations. A sizeable literature has tried to rationalize debt intolerance. Reinhart et al. (2003) emphasize credit history, weak fiscal and monetary institutions, and liability dollarization. The sovereign default literature has accounted for part of the gap through countercyclical default risk (Mendoza and Yue, 2012), uncertainty about the persistence of default costs (Chamon and Roldán, 2025), political-economy frictions (Meyersson, 2006; Hatchondo et al., 2009), and volatility of the country's fundamentals (Catão and Kapur, 2006), among other mechanisms.

Hidden debt as a complementary channel. Our quantitative model points to underreporting of debt as a complementary channel to the existing explanations. As shown in the main text, the magnitude and noisiness of hidden debt accumulation are systematically larger in countries with low institutional quality than in countries with strong institutions. In the model, this maps directly into a country-specific stochastic process for the hidden-debt innovation ε. We use this mapping to run a simple comparative statics exercise. Holding all other parameters at their benchmark values, we first compare two calibrations of the hidden-debt process: one from high-income countries, which on average have strong institutions, and one from low and lower middle-income countries, which on average have relatively weak institutions, as described in detail in Section D.11. For additional perspective, we also consider a third, 'most-opaque' economy calibrated to countries in the top decile of the debt-revision distribution:

i. a *strong-institutions, high-income* economy with $(\mu_\varepsilon, \sigma_\varepsilon) = (0.16\%, 1.5\%)$, estimated from debt revisions in high-income countries with high average institutional quality scores;

ii. a *weak-institutions, low-income* economy with $(\mu_\varepsilon, \sigma_\varepsilon) = (1.17\%, 4.51\%)$, with values estimated from debt revisions in low- and lower-middle income countries with low average institutional quality scores (and which we use in Table E.1); and

iii. a *most-opaque* economy with $(\mu_\varepsilon, \sigma_\varepsilon) = (5.6\%, 12.6\%)$, with values estimated from debt revisions in the countries in the top-decile in the debt revisions distribution.

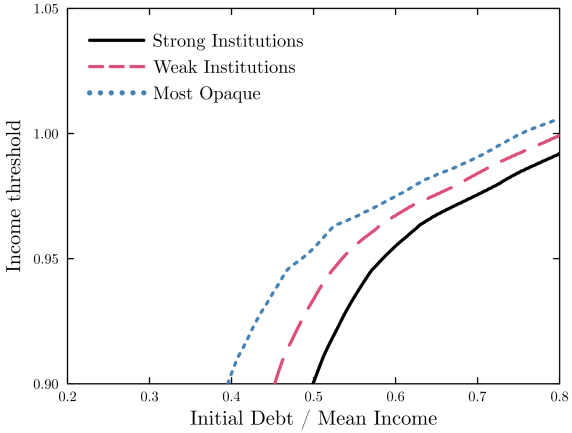
The three economies differ only in the hidden-debt process. Any divergence in their equilibrium debt and spread behavior, therefore, isolates the contribution of the hidden-debt channel to the debt-intolerance phenomenon. The weak- versus strong-institutions comparison corresponds to the exercise reported in the main text, while the most-opaque economy illustrates how the mechanism strengthens further in the right tail of the empirical revision distribution.

Mechanism: default incentives and the spread schedule. Figure E.3 summarizes the model mechanism and shows the income default threshold for the three economies in Panel A.

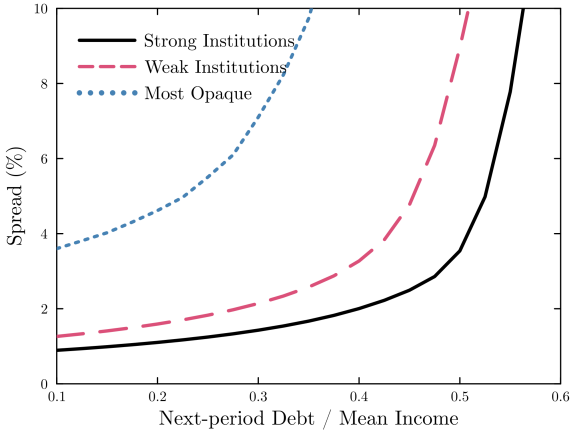
For every level of initial market debt, the most-opaque and the weak-institutions economies have strictly higher default thresholds than the strong-institutions economy: the same market debt carries a higher default probability. Higher and more uncertain hidden debt feeds directly into the *relative* value of default, strengthening the incentive to walk away from market obligations at any given level of reported debt.

Figure E.3: Default incentives and spreads across hidden-debt calibrations

Panel A: Default thresholds



Panel B: Spread-debt menus



Notes: Panel A shows the income threshold below which the default probability exceeds 50%. Panel B shows combinations of next-period debt and spreads from which the country can choose in the current period under no-monitoring. Panel A assumes that initial $h = 0$ and that $\varepsilon = 0$. Panel B assumes that y is 5% below its mean and that initial market debt is at 45% (the mean in the simulations). Both panels have $\tau = 5$ (the median value in the simulations).

Panel B of Figure E.3 traces the equilibrium spread-debt menus faced by the sovereign in the three economies. Two features stand out. First, at every displayed level of next-period market debt, the most-opaque and weak-institutions economies face higher spreads than the strong-institutions economy. Second, these differences widen as debt approaches the endogenous borrowing limit, producing steeper spread schedules in the economies with larger and noisier hidden debt processes. The mechanism operates through the beliefs entering the no-monitoring price. After observing repayment and the borrowing choice b', lenders form a joint posterior over current hidden debt and the current innovation and map it, through the hidden-debt law of motion, into the predictive distribution $\mu_{\text{NM}}(h' \mid b, b', y, \tau)$. In the states shown, a noisier hidden-debt process places more probability on high next-period hidden debt. These states carry greater default risk and lower recovery values for market debt, reducing q_{NM} and raising the spread charged at issuance.

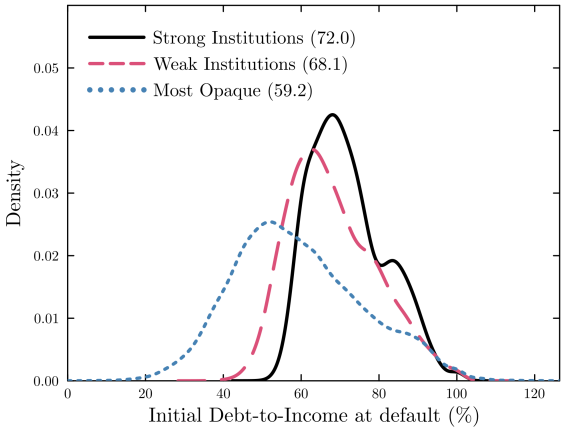
Equilibrium outcomes: debt at default and spreads. Figure E.4 reports the corresponding equilibrium distributions, generated by long simulations of the three economies. Panel A plots the density of the debt-to-GDP ratio at the moment of default. The mass shifts visibly to the left in the weak-institutions economy: the average debt-at-default falls from 72.1% in the strong-institutions economy to 68.2% in the weak-institutions economy. The model thus speaks to the central stylized fact of the debt-intolerance literature: countries with a more

opaque liability process default at lower levels of *reported* debt. Panel B plots the distribution of equilibrium spreads, conditional on the country not being excluded from bond markets. The mean spread increases markedly, from 4.1% in the strong-institutions economy to 4.8% in the weak-institutions economy, reflecting the increased investor uncertainty about true debt levels. These two panels together summarize the model's prediction that economies with low institutional quality scores are simultaneously characterized by (i) a lower debt-carrying capacity, in the sense of Reinhart et al. (2003), and (ii) higher borrowing costs at comparable levels of observable indebtedness.

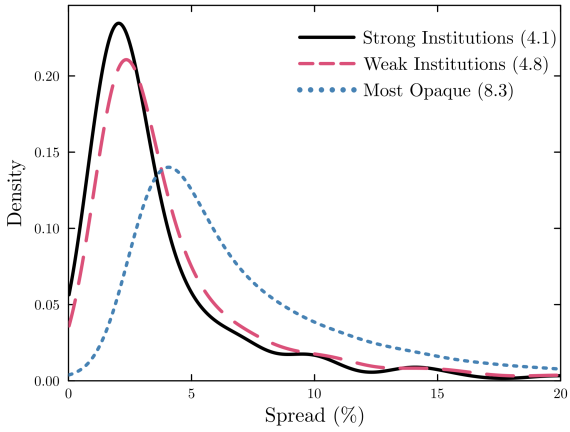
If we move beyond the comparison of group averages toward the most opaque borrowers in our cross-country sample, even larger effects become visible. Relative to the strong-institutions economy, mean debt ratios at default decrease by 13 percentage points to 59.2%, while mean spreads increase by more than 400 basis points to 830 basis points.

Figure E.4: Effects on Debt Intolerance

Panel A: Debt ratios at default



Panel B: Sovereign spreads

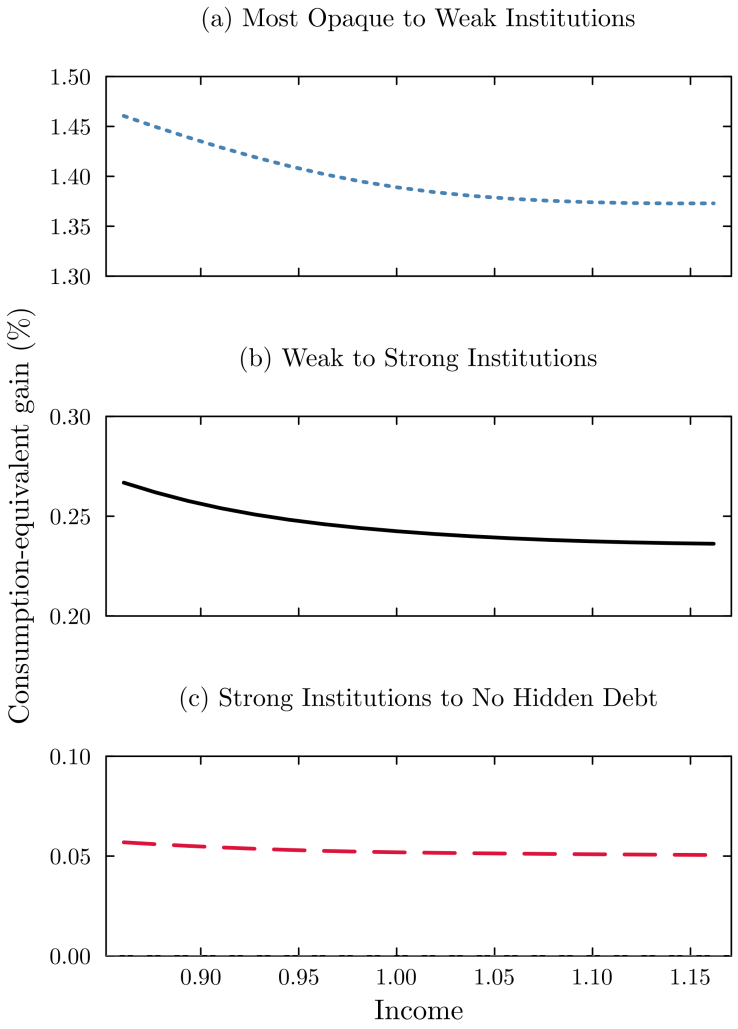


Notes: The figure compares three model economies that differ only in the hidden-debt process, using long simulations of each. The Most Opaque, Weak-Institutions, and Strong-Institutions economies are defined in the text and in Appendix Section D.11. Panel A plots the distribution of the market debt-to-GDP ratio at the moment of default. Panel B plots the distribution of sovereign spreads in non-exclusion periods. Legend values report the corresponding group means.

The size of the effect is economically meaningful, although by construction it does not aim to account for the entirety of the debt-intolerance phenomenon. Following Reinhart et al. (2003), we use our dataset to compute debt-at-default for both the weak- and the strong-institutions country groups and document a gap of roughly 20 percentage points of GDP. Our hidden-debt channel alone generates a gap of 4 percentage points, accounting for a fifth of the observed differential in debt-carrying capacity. A similar logic applies to spreads: in our dataset, we document a gap in average spreads of roughly 250 bps, and the model accounts for roughly a quarter of that (70 bps), purely from differences in the hidden-debt processes.

Welfare implications. If the representative agent in the weak-institutions country could pay to *move* to the strong-institutions country, how much would she be willing to pay? And how much would she pay to get rid of hidden debt altogether? We use the different economies defined

Figure E.5: Welfare effects



Notes: This figure assumes zero initial debt (both market and hidden), $\varepsilon = 0$, and $\tau = 5$ (the median in the simulations). We compute these welfare gains using a discount factor of $1/(1+r) \approx 0.96$.

above to answer these questions by computing consumption-equivalent measures of the welfare gains of moving (i) from the most-opaque economy to the weak-institutions economy, (ii) from a weak to a strong-institutions economy, and (iii) from the strong-institutions economy to one without hidden debt.[57] As before, these economies do not differ in any aspect other than their hidden-debt process.

Figure E.5 shows that these welfare gains are positive and decreasing in the initial level of income. The welfare gains are countercyclical: largest in bad times, when default is more likely and hidden debt distorts borrowing terms the most.[58] Evaluated at mean income, reducing the magnitude and noisiness of hidden debt from the levels in the most opaque economy to those in the weak-institutions economy yields a welfare gain equivalent to 1.4% of permanent consumption. Further reducing the mean and standard deviation of hidden debt to the lev-

[57] We define the No-Hidden-Debt economy as one in which $\mu_\varepsilon = \sigma_\varepsilon = 0$.

[58] This is the welfare counterpart of the procyclical accumulation of hidden debt documented in Section 4.3.

els in the strong-institutions economy generates an additional gain of approximately 0.25%, while eliminating hidden debt altogether adds only another 0.05%.[59] Thus, the welfare cost of hidden debt stems primarily from its magnitude and noisiness: once these are reduced to the levels observed under strong institutions, the remaining gains from eliminating hidden debt are comparatively small.

We view these results as complementary to, rather than a substitute for, existing explanations of debt intolerance. Moreover, mechanisms emphasized in earlier work can, in principle, interact with the hidden-debt channel in ways our model does not capture. More broadly, the hidden-debt mechanism provides a link between a measurable empirical fact—the systematic upward revision of sovereign debt statistics—and one of the most enduring puzzles in international macroeconomics.

E.7 Robustness to Third-Party Hidden-Debt Revelations

The baseline model features two channels through which hidden-debt revelations emerge endogenously: hidden obligations become public when lenders monitor or when the sovereign defaults, both being equilibrium outcomes. This appendix augments the model economy with an additional third-party revelation event: an outside institution uncovers hidden debt before the default decision is made and makes it public at no direct monitoring cost to private lenders (or any other agent). A natural interpretation is a statistical review, debt reconciliation exercise, or external transparency initiative conducted by an institution such as the World Bank or IMF. The experiment is therefore both a robustness check and a simple policy evaluation of greater third-party transparency.

The exercise yields a clear answer. More third-party transparency changes how hidden debt becomes public, but it does not undo the main economics from our theory. Even when outside revelations are allowed to occur with high probability, the model continues to generate the same effects of hidden debt: weak-institution economies face higher spreads, default at lower public debt levels, and attach comparable welfare values to moving to the strong-institution hidden-debt process.

Third-party revelation and timing. Let $z_t \in \{0, 1\}$ denote the third-party revelation event, with

$$\Pr(z_t = 1) = \pi_R \,.$$

The event is exogenous with respect to the model's state: it is i.i.d. and independent of income, hidden-debt innovations, taste shocks, and all other state variables. Economically, π_R indexes the intensity of outside transparency. The event is realized at the beginning of the period, after y_t and ε_t are realized and before the default decision is made. If $z_t = 1$ and the sovereign is in good standing, hidden debt is revealed by the third party. The sovereign can still default after this exogenous revelation. If it repays, the hidden-debt stock and the current hidden-

[59] These welfare gains are similar in magnitude to, for example, those associated with eliminating debt dilution (Hatchondo et al., 2016).

debt innovation are incorporated into current market issuance, hidden debt resets to zero next period, and the revelation clock resets to $\tau' = 1$. If the sovereign defaults in the same period after the third-party revelation, default and recovery accounting follow the benchmark default timing: the default branch uses the hidden-debt stock inherited at the beginning of the period, and the current hidden-debt innovation does not enter recovery accounting. If $z_t = 0$, the period proceeds as in the benchmark model: the sovereign chooses default or repayment, and conditional on repayment, lenders may endogenously monitor.[60]

This extension introduces a third-party-revelation repayment branch. Let $V_0^N(s)$ denote the repayment value in a period without a third-party revelation, where $s = (b, h, y, \varepsilon, \tau)$, and let $V_0^{FR}(s)$ denote the repayment value after a free third-party revelation. For a candidate market-debt choice b', the free-revelation branch is

$$v_{FR}(b'; s) = u(c_{FR}) + \beta E_{y',\varepsilon'|y}\left[V(b', 0, y', \varepsilon', 1)\right], \tag{E.37}$$

$$c_{FR} = y - \kappa(b + h) + q_{\mathrm{FR}}(b', y)\,\iota_{\mathrm{FR}} + q_h\varepsilon, \qquad \iota_{\mathrm{FR}} = b' - \left[(1-\delta)b + (1-\delta)h + \varepsilon\right], \tag{E.38}$$

with $q_h = q_{\mathrm{FR}}$. Thus, the borrower's budget constraint in the third-party-revelation branch is the same as under monitoring: all hidden obligations become public and are absorbed in current market issuance. The difference is on the lender side. Because the information is produced outside the private monitoring technology, lenders do not pay the monitoring fee f. The third-party-revelation bond price satisfies the analogue of the monitored pricing equation,

$$q_{\mathrm{FR}}(b', y) = \frac{E^{\ell}\left[u'_{\ell}(C_{\ell}^{\mathrm{FR}\prime})\mathcal{R}'(b', 0, y', \varepsilon', 1)\right]}{E^{\ell}\left[u'_{\ell}(C_{\ell}^{\mathrm{FR}\prime})(1+r)\right]}, \tag{E.39}$$

where

$$C_{\ell}^{\mathrm{FR}\prime} = \left(W - q_{\mathrm{FR}}(b', y)B'\right)(1+r) + B'\mathcal{R}'(b', 0, y', \varepsilon', 1).$$

Relative to the monitored price schedule q_{M}, the information set is the same, but the lender budget does not subtract f because the revelation comes from the third party.

Let $\Pi_d^N(s)$ be the default probability in a period without a third-party revelation and $\Pi_d^{FR}(s)$ the default probability after a free third-party revelation. The relevant ex-ante default probability is therefore

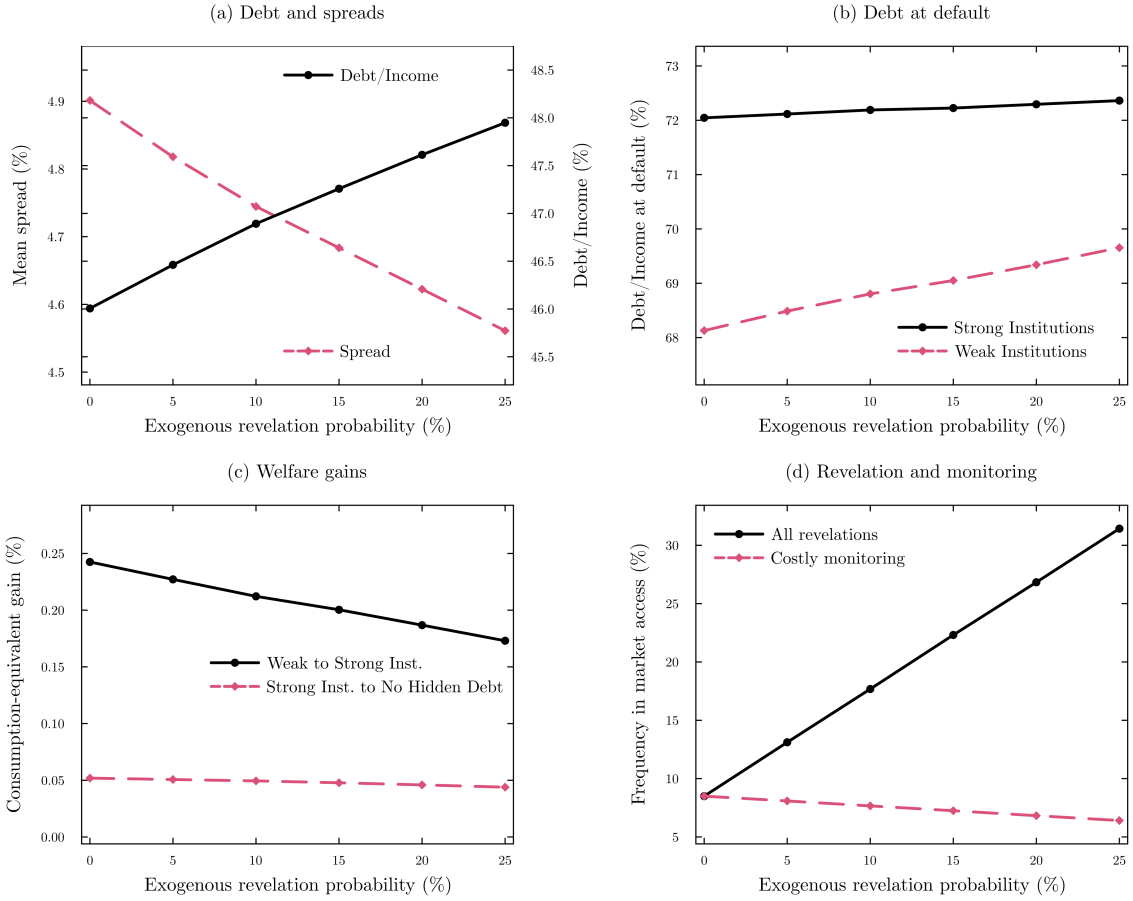
$$\Pi_d^{ex}(s) = (1 - \pi_R)\Pi_d^N(s) + \pi_R\Pi_d^{FR}(s)\,. \tag{E.40}$$

Similarly, the ex-ante value entering the recursive problem is

$$V(s) = (1 - \pi_R)V^N(s) + \pi_R V^{FR}(s)\,, \tag{E.41}$$

[60] The introduction of third-party revelations does not alter the Bayesian update following no revelation. Conditional on repayment and the borrowing choice b', the absence of a third-party revelation contributes the state-independent factor $1 - \pi_R$ to the likelihood of every latent (h, ε) state. This common factor cancels when the posterior is normalized, leaving the benchmark Bayesian update unchanged.

Figure E.6: Robustness to third-party hidden-debt revelations



Notes: The figure varies the third-party revelation probability π_R while holding the remaining calibrated parameters fixed. Panel (a) reports mean debt-to-income and spreads in non-exclusion periods. Panel (b) reports debt at default for the weak- and strong-institution economies. Panel (c) reports consumption-equivalent welfare gains evaluated at the common state $(b, h, y, \varepsilon, \tau) = (0, 0, 1, 0, 5)$, using the discount factor $1/(1+r)$. Panel (d) reports the frequency of all revelations and the frequency of costly private monitoring.

where each branch includes the default-versus-repayment log-sum for the corresponding information structure. Since z_{t+1} is part of next period's state, lenders also integrate over it when pricing debt. Naturally, when $\pi_R = 0$, we recover the benchmark model.

Robustness and policy interpretation. Holding all calibrated parameters fixed, we solve and simulate the model for third-party revelation probabilities between zero and 25 percent. Higher values of π_R can be read as stronger or more frequent outside scrutiny of public debt statistics. In this interpretation, the exercise approximates the effect of more intensive reporting, validation, or debt-transparency work by an institution such as the World Bank, while holding fixed the underlying hidden-debt process.

Figure E.6 summarizes the exercise, showing that third-party revelations operate in the expected direction without overturning the model's core quantitative implications. As π_R rises, total revelations increase mechanically, while the frequency of costly private monitoring falls only modestly. Debt rises slightly and spreads decline slightly, consistent with outside transparency reducing uncertainty and resetting hidden debt without imposing monitoring costs on lenders.

Debt at default is somewhat higher when third-party revelations are more frequent, but the difference in debt-carrying capacity between weak- and strong-institution economies remains. The fixed-state welfare gains decline gradually as third-party revelations become more frequent. The gain from moving from the weak- to the strong-institution economy falls from approximately 0.25% to 0.17% of permanent consumption as π_R rises from zero to 25%, while the additional gain from eliminating hidden debt in the strong-institution economy falls from approximately 0.05% to 0.04% and remains small.

The main take-away is that the benchmark results do not hinge on assuming that every hidden-debt revelation is generated by private monitoring or default. A third-party transparency technology changes the accounting of how hidden debt becomes public, and it can improve borrowing terms at the margin by reducing uncertainty. But it does not change the main economics: hidden-debt processes that are larger and noisier still generate higher spreads, lower debt-carrying capacity, and economically meaningful welfare losses.

E.8 Costly Suppression of Third-Party Revelations

In this final exercise, we allow the sovereign to conceal a third-party revelation at a resource cost. As in the preceding section, the revelation shock $z_t \in \{0, 1\}$ is realized after (y_t, ε_t) and before the default decision. When $z_t = 1$, the government first chooses whether to default. Conditional on repayment, it then chooses between allowing the third-party revelation to become public and paying a tradable-good cost x to suppress it. This reduced-form resource cost captures the administrative, legal, or political costs associated with obstructing or delaying disclosure. If the revelation is allowed, $h + \varepsilon$ becomes public, the hidden obligations are incorporated into current market issuance, and hidden debt and the revelation clock τ are reset. If the revelation is suppressed, the cost x is subtracted from current consumption and the period proceeds as under the usual monitoring technology: hidden debt remains unobserved unless private lenders monitor. Default continues to reveal hidden debt, so suppression is not available on the default branch.

The concealment decision. Let $V_0^{FR}(s)$ denote the repayment value when the third-party revelation is allowed, as defined in the preceding section, and let $V_0^{SUP}(s; x)$ denote the repayment value when it is suppressed, where $s = (b, h, y, \varepsilon, \tau)$. For a candidate market-debt choice b', define the suppression-branch value

$$v_{SUP}(b'; s, x) = \Pi_m(b, b', y, \tau) v_M^x(b'; s) + \left[1 - \Pi_m(b, b', y, \tau)\right] v_{NM}^x(b'; s)\,, \tag{E.42}$$

where v_M^x and v_{NM}^x coincide with the monitoring and no-monitoring repayment values in equations (E.31)–(E.32), except that x is subtracted from current consumption. Integrating over the borrowing-choice shocks, we obtain the ex ante value under suppression,

$$V_0^{SUP}(s; x) = \chi_b \log \sum_{b' \in \mathcal{B}} \exp\left(\frac{v_{SUP}(b'; s, x)}{\chi_b}\right). \tag{E.43}$$

The government suppression policy $S(s;x)$ is given by

$$S(s;x) = \mathbf{1}\{V_0^{SUP}(s;x) > V_0^{FR}(s)\}. \tag{E.44}$$

Thus, suppression itself is a deterministic choice conditional on the state, even though default, borrowing, and monitoring are smoothed by their respective taste shocks. The trade-off in (E.44) is direct. Allowing the revelation forces the sovereign to absorb its previously hidden obligations into current market debt, but it removes uncertainty about those obligations. Suppressing avoids this immediate balance-sheet adjustment, at the cost x, while leaving the sovereign exposed to private monitoring and to the future consequences of carrying hidden debt.

Lender beliefs after no revelation. Once suppression is possible, the absence of a public revelation is itself informative. It can reflect either that no third-party revelation shock arrived or that a shock arrived and the government successfully concealed it. To make this explicit, write $s_{ik} = (b, h_i, y, \varepsilon_k, \tau)$, let $\Pi_d^N(s_{ik})$ denote the default probability when $z_t = 0$, and let $\Pi_d^R(s_{ik})$ denote the default probability after $z_t = 1$, when the repayment value incorporates the option to suppress. Let Π_b^N and Π_b^{SUP} denote the borrowing-choice probabilities on the no-third-party-revelation and suppressed-third-party-revelation repayment branches. Conditional on observing repayment, the market-debt choice b', and no public revelation, denoted by NR, the likelihood of (h_i, ε_k) is

$$\begin{aligned}\mathcal{L}_{ik}^{NR}(b', b, y, \tau; x) = (1-\pi_R)\left[1-\Pi_d^N(s_{ik})\right]\Pi_b^N(b' \mid s_{ik}) \\ + \pi_R S(s_{ik};x)\left[1-\Pi_d^R(s_{ik})\right]\Pi_b^{SUP}(b' \mid s_{ik}).\end{aligned} \tag{E.45}$$

The corresponding joint posterior is

$$\Pr(h_i, \varepsilon_k \mid b', b, y, \tau, \text{repay}, NR) = \frac{\mathcal{L}_{ik}^{NR}\pi_0(h_i \mid b, y, \tau)\Pr(\varepsilon_k)}{\sum_{j,\ell}\mathcal{L}_{j\ell}^{NR}\pi_0(h_j \mid b, y, \tau)\Pr(\varepsilon_\ell)}. \tag{E.46}$$

This joint posterior, together with $h' = (1-\delta)h_i + \varepsilon_k$, determines the distribution of next-period hidden debt used in the no-monitoring price. When concealment is not available, the absence of a third-party revelation is equally likely across all latent states. The common factor $(1-\pi_R)$ therefore cancels from Bayes' rule, and lenders update their beliefs as in the benchmark model.

Equation (E.46) captures an important equilibrium consequence of concealment. Even when concealment succeeds, it is not informationally neutral: observing no revelation reweights beliefs toward the hidden states in which suppression, repayment, and the observed borrowing choice are more likely. In particular, when governments with larger hidden obligations are more likely to suppress, the absence of a revelation can make lenders more suspicious rather than fully reassuring them.

Cost and state dependence. We hold all calibrated parameters fixed and vary only the third-party revelation probability π_R and the suppression cost x. The resulting policy is highly

cost-sensitive and state-contingent. Suppression is most valuable when revelation would force the government to absorb a large stock of hidden liabilities into market debt at unfavorable bond prices, especially when repayment capacity is limited. It is therefore concentrated in states with high hidden debt, high market debt, and low income. Conversely, when $h + \varepsilon$ is small or negative, disclosure requires little additional market issuance and can even reveal net hidden assets, leaving little incentive to pay for concealment. Increasing x shrinks the set of states in which the benefit of avoiding disclosure exceeds its resource cost.

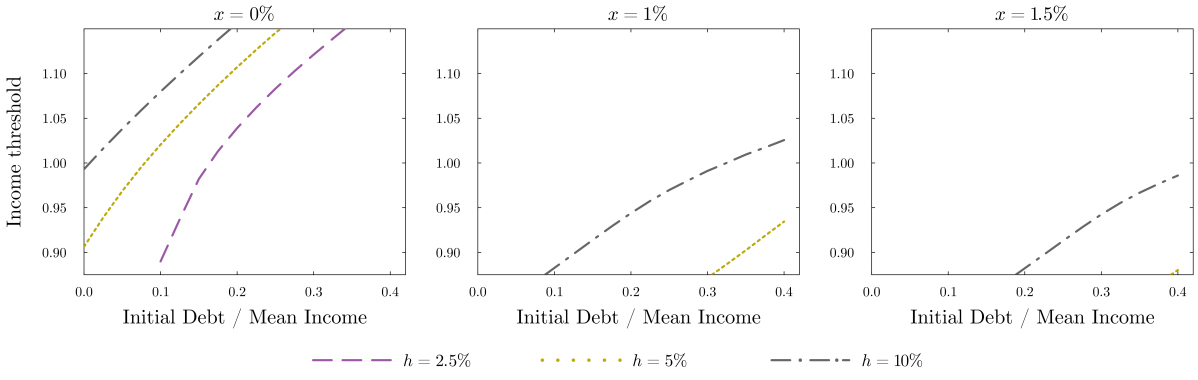
Figure E.7 illustrates these forces directly. For fixed $(h, \varepsilon, \tau, x)$, define the income threshold $\bar{y}(b; h, \varepsilon, \tau, x)$ by

$$V_0^{SUP}(b, h, \bar{y}, \varepsilon, \tau; x) = V_0^{FR}(b, h, \bar{y}, \varepsilon, \tau)\,. \tag{E.47}$$

Conditional on repayment, suppression is preferred below this threshold and allowing the revelation is preferred above it. Low income makes the immediate absorption of hidden obligations especially costly, while high market debt further limits the sovereign's capacity to accommodate the revelation.

The figure fixes $\pi_R = 5\%$, $\tau = 5$, and $\varepsilon = \mu_\varepsilon + \sigma_\varepsilon$, and compares initial hidden debt stocks of 2.5%, 5%, and 10% of mean income. When suppression is free, the suppression region is broad and expands with both hidden and market debt. At a cost of 1% of mean income, the threshold shifts down substantially: suppression largely disappears at low hidden debt but remains relevant when hidden obligations are large. At a cost of 1.5%, suppression is never optimal for low and medium levels of hidden debt and remains relevant only for very large levels of hidden debt ($h = 10\%$) and market debt. Thus, even a modest resource cost eliminates concealment in ordinary states while leaving it as an equilibrium response when disclosure would be especially painful.

Figure E.7: Suppression thresholds for costly third-party revelations



Notes: Lines plot the income level $\bar{y}$ at which the sovereign is indifferent between suppressing and allowing a third-party revelation across levels of initial market debt b. Suppression is preferred below each line; allowing the revelation is preferred above it. The figure fixes $\pi_R = 5\%$, $\tau = 5$, and $\varepsilon = \mu_\varepsilon + \sigma_\varepsilon$. Lines correspond to initial hidden debt of $h \in \{2.5\%, 5\%, 10\%\}$ of mean income, and panels correspond to suppression costs $x \in \{0\%, 1\%, 1.5\%\}$ of mean income. States in which the default probability following the third-party revelation shock is greater or equal than 50% are excluded. A missing segment means that suppression is never preferred for that h, x pair.

The model extension clarifies when strategic suppression of information is most valuable. Concealment is not a uniform response to outside scrutiny but is most attractive to the sovereign

in those states where the disclosure of hidden debt would be most costly: when the stock of hidden liabilities is large, income is low, and sovereign default risk is elevated. At the same time, concealment does not erase all informational consequences because the absence of a revelation is itself informative: lenders understand the government's equilibrium policy and update their beliefs accordingly. Moreover, private monitoring can still reveal hidden debt after a suppressed third-party event, and default makes suppression infeasible. Strategic information suppression can therefore delay disclosure, but it does not eliminate the existing revelation channels through which outside scrutiny and sovereign distress ultimately bring hidden obligations to light.

A natural cross-sectional interpretation of the model predictions is that strategic suppression incentives are strongest in precisely the high-risk countries, where our empirical analysis finds the hidden debt problem to be most severe. The interpretation is also consistent with the time-series pattern documented in Sections 4.3 and 5, where large hidden debt revelations are more likely during economic downturns and periods of sovereign distress. While the incentives to suppress information are highest during such episodes, the *ability to suppress* information is likely most limited, as creditor monitoring, external scrutiny, and ultimately default itself put greater pressure on the sovereign's books. In this sense, sovereign distress can simultaneously increase the government's incentive to conceal hidden debt and increase the likelihood that external scrutiny ultimately brings it to light.

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